BIOLOGICAL ASSESSMENT

of the

Arizona Game and Fish Department's

Statewide and Urban Fisheries Stocking Program

for the years

2011-2021

Arizona Game and Fish Department and

U.S. Fish and Wildlife Service,

Wildlife and Sport Fish Restoration Program

2011

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Recommended Citation

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Acorynyms Used in this Document

ACS: Additional Conservation Species

AESO: U.S. Fish and Wildlife Servie, Arizona Ecological Services Office

AGFD: Arizona Game and Fish Department

BA: Biological Assessment

DBCO: Draft Biological and Conference Opinion

DEA: Draft Environmental Assessment

FIN: Fishing in the Neighborhood

FWS: U.S. Fish and Wildlife Service

NEPA: National Environmental Policy Act

RPM: Reasonable and Prudent Measure

SFRA: Sport Fish Restoration Act of August 9, 1950, as amended (16 U.S. Code 777–777n)

UFP: Urban Fishing Program

WSFR: U.S. Fish and Wildlife Service, Wildlife and Sport Fish Restoration Program

Organization of This Document

Executive Summary

Briefly identifies project action and location, lead contacts for the U.S. Fish and Wildlife Service, Wildlife and Sport Fish Restoration Program and Arizona Game and Fish Department (AGFD).

Chapter 1-Introduction

Provides an introduction and overview of the AGFD Sport Fish Stocking Program, Laws, Regulations and Authorities, Action Area, description of the Proposed Action and description of the process for determining Federally listed species to be addressed in this BA. Additionally, a conservation actions program to be implemented as part of the proposed action is provided and described.The conservation actions program, as described, serves to minimize and mitigate for potential impacts of the proposed stocking actions.

Chapter 2 – Environmental baseline and Resource Conditions

The chapter provides biological and natural history information for the sport fish proposed for stocking in Arizona waters. In addition, the AGFD's role in fisheries management, legal authorities, fishing regulations, protocols and stocking procedures related to the proposed action are described in detail. These data are used to assist in the determination of potential direct, indirect, interrelated, interdependent and cumulative effects of sport fish stocking on listed, candidate and proposed for listing species and/or critical habitats.

Chapter 3- Analysis Methods and Criteria

This chapter describes the geographic and biological criteria used to develop the methods of analysis for federally listed threatened and endangered species and their critical habitat, candidate species, and two species likely to be listed in this consultation period .

Chapter 4-Species Analyses

This chapter describes the possible interactions between stocked species and consultation species.

Chapter 5-11 Individual Watershed Chapters

Each watershed containing proposed stocking locations is written into individual chapters (5-11). Several of those watershed chapters are further subdivided into Sub-Watershed documents due to file size and for ease in their distribution to the public. Within those chapters, the watershed is then divided into sub watersheds using the 8 digit Hydrologic Unit Code names. In each chapter,

the important hydrologic and geomorphic attributes of the watershed, distribution of listed and proposed species within the watershed, key data and isolating mechanisms that assist in making an effect determination are described. The stocking sites were then placed into complexes defined by the hydrologic connection between stocking sites and into the main tributary connection. In those cases where complexes were identified, the assessment of potential impacts and effects is analyzed as a complex, due to the close proximity or hydrologic relationship of the proposed stocking sites. Each stocking site within the sub-watershed description may include, when that information is available: the geographic location, local hydrologic and geomorphic data, key local isolating mechanisms, proximity to listed, candidate and proposed species and/or critical habitat. Thus, while the data to make an effect determination may be similar for each stocking location within the watershed and sub watershed, each assessment and determination is on a site-specific basis..

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Appendix A. Table of Proposed Stocking Actions

Appendix B. Department Protocols and Stocking Policies

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Executive Summary

The Arizona Game and Fish Department (AGFD) Sport fish Management Program goals include maintaining, managing, and enhancing the quality, abundance, availability, and diversity of sport fishing opportunities for the public while contributing to the recovery of Arizona's native fish. This document addresses this objective through an assessment of potential effects of sport fish stocking on federally listed, candidate, proposed species and/or critical habitats. During development of this document stocking regimes were modified to reduce potential conflicts with federally listed, candidate, proposed species and critical habitat. AGFD strives to manage recreational fishing opportunities that would avoid negatively impacting listed species, and proposes stocking locations and sport fish species that would not limit future conservation and recovery actions for native non-listed aquatic and riparian species.

The process undertaken within this document uses the best scientific and commercial information available, including recovery plans, conservation plans and other pertinent agreements. This document would be amended within the ten year time period whenever a species is added to or removed from the Endangered Species Act (ESA) list, proposed to be listed , or whenever the status of the species changed. Also, this document would be amended when critical habitat is designated or removed from designation, or AGFD proposes changes to the stocking action. Any of these changes would require WSFR to reinitiate intra-service consultation. Reinitiation would also be required if incidental take is reached or exceeded.

Proposed Action: The U.S. Fish and Wildlife Service Wildlife (FWS), Wildlife and Sport Fish Restoration (WSFR) Program proposes to continue to provide funding for the Sport Fish Stocking Program under the Dingell-Johnson Sport Fish Restoration Act of August 9, 1950, as amended (16 U.S. Code 777–777n) (SFRA). The SFRA directs the FWS to provide federal aid to states for the "material value in connection with sport or recreation in the marine and/or fresh waters of the United States." With the provision of federal funding, the AGFD Sport Fish Stocking Program is subject to compliance with theESA, as well as other applicable environmental laws and regulations. The FWS is the lead federal agency responsible for ESA compliance; the AGFD is the applicant and federal representative. The AGFD Sport Fish Stocking Program proposes to use the grant funds to maintain and enhance recreational fishing opportunities at 167 locations within 8 of the 14 watersheds in Arizona.

Type of statement: The purpose of this Section 7 Biological Assessment (BA) is to provide the data necessary to evaluate the effects of the proposed action on a location-specific basis while also considering the potential interdependent, interrelated actions and cumulative effects on federally listed, proposed species and/or critical habitats. Through this evaluation, WSFR will determine the need for informal or formal consultation and/or conference to comply with the Endangered Species Act.

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Chapter 1 INTRODUCTION

The purpose of this Biological Assessment (BA) is to identify, analyze and evaluate potential impacts of proposed fish stocking activities of the Arizona Game and Fish Department (AGFD) through the statewide stocking program for a period of ten years on any listed species and/or critical habitats, candidate species, and certain species likely to be listed during this consultation period, This analysis will determine the need for informal or formal consultation, and/or conference with the U.S. Fish and Wildlife Service's Arizona Ecological Services Office (AESO) to achieve compliance with the Endangered Species Act (ESA). This document incorporates the required information as outlined in the Federal Aid Section 7 Biological Evaluation Form, guidance from the Federal Aid Toolkit and Section 7 Consultation Handbook.

PROPOSED ACTION

The Dingell-Johnson Sport Fish Restoration Act as amended (16 U.S.C. 777-777n) (SFRA) directs the FWS to provide Federal aid to States for the management and restoration of fish having "material value in connection with sport or recreation in the marine and/or fresh waters of the United States." In accordance with this Act, for nearly 50 years, the FWS has been distributing SFRA funds in support of the State's efforts to stock sport fish to maintain, expand, and enhance angling opportunities. To fulfill this legislative mandate, the WSFR proposes to fund, in part, for the next ten years, the AGFD sport fish stocking program. Sport fish would be stocked in selected waters of Arizona to provide the public with opportunities for recreational fishing. The proposed action also includes a Conservation and Mitigation Program to address impacts on native species, including federally listed and candidate species.

This consultation is focused on evaluating impacts of the sport fish stocking program funded with SFRA grant dollars, to candidate, threatened, and endangered species and critical habitat listed under the ESA of 1973 as amended. For the purposes of this consultation, the sport fish stocking program involves transport of fish from hatcheries or via contract vendors to proposed stocking locations and any effects resulting from these activities. State hatchery operation and maintenance have been evaluated under a separate Section 7 consultation. Furthermore, this consultation also includes, as part of the proposed action, the implementation of a Conservation and Mitigation Program, described below in this section, to address potential effects of the fish stocking program.

PROPOSED STOCKING LOCATIONS & STOCKED SPECIES

The current proposed action identifies a total of 167 stocking sites (lakes, tanks, stream reaches) and 18 fish species for stocking for the period covered by this consultation (Table 1; Figure 1). Of these waters, 131 are within the Statewide Stocking Subprogram, 21 are within the UFP and 15 are within the FIN Subprogram. Appendix A provides a detailed breakdown of each proposed stocking site, species proposed to be stocked, frequency of stocking actions, numbers of fish to

be stocked annually and size class of fish to be stocked. Ranges of frequency and timing of stocking events are also identified to allow flexibility depending primarily on fish availability as well as water availability and quality.

Table 1. Species proposed for stocking in Arizona waters by the Sport Fish Stocking Program.

Common Name	Code	Scientific Name	Common Name	Code	Scientific Name
Apache Trout	ONAP	*Oncorhynchus apache*	Largemouth Bass	MISA	*Micropterus salmoides*
Arctic Grayling	THAR	*Thymallus arcticus*	Rainbow Trout	ONMY	*Oncorhynchus mykiss*
Black Crappie	PONI	*Pomoxis nigromaculatus*	Redear Sunfish	LEMI	*Lepomis microlophus*
Bluegill Sunfish	LEMA	*Lepomis macrochirus*	Smallmouth bass	MIDO	*Micropterus dolomieu*
Brook Trout	SAFO	*Salvelinus fontinalis*	Threadfin Shad[1]	DOPE	*Dorosoma petenense*
Brown Trout	SATR	*Salmo trutta*	Walleye	SAVI	*Sander vitreus*
Channel Catfish	ICPU	*Ictalurus punctatus*	White Amur[2]	CTID	*Ctenopharyngodon idella*
Cutthroat Trout	ONCL	*Oncorhynchus clarki*	White Crappie	POAN	*Pomoxis annularis*
Gila Trout	ONGI	*Oncorhynchus gilae*	Yellow Perch	PEFL	*Perca flavescens*

The maximum number of fish to be stocked includes a buffer above and beyond the number of fish that would normally be stocked (or is planned to be stocked) annually to allow for unanticipated opportunities to stock more fish if needed (e.g. when surplus fish are available from a hatchery, or when stocking conditions are unsuitable at one location, and an alternate stocking location needs to be identified). It is unlikely that the maximum numbers of fish identified in the proposed action will be stocked every year; however, if surplus fish are available the AGFD desires the ability to stock these fish in approved waters to provide additional angling opportunity rather than discard them.

Fish are categorized into length groups generally depending on length ranges; size groups include: fry, fingerling, sub-catchable or catchable (Table 2). Minimum lengths are indicated for the catchable category; any fish greater than the specified length is considered a catchable. Super catchable or incentive fish are considered catchables.

[1] Stocked as a forage fish for sport fish
[2] Stocked in lakes primarily for vegetation control, not necessarily for sporting opportunity, although some opportunity may be provided.

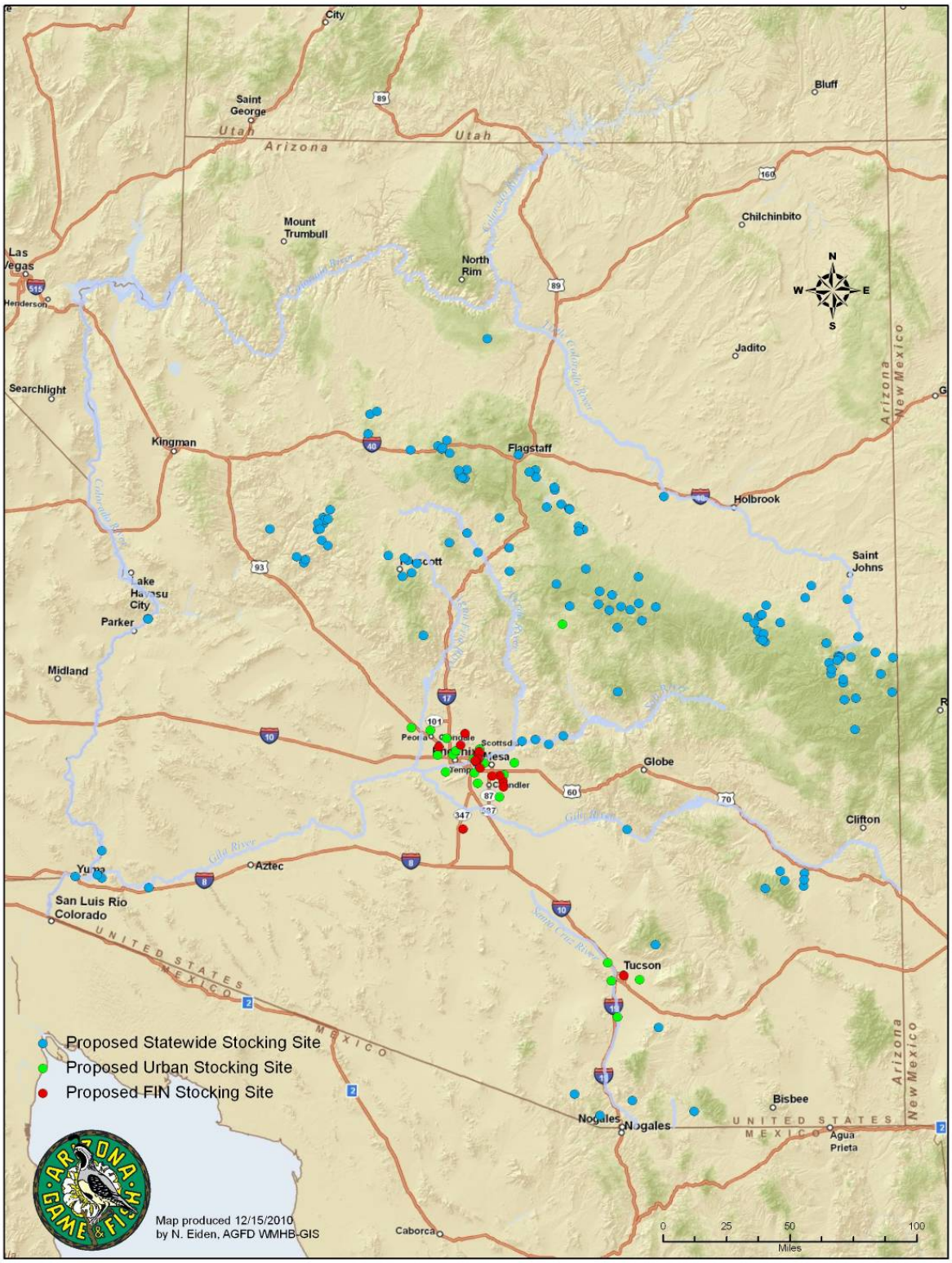


Figure 1. Proposed statewide stocking location within all three AGFD stocking programs.

Table 2. Fish length (in inches) ranges for fry, fingerling, sub-catchable or catchable categories. A size range is only indicated for those sizes proposed for stocking.

Warm Water Species	Fry	Fingerling	Sub-catchable	Catchable
Bluegill Sunfish	<0.5”	-	0.5 - 3”	>3”
Channel Catfish	<1”	-	1 - 11”	>11”
Largemouth Bass	<1”	-	1 - 8”	>8”
Redear Sunfish	<0.5”	-	0.5 – 4”	>4”
Smallmouth Bass	<1”	-	1 - 7”	>7”
White or Black crappie	<0.5”	-	0.5 - 5”	>5”
Cool Water Species*				
Walleye	<1”	1 – 2”	-	-
Yellow Perch	<0.5”	0.5 – 2”	-	-
Cold Water Species				
Trout	-	3 – 5”	6 – 8”	>8”
Arctic Grayling	-	3 – 5”	5 – 7”	-

*Cool water species sizes are for sac fry rather than fry

Sources of Stocked Sport Fish

Each year, the AGFD stocks more than 3 million fish for anglers to catch in Arizona’s lakes, rivers and streams. In order to accomplish these stockings, the AGFD acquires eggs from outside vendors for hatching and production in state hatchery facilities as well as purchases of fish from contract vendors. Fish are also received on an opportunistic or special basis from Federal or other State hatcheries outside Arizona.

Given the last three complete years of stocking (Fiscal Years 07-09) [3]:

- On average, 89.5% of the fish stocked by the program are from state hatcheries and 10.5% are from contract vendor
- Of fish stocked in the Statewide subprogram, 99.2% are cold water species comprised of Apache (3.3%), brook (5.4%), brown (1.6%), cutthroat (1.6%) and rainbow trout (88.1%).

[3] Calculations exclude walleye and bass stockings in Saguaro, Canyon and Apache lakes as inclusion of these numbers bias the average numbers and are not typical of any given stocking year. Fingerling walleye were opportunistically stocked in FY08 &09; bass were stocked in response to a golden algae kill. There are no plans to stock bass in these reservoirs in the current proposed action unless there is another catastrophic loss of the fishery.

- Of contract vendor fish purchased, 93.7% are stocked in UFP waters; 6.3% are stocked in statewide waters.
- 90.4% of warm water fish stocked in the state are stocked into UFP waters
- 99.2% of fish stocked in Statewide subprogram waters are cold water fish

State Hatcheries

The AGFD acquires eggs from vendors for fish production in the six hatcheries operated by the State of Arizona. Five of these hatcheries supply fish for the AGFD Sport Fish Stocking Program; the sixth facility, the Bubbling Ponds Hatchery, does not usually supply fish for this program and is not SFRA funded. The other five AGFD hatcheries supply close to 90% percent of the fish stocked under the existing AGFD Sport Fish Stocking Program. In total, five species of fish are produced; these include Apache trout, brook trout, brown trout, cutthroat trout, and rainbow trout. Within the AGFD hatcheries, brook trout, cutthroat trout, and brown trout are reared to fingerling and sub-catchable sizes; only very rarely are they reared to catchable size. Annual production from each hatchery is dependent on temperature, fish strain, feeding regime and fish health. Currently, the hatcheries are at maximum production capabilities.

The hatcheries do not maintain brood stock for egg sources, so all fish produced originate from other sources. These include commercial, state, and Federal producers. Egg and fish suppliers must be able to demonstrate annually and historically that originating facilities have had annual fish health inspections, following protocols established by the American Fisheries Society Fish Health Section, as being free of restricted fish diseases and their causative agents as identified in R12-4-410. Additionally, all AGFD hatcheries are inspected annually following the aforementioned protocols prior to the distribution season. AGFD operates a fish health laboratory staffed with a Fish Health Specialist whose primary responsibility is to provide fish health inspection and diagnostic services for hatchery operations and wild fisheries.

Contract Vendors

Since state operated hatcheries are at maximum production capabilities, and primarily produce trout species, additional fish are supplied through contract vendors. Contracted fish are primarily warm water species; however some trout are also purchased. The UFP is the primary recipient of contract purchased fish; however, if funding is available, several waters in the Statewide Stocking Program may be stocked with sport fishes in addition to those fish provided by the AGFD hatcheries (primarily trout) in order to increase fishing opportunities statewide. Stocked warm water fish create a different and/or seasonal opportunity when rainbow trout cannot be stocked, and at several waters provide opportunity during warmer months when trout are not active.

Fish purchased from contract vendors must meet strict health certification requirements. By Contract, fish must be certified free of pathogens and disease and non-target organisms. AGFD

employees receive all stockings and inspect deliveries prior to stocking. Proof of disease status must be supplied annually.

Best Management Practices & Standard Operating Practices

The AGFD employs several best management and standard operating practices intended to promote consistent statewide fisheries management approaches. Several of these practices are integral components of the Sport Fish Stocking Program.

Standard Fish Sampling Protocol for State of Arizona Waters

The AGFD Sport Fish Program employs the Standard fish Sampling Protocol (Bryan et al 2004). The primary objective of this manual is to provide a standardized format for collecting and reporting fishery data. It also serves as a reference document for biologists, technicians, and administrators on specific survey gear and techniques. The manual focuses on sampling activities that, based on the best available information, provide the requisite information necessary for planning and evaluating fish management programs. Unless otherwise specified in reporting, post 2004 AGFD data reported and discussed in this biological assessment is collected in accordance with Bryan et al 2004.

This manual is reviewed and modified frequently to respond to planning needs and to justify management practices. Continuous evaluation and refinement of survey techniques are also necessary to incorporate new information while ensuring comparability to historical data.

Additional procedures have been developed and implemented statewide intended to detect and minimize transport of other non target organisms, examples include: Decontamination Procedures for Golden Alga, and Decontamination Procedures for Quagga Mussels.

Hazard Analysis Critical Control Point (HACCP) & AGFD Hatcheries

In the course of human activities, equipment and/or organisms are often moved from one location to another. The specific equipment or organism being moved is called the target. Targets can include fish for stocking to meet recreational demands or conservation requirements. Fish stocking may require the use of equipment such as trucks, sampling tools/gear such as nets or traps, and people. Transporting targets provides a potential vector for the spread of non-target organisms that could potentially invade new habitat. Non-target organisms (NTO) are the plants, animals, diseases, pathogens and parasites that are not intended to be moved.

The management of potential pathways to control the movement of non-target organisms has been standard business operations with the food production industry and military for decades and is known as Hazard Analysis and Critical Control Points (HACCP; Figure 2). Within the past 5-10 years, HACCP processes have been designed specifically for numerous natural resource applications, such as hatchery operations. HACCP planning is a management tool that provides a

structured method to identify risks by applying detailed focus on procedures[4]. More specifically, HACCP planning involves a comprehensive review of operational actions that in turn can provide a systematic method to identify threats of contamination by NTO's. The planning process strategically highlights *critical control points* where specific actions should be used to eliminate or significantly reduce the risk of NTO's contamination.

HACCP plans also provide an important reference source allowing procedures and processes to improve and evolve through time. HACCP planning is a concept that identifies where to concentrate research, development, or other efforts to control or prevent the spread of NTO's through an aquaculture pathway.

A critical control point is the best point, step, or procedure at which significant hazards can be prevented or reduced to a minimum risk. All HACCP's utilize a common approach to nuisance, invasive, or non-target organisms in that they cover a broad range of organisms (i.e., vertebrates, invertebrates, plants, and other biota or pathogens) rather than listing species-specific threats. The AGFD provides training to hatchery staff and field resource managers with the specific goal to develop and maintain HACCP plans for essential hatchery activities.

Procedures

Assuming hatchery water supply is reasonably secure from bio-contamination, then for most hatchery operations, there are essentially three operational areas warranting development and practice of HACCP procedures:

- Products such as fish or eggs coming into a hatchery,
- Products (i.e., fish) leaving a hatchery, and
- Transfer of equipment between facilities.

AGFD hatcheries are at a comparatively very low risk for transmitting NTO's from hatcheries to other points in the state. The AGFD operates five hatcheries that produce trout for stocking, and one cool water facility that produces native fishes for conservation:

- Page Springs Hatchery (PSH)
- Sterling Springs Hatchery (SSH)
- Canyon Creek Hatchery (CCH)
- Tonto Creek Hatchery (TCH)

[4] See the following website for additional information: http://haccp-nrm.org/

- Silver Creek Hatchery (SCH)

Hatcheries that have secured water sources (TCH, CCH, and SSH) are extremely unlikely to become infected with NTO biota because there are no reasonable pathways to infect the source springs other than through deliberate human sabotage of the spring boxes or pipes.

Page Springs Hatchery has two water sources, one of which is secured (Pond Springs) and the other is partially secured (Cave Spring). It is unlikely that NTO biota could become established due to the small area of exposed water surface coming from Cave Spring before it enters underground pipes. Moreover, the exposed portion of Cave Spring is protected by a chain link fence, locked gate, and screened entrance. There are also metal screens that filter debris prior to entering the headbox and subsequent hatchery pipes. Introduction of NTO biota via more natural means (transmission via mammals or birds) is unlikely due to fast moving water, which largely precludes use of Cave Spring by mammals and birds.

Silver Creek Hatchery has an open water sources and therefore has a greater potential for NTO contamination. See Table 3 for more information regarding water source and associated risks.

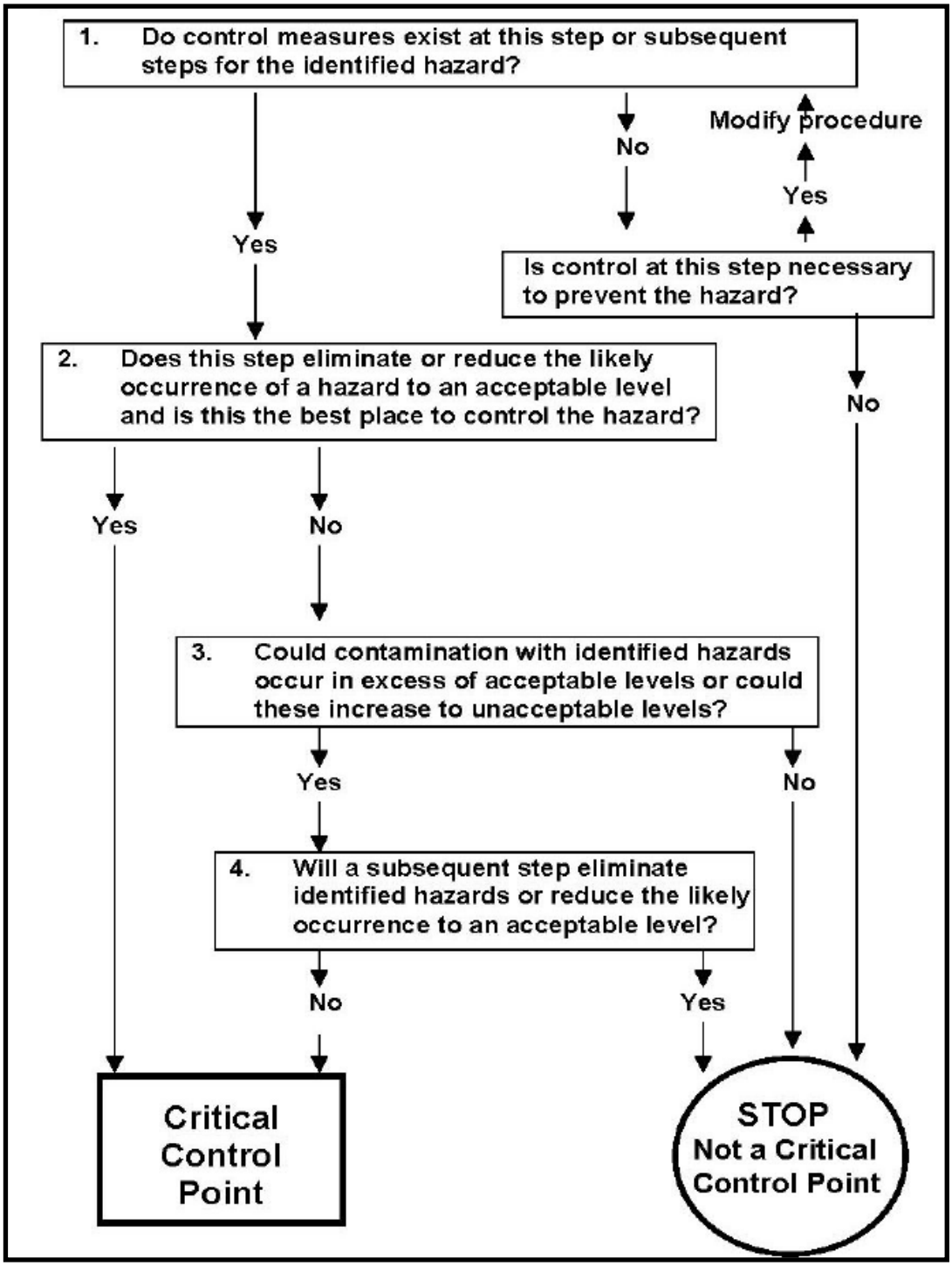


Figure 2. Critical control point decision tree.

Table 3. Water source information and risk of contamination of Non-Target Organisms for AGFD hatcheries.

Hatchery	Water Source	NTO's Present in Water Source	HACCP Plan developed for fish distribution	Risk of transferring NTO's to other waters
Sterling Springs	Secured spring, and underground as well as above-ground pipes	No	No[5], but has HACCP for equipment transfers to/from Sterling Springs Hatchery.	Virtually None
Page Springs	Combination of secured spring (Pond Spring) and semi-exposed spring (Cave Spring) all with underground pipes	No	YES	Very low
Tonto Creek	Secured springs with underground pipes	No	YES	Virtually None
Canyon Creek	Secured springs with underground pipes	No	YES	Virtually None
Silver Creek[6]	Open spring, open ditch.	YES, crayfish, native fish, nonnative fish, and aquatic vegetation are present	YES	Low[7]

The hatcheries do not maintain brood stock for egg production. Thus, trout eggs are obtained from external sources. The AGFD requires fish health certification for all imported. HACCP's

[5] Distribution of fish from Sterling Springs is done by staff from Page Springs Hatchery with Page Springs equipment. The Page Springs HACCP plan for fish stocking is applied to stockings from Sterling Springs.
[6] The spring source for Silver Creek Hatchery is currently open to ingress of non-target organisms such as bullfrogs and flows through an open ditch system to the hatchery. Silver Creek is scheduled to be renovated starting in Autumn 2011. The renovation includes protection of the spring water source and distribution of the water to the hatchery in a closed pipe system which will minimize risks associated with mollusk and vegetation in the hatchery. Thus, after the renovation, the risk of transferring NTO's to other waters will be low.

[7] Hatchery-produced fish are transferred to a stocking truck or trailer tank from the raceways either by netting or by using a fish harvester. Both methods remove hatchery water so that fish are placed into a tank that contains clean groundwater from a well. Fish are visually inspected prior to stocking.

have been developed to cover fish distribution as well as equipment transfers. Each hatchery facility has a HACCP Plan because each facility is unique (water source, infrastructure, risks/hazards present, etc.) and has slightly different operational procedures.

The HACCP plans for the above-mentioned actions focus efforts on "Critical Control Points"; however, there are also several operational areas where detection of NTO's can take place. For example, detection of a NTO can occur at various procedural steps in the production process such as cleaning raceways, feeding fish, or other repetitive tasks. The procedures provide an opportunity to detect NTO's or fish disease. Should a NTO or significant fish health issue be discovered, it would be investigated to determine the source, analyze the threat to the hatchery, and thereafter options would be reviewed to determine the best approach to address and/or remove the NTO or threat. Table 4 indicates procedural steps employed in AGFD hatcheries that additionally serve as detection points for NTOs.

Table 4. Procedural steps that additionally serve as detection points for non-target organisms for AGFD hatchery operations.

Hatchery Procedure	**Hatchery**	**Frequency**
Inspect spring boxes or water source	PSH	As needed
	SSH	Semi-annually
	CCH	As needed
	TCH	Monthly
	SCH	Daily
Clean screens for inflow and/or outflow	PSH	Daily
	SSH	NA
	CCH	NA
	TCH	Monthly
	SCH	Daily
Clean and inspect sediment traps	PSH	NA
	SSH	NA
	CCH	Semi-annually
	TCH	Semi-annually
	SCH	NA
Feed and observe fish	PSH	Ranges from twice daily to once every week
	SSH	Ranges from hourly to once every week
	CCH	Ranges from hourly to once every week
	TCH	Ranges from hourly to once every week
	SCH	Ranges from twice daily to once every week

Hatchery Procedure	Hatchery	Frequency
Conduct fish health assessments	PSH	Minimum of once annually and as needed
	SSH	Minimum of once annually and as needed
	CCH	Minimum of once annually and as needed
	TCH	Minimum of once annually and as needed
	SCH	Minimum of once annually and as needed
Monitor water quality (oxygen) in rearing units	PSH	Minimum once per week and as needed
	SSH	Minimum once per week and as needed
	CCH	Minimum once per week and as needed
	TCH	Minimum once per week and as needed
	SCH	Minimum once per week and as needed
Remove dead fish	PSH	Daily
	SSH	Daily
	CCH	Daily
	TCH	Daily
	SCH	Daily
Clean rearing units	PSH	1-2 times per week
	SSH	1-2 times per week
	CCH	1-2 times per week
	TCH	1-2 times per week
	SCH	Usually 1 time per year at the end of the stocking season (October)
Crowd and sample count fish for transfer or stocking	PSH	Usually done within ± 3 days of stocking or a transfer
	SSH	Usually done within ± 3 days of stocking or a transfer
	CCH	Usually done within ± 3 days of stocking or a transfer
	TCH	Usually done within ± 3 days of stocking or a transfer
	SCH	Usually done within ± 3 days of stocking or a transfer
Inventory fish	PSH	Usually 2-3 times per year during transfers to other rearing units
	SSH	Usually 2-3 times per year during transfers to other rearing units
	CCH	Usually 2-3 times per year during transfers to other

Hatchery Procedure	Hatchery	Frequency
		rearing units
	TCH	Usually 2-3 times per year during transfers to other rearing units
	SCH	Fish are inventoried at TCH before transfer to SCH
Transfer fish among rearing units	PSH	Usually 2-3 times per year per rearing unit
	SSH	Usually 2-3 times per year per rearing unit
	CCH	Usually 2-3 times per year per rearing unit
	TCH	Usually 2-3 times per year per rearing unit
	SCH	NA
Dewater and sanitize rearing units by scrubbing and pressure washing	PSH	Usually 2-3 times per year following transfers
	SSH	Usually 2-3 times per year following transfers
	CCH	Usually 2-3 times per year following transfers
	TCH	Usually 2-3 times per year following transfers
	SCH	Usually 1 time per year at the end of the stocking season (October)

SPORT FISH STOCKING CONSERVATION & MITIGATION PROGRAM

Program Overview

For over 40 years, the Department has provided significant management resources for the conservation of nongame wildlife. In 1967, the Department created a full time position for the management of nongame species, the first such state position in the nation. Since 1967 the Department has developed one of the most robust state nongame programs in the nation, with expenditures of several million dollars per year.

The Department recognizes that the ability to continue to provide sport fishing opportunities is closely tied to the continued conservation of native aquatic species. It is upon this foundation, and consistent with its long history of conservation, that the Department intends to offset impacts of the stocking program through implementation of a Conservation and Mitigation Program (Program) that will provide for a total average of $500,000 per year for the 10 year Program period. This funding will provide a net increase of funding toward conservation for the Program species. The intent of the Program is to not only offset impacts but to further improve the baseline status of species identified by the Endangered Species Act (ESA) and National Environmental Policy Act (NEPA) evaluation processes through directed conservation actions in

order to help secure future management opportunities. The Department's budget process is administered by the Arizona Game and Fish Commission.

Program Species

As such, the Program includes activities targeted at both consultation species identified in the draft Biological and Conference Opinion (DBCO) and sensitive aquatic species identified in the draft Environmental Assessment (DEA). Collectively, these are termed the "Program Species." Program Focal Species are those identified by DBCO that are federally listed or candidate species most closely associated with the stocking action (Table 5). Additional Conservation Species (ACS) are the other species evaluated in the DBCO comprised of federally listed or candidate species whose future conservation status can have a direct bearing on future sport fish stocking activities. Mitigation actions are also targeted at sensitive aquatic species identified in the DEA that are most closely associated with the stocking action.

Table 5. Draft Biological and Conference Opinion Focal Species

Species	**ESA Status**
Chiricahua leopard frog	Threatened
Headwater chub	Candidate
Loach minnow	Threatened
Narrow-headed garter snake	Potential Candidate[8]
Northern Mexican garter snake	Candidate
New Mexico meadow jumping mouse	Candidate
Northern leopard frog	12 Month Review in prep
Roundtail chub	Candidate

Program Approach

The Program employs several approaches or tools that can be used to provide information that can help determine what actions are necessary for the conservation and recovery of species or to directly conserve and recover wildlife. These tools include:

- Population inventory: systematic sampling of areas to assess species presence;
- Population or community monitoring: systematic sampling of populations to determine status and/or trend over time;

[8] Project area species likely to be listed in the near future were evaluated in the BCO.

- Directed research: activities that focus on specific issues relating to species interactions to define management options for future implementation;
- Address stressors[9]: Identify and assess current and future key stressors to native aquatic wildlife populations that are, or may be, controlling or predominant contributing force driving the population or species declines. Collaborate with stakeholders to address, remove, or mitigate these key stressors;
- Reintroduction and augmentation: reintroduction or augmentation into historical range is a frequently used tool to recover species. Reintroductions are often coupled with construction of exclusion barriers and removal or suppression of nonnative species. Reintroductions and augmentations are implemented consistent with accepted guidelines such as George et al. (2009).
- Information, education, and outreach activities: includes signs, publications, promotions, and marketing activities; and
- Guidelines: assessing, evaluating, and proposing modifications of guidelines or regulations that can protect or minimize threats to native aquatic species.

The fundamental concept of the Program is to provide aquatic community based conservation strategies that will benefit Program species as well as other native species. Community-based conservation actions provide benefits to Program and other native species at the individual, population and watershed scales, and depending on location, can benefit multiple species at one time. Aquatic habitats available for conservation actions under the Program may be limited, and with a community-based focus, the Program can work to establish functional native aquatic communities in the conservation areas. For example, reintroduction or augmentation actions often include suppression or removal of nonnative species prior to reintroduction of the target species, a benefit to the entire native aquatic community at the introduction site. Reintroduction will include the target species and a contingent of additional appropriate native species in order to establish a functional native aquatic community.

Reduction or removal of stressors on the landscape is a tool that has a range of benefits at both the local and broad scales. Removal of sources of nonnative species from the landscape (e.g. to facilitate introductions or to eliminate a watershed source, etc) minimizes impacts to native species at the site of removal and also minimizes downstream contributions of individuals that help maintain or augment resident nonnative populations.

[9] Implementation of actions on the landscape may result in stressors that affect species or their habitat. Such actions can include land management actions, road construction, or introduction of new species. Examples of stressors are habitat loss or degradation, predation, competition, or direct disturbance of individuals of a species.

Program Activities

Two tiers of Program activities have been identified; a set of mandatory conservation/mitigation activities targeted at Focal DBCO species and those ACS species with reasonable and prudent measures (RPMs) or terms and conditions (T&C) identified in the draft biological opinion (Table 6) and sensitive aquatic species identified in the DEA (Table 7). Table 8 contains an additional set of activities targeting Program species that will be implemented depending on funding availability.

Each year the Department will identify Table 6 and Table 7 activities for implementation that year through the annual work plan process. If funds remain after the Table 6 and Table 7 activities are funded, activities from Table 8 will be implemented. The average annual program budget will be $500,000.

Table 6. Mandatory ESA Conservation Actions.

Note that many Program species, regardless of activity focus as identified in the table, will benefit from both ESA and NEPA actions.

<table>
<tr><th>Species</th><th>Conservation Measure</th></tr>
<tr><td rowspan="2">Multiple Species[10]</td><td>Within 3 years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes.</td></tr>
<tr><td>The AGFD shall secure existing or establish new conservation populations for Focal Species:
<table>
<tr><th>Species</th><th>Number of populations secured or established</th></tr>
<tr><td>Chiricahua leopard frog</td><td>3</td></tr>
<tr><td>Headwater chub</td><td>3</td></tr>
<tr><td>Roundtail chub</td><td>3</td></tr>
<tr><td>Loach minnow</td><td>2</td></tr>
<tr><td>Northern leopard frog</td><td>2</td></tr>
<tr><td>[11]Northern Mexican gartersnake</td><td>2</td></tr>
<tr><td>[4]Narrow-headed gartersnake</td><td>2</td></tr>
</table></td></tr>
</table>

[10] Benefits would result for most aquatic-associated Focal, ACS and other special status species with implementation of these measures. For each measure, some species may benefit directly and some species may benefit indirectly. The magnitude of benefits for each species would also vary.
[11] Dependent upon available repatriation source, numbers, and protocols.

Species	Conservation Measure
	The AGFD shall conduct a statewide live bait (bait fish and tiger salamander) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission for implementation consideration.
	The AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species.
	The AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.
Apache Trout	The AGFD shall continue to work with partners to evaluate barrier conditions on the three streams, survey for nonnative fish in recovery streams, and repair barriers as part of the proposed action.
Chiricahua Leopard Frog	For warm-water sport fish stocking actions via contract vendors at sites where effects to Chiricahua leopard frogs are a concern, the “sensitive areas” HACCP plan shall be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan shall involve the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sport fish. Loads containing unwanted aquatic organisms shall be refused and not stocked.
	For coldwater sport fish stocking actions at sites where effects to Chiricahua leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery shall be in place to reduce the risk of contamination of the fish to be stocked.
	The AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.

Species	Conservation Measure
	The AGFD shall visually examine the shoreline and shallow lake margins for the presence of submerged/shoreline vegetation cover for tadpoles at the time rainbow trout are stocked and during any fish surveys conducted post-stocking.
	The AGFD shall work with the Coronado National Forest in management of habitat conditions at Peña Blanca Lake to ensure that submerged/shoreline vegetation cover for tadpoles is maintained at the lake.
Gila chub	In two years during the 10-year period, the AGFD shall survey the occupied Gila chub habitat on public lands in Spring Creek above the barrier when habitat conditions are conducive to rainbow trout persistence. If any stocked rainbow trout are found, these shall be documented and removed from the stream and an additional survey to locate stocked rainbow trout shall be implemented in the following year.
Headwater Chub	The AGFD shall implement actions to increase angler awareness of headwater chub, including the fact that headwater chub is not a legal sport fish at the East Verde River and Haigler Creek stocking sites.
	Headwater chub habitats in the East Verde River and Tonto Creek shall be considered priority areas for use of triploid rainbow trout to avoid augmentations to existing wild populations.
	In order to obtain information needed to implement conservation actions, the AGFD shall undertake an assessment of headwater chub populations in the East Verde River, Tonto Creek, and the Haigler Creek drainage to determine population structure and extent, nonnative species present as stressors, sites for potential reestablishment, and identification of specific research needs. This assessment shall tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for headwater chub and five other native fish species, because that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment shall serve as a guidance document for implementing conservation actions for the headwater chub.

Species	Conservation Measure
Roundtail Chub	The AGFD shall, within the first two years of the program, develop an assessment of opportunities across the range of the roundtail chub focusing on those with the greatest potential for conservation benefits for the species. This assessment shall tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for roundtail chub and five other native fish species, as that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment shall serve as a guidance document for implementing conservation actions for the roundtail chub.
Spikedace	The AGFD shall continue monitoring of the Upper Verde River to evaluate native and nonnative fish populations. Any individuals of the stocked sport fish species captured during such monitoring shall be removed from the river.
Loach Minnow	In the event of insufficient Apache trout to meet annual recreational stocking demands, the East Fork Black River shall be stocked with Apache trout after those recreational stocking sites associated with a recovery population (i.e., West Fork Black River, West Fork Little Colorado River at Sheeps Crossing, and Lee Valley Lake). Any rainbow trout that are stocked into the East Fork Black River shall be sterile triploids to avoid any augmentation to the reproducing population of rainbow trout in the East Fork Black River.
	If a spill from Big Lake or Crescent Lake is anticipated, the AGFD shall install a fish weir to capture fish and prevent downstream movement. If the weir is not installed prior to a spill, a survey for nonnative trout species in the occupied habitat of the loach minnow shall be completed within that spring/summer season. All nonnative fish species encountered during that survey shall be removed.
	In coordination with partners, the AGFD shall develop and implement a standard survey schedule and procedures to evaluate fish community with emphasis on stocked trout presence in the loach minnow occupied areas of the East Fork Black River drainage.

Species	Conservation Measure
Northern Leopard Frog	For warm-water sport fish stocking actions via contract vendors at sites where effects to northern leopard frogs are a concern, the "sensitive areas" HACCP plan shall be followed by AGFD personnel receiving the fish from the vendor. This "sensitive areas" plan shall involve the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sport fish. Loads containing unwanted aquatic organisms shall be refused and not stocked.
	For coldwater sport fish stocking actions at sites where effects to northern leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery shall be in place to reduce the risk of contamination of the fish to be stocked.
Sonoran tiger salamander	The AGFD shall work with Federal, state, and private partners to identify and implement projects that reduce the risk of hybridization between Sonoran tiger salamanders and nonnative salamanders.
	The AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.
Northern Mexican Gartersnake	The AGFD shall develop outreach material on gartersnakes to attempt to reduce the deliberate killing or injuring of gartersnakes by the public. Materials developed for this program shall be posted at stocking sites that contain populations of gartersnakes.
	In providing for two gartersnake populations either through securing existing but threatened populations or establishment of new conservation populations, a source for individuals to reestablish conservation populations is needed, as well as information on propagation and release options. The Gartersnake Working Group has initiated work in these arenas, and the AGFD shall contribute to these efforts during the 10-year program. Once sufficient information on potential release sites, release progeny, and release methods is obtained, the AGFD shall initiate the reestablishment program.

Species	Conservation Measure
	As part of all native fish reintroduction efforts in Arizona, the AGFD shall ensure that renovated streams occupied by northern Mexican gartersnakes are quickly restocked with appropriate native fish species and native frog species that can provide prey for Northern Mexican gartersnakes in order to not put stress on any gartersnake population through elimination of its forage base.
Narrow-headed Gartersnake	The AGFD shall develop outreach material on gartersnakes to attempt to reduce the deliberate killing or injuring of gartersnakes by the public. Materials developed for this program shall be posted at stocking sites that contain populations of gartersnakes.
	In providing for two gartersnake populations either through securing existing but threatened populations or establishment of new conservation populations, a source for individuals to reestablish conservation populations is needed, as well as information on propagation and release options. The Gartersnake Working Group has initiated work in these arenas, and the AGFD shall contribute to these efforts during the 10-year program. Once sufficient information on potential release sites, release progeny, and release methods is obtained, the AGFD shall initiate the reestablishment program.
	As part of all native fish reintroduction efforts in Arizona, the AGFD shall ensure that renovated streams occupied by narrow-headed gartersnakes are quickly restocked with appropriate native fish species that can provide prey for narrow-headed gartersnakes in order to not put stress on any gartersnake population through elimination of its forage base.
Three Forks Springsnail	The AGFD shall continue to implement the HACCP plan for operations at state hatcheries and the transport of trout to the stocking sites in the Black River drainage.
Mt Graham Red Squirrel	The AGFD shall coordinate with the Coronado National Forest on traffic management that can reduce the risk of mortality to Mount Graham red squirrels from vehicles accessing Riggs Flat Lake as part of continuing implementation of the Mount Graham Red Squirrel Recovery Plan.

Species	Conservation Measure
Little Colorado Spinedace	The stocking restrictions and implementing actions from the 1995 (FWS 1995) and 2001 (FWS 2001) incidental take statements for CC Craigin Reservoir, Knoll Lake, and Nelson Reservoir, except for modified creel survey requirements, are part of the Proposed Action for this consultation and shall be implemented over the next 10 years as described in those documents. Creel surveys shall occur no less than once every 10 years.
Arizona Treefrog Huachuca Distinct Population Segment	The AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.
Bonytail Razorback Sucker	A barrier net shall be installed at the La Paz County Park Lagoon immediately prior to the stocking event and remain in place for seven days after the stocking event. Prior to any stocking into La Paz County Park Lagoon, signs similar to those used on Lake Havasu shall be posted at the lagoon describing bonytail to anglers and informing them of what to do should they catch a bonytail. These signs shall remain in place as long as the barrier net is in place at the lagoon.
New Mexico Meadow Jumping Mouse	The AGFD shall provide protection from human access impacts, and if needed, enhancement actions for meadow jumping mouse habitats on AGFD-owned lands on the West Fork Black River. The AGFD shall coordinate with the Apache–Sitgreaves National Forests on evaluations of effects to meadow jumping mouse habitat along the East and West Forks of the Little Colorado River.

Table 7. Mandatory NEPA Mitigation Actions.

Note that many Program species will benefit from both ESA and NEPA activities.

Species	Mitigation Action

Multiple Other Special Status Aquatic and Semi-aquatic Species[12]	The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species through the removal of key stressors. The AGFD shall address two stressors impacting these species and associated aquatic communities within each of the following sub-watersheds/catchments: • Verde River sub-basin • Salt River sub-basin • Middle Gila sub-basin • Little Colorado River sub-basin • Bill Williams sub-basin
	The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species through planning using a watershed approach. The AGFD shall apply the its Watershed-based Fish Management Process (AGFD 2009) to develop aquatic species management plans for all priority watersheds in the state. The planning process will include consideration for special status species and identify conservation opportunities for incorporation within the planning framework. Special status species will benefit through identification of focal management areas and restoration needs that can be prioritized into multiple land management programs and funding sources in a coordinated approach.
Piscivorous Riparian or Aquatic Nesting Birds	The AGFD shall develop information tools to educate anglers on the impacts of fishing debris on riparian or aquatic nesting birds. The AGFD shall continue to support the monofilament recovery bin program by replacing old and providing new bins.

Table 8. ESA Conservation Commitments that will be implemented contingent upon funding availability; actions are targeted at Additional Conservation Species (ACS) but may also benefit Focal and NEPA sensitive aquatic species.

Species	**Conservation Action**
Multiple Species	The AGFD shall reintroduce ACS and sensitive aquatic species alongside Focal species as deemed appropriate during planning.

[12] Mitigation measures would also benefit ESA Focal and ACS species. For each measure, some species may benefit directly and some species may benefit indirectly. The magnitude of benefits for each species would also vary.

Species	Conservation Action
Arizona Treefrog Huachuca DPS, Northern Leopard Frog, N. Mexican Gartersnake, Narrow-headed Gartersnake, Headwater Chub, Roundtail Chub, Loach Minnow, Chiricahua LF, Quitobaquito pupfish, Desert pupfish, Sonoran tiger salamander, Gila Topminnow, Razorback sucker, Apache Trout, Southwestern Willow Flycatcher, Little Colorado Spinedace, Page Springs Springsnail, Sonora Chub, Spikedace, Three Forks Spring Snail, Yellow-billed Cuckoo	The AGFD shall continue to work with partners to implement species recovery plans or other recovery/conservation strategies, including monitoring, nonnative species removal efforts, reestablishment of populations within the historical range, monitoring and repair of barriers, or other tools/approaches.
Chiricahua LF, spikedace loach minnow, northern LF, narrow-headed garter snake	The AGFD shall share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and gartersnake populations in the San Francisco River drainage.
Gila Chub	The AGFD shall work with AESO and partners to develop and implement a recovery plan for the Gila chub. As part of that effort, conservation needs for the species relative to nonnative fish species will be identified and included in the plan.
Southwestern Willow Flycatcher	The AGFD shall work with the ASNF to evaluate impacts to physical and biological features of designated critical habitat on the West Fork Little Colorado River from anglers accessing the stocking sites at Greer and Sheeps Crossing.

Species	Conservation Action
Yellow-billed cuckoo	The AGFD shall work with the Coconino, Prescott, and Tonto National Forests to evaluate impacts to physical habitat features along the occupied habitats on the Verde River from anglers accessing the stocking sites at the middle Verde River, Oak Creek, West Clear Creek, and Wet Beaver Creek.
Little Colorado spinedace	While implementing the Integrated Fisheries Management Plan for the Little Colorado River (Young et al. 2001) and the East Clear Creek Watershed Recovery Strategy for Little Colorado Spinedace and Other Riparian Species (USDA 1999), in cooperation with other partners, the AGFD whall consider other conservation actions to benefit the species. Such actions may include, but are not limited to: • Surveys in the Chevelon Creek watershed from the headwaters to Rock Art Ranch to identify nonnative species distribution and determine suitability of habitats for spinedace reintroductions; • Once suitable habitats are identified, plan and implement renovations and reintroductions of spinedace into the Chevelon Creek watershed; • Mechanically remove wild trout from drainages above CC Cragin Reservoir and green sunfish from below the reservoir; • Remove wild brown trout and nonnative warmwater fish species from the mainstem Little Colorado River above Lyman Lake; • Repatriate spinedace found in Nelson Reservoir to occupied habitat upstream; • Continue to work with partners to replicate populations, fund habitat improvements, and maintain or improve habitat for spinedace on Wildlife Management areas that support spinedace;
New Mexico Meadow Jumping Mouse	The AGFD shall explore opportunities to manage for suitable meadow jumping mouse habitats at other AGFD-owned properties in the White Mountains.

Species	Conservation Action
Humpback chub	While implementing the Integrated Fisheries Management Plan for the Little Colorado River (Young et al. 2001), the AGFD shall consider information and recommendations identified in Stone et al. (2007), Hilwig et al. (2009) and Valdez and Thomas (2009) regarding the Little Colorado River drainage above Grand Falls as a possible source of nonnative fish species (particularly channel catfish) into occupied humpback chub habitat in the lower Little Colorado River.

Planning and Program Implementation

A 10-year planning document will be developed to guide annual work plans for Focus species (Table 5) that identify resourcing as necessary to accomplish objectives. Annual conservation work plans will identify and prioritize species, activities, conservation tools, budget and staffing that will implement conservation objectives, including specific conservation actions or targets identified in Table 6 and 3 for Program species. In each year, an annual work plan will be developed by AGFD with input from and coordination with AESO and WSFR. The plan will identify specific actions which will be taken for consultation species in that year. The annual report of the previous year's activities will be the vehicle to assess progress toward meeting the conservation measures.

Annual work plans will also include additional species and activities based on conservation priority and program budget availabilities (within the $500,000 average annual Program budget). Annual conservation work plans will identify and prioritize species, activities, conservation tools, budget and staffing that will implement achievable conservation activities, potentially including conservation actions identified in Table 8.

Program Reporting

The AGFD would report on progress and implementation of mitigation measures annually over the 10-year period. Reports would be submitted to the WSFR following existing annual grant reporting schedules and would include any findings as identified in the terms and conditions.

ACTION AREA

INDIVIDUAL SPECIES SITE-SPECIFIC SCALE

The individual species site-specific scale evaluates the effects attributable of the proposed action of stocking sportfish into the stocking sites relative to the presence of consultation species at or near those sites and how that stocking affects those species, and includes effects to species from anglers accessing the stocking sites. The action area for this scale includes the proposed sportfish stocking sites and the hydrologically connected areas surrounding them where stocked

sportfish or their progeny may be found after the stocking event. The hydrologically connected areas for each stocking site were determined based on a number of factors including the presence of perennial water, connectivity between waters during normal hydrological cycles, and the presence of barriers or obstacles that impeded or prevented movement by live sportfish from the stocking site. Some stocking sites were determined to be closed, and the action area for those sites did not extend beyond the stocking site and the adjacent area anglers use to access the stocking site.

Consultation species evaluated under the individual species site-specific scale are those where direct and/or indirect effects from the stocking actions are anticipated. Those effects, and any conservation measures included in the proposed action, are analyzed on those effects, the status of the species, the environmental baseline and the cumulative effects.

AREA-WIDE SCALE

The area-wide scale has a wider perspective and focuses on the indirect, interrelated, and interdependent effects of the proposed action that are more effectively addressed at this wider scale and looks at three general areas; two of which are concerned with the introduction or facilitated movement of nonnative fish, amphibians, and invertebrates; invasive aquatic species; and parasites or diseases (hereinafter referred to as unwanted aquatic organisms) to waters in Arizona.

The first is the inadvertent transport of unwanted aquatic organisms via stocking actions that are part of the proposed action, persons legally engaged in supporting sportfishing in Arizona (for example, bait dealers) or by anglers pursuing stocked sportfish.

The second is the illegal introduction or transport of unwanted aquatic organisms through deliberate actions of anglers or other persons for purposes of creating private bait sources, creating new fishing opportunities outside of legal stocking actions, or other violations of laws and regulations regarding introduction and transport of aquatic species.

Not all illegal or inadvertent movement of unwanted aquatic organisms is attributable to the <u>current</u> proposed action as an interdependent action; the illegal and inadvertent movement of unwanted aquatic organisms has gone on for decades and while originally these activities were directly attributable to nonnative fish stocking of the time and should be considered an effect of those actions, the spread of unwanted aquatic organisms during the period covered by this consultation is more complex. All illegal or inadvertent movements of unwanted aquatic organisms that occurred prior to the date of this BA are part of the Environmental Baseline for this consultation. A subset of the future illegal or inadvertent movement of nonnative aquatic organisms is considered under the effects of the action as an interdependent action, and the remainder considered in Cumulative Effects. Conservation measures identified to address effects from these actions are considered in this analysis.

The third area is the physical effects to aquatic or riparian habitats from anglers pursuing stocked sportfish at stocking sites. These include degradation of physical habitat features, and the disturbance, injury, or death of individuals of affected species (both aquatic and terrestrial). For the terrestrial species, this evaluation is included in greater detail in the individual species site-specific analyses, because it is the only effect of the action on those species. Because there is no measure of these effects, and other recreationists also contribute to these effects, it is not feasible to measure the magnitude of these effects across the landscape.

SPECIES CONSIDERED IN THE CONSULTATION

BACKGROUND

The WSFR Program requested a species list for this consultation on August 19, 2008. The Arizona Ecological Services Office (AESO) responded with a list of species on September 9, 2008. A letter was sent by WSFR on October 7, 2009 to request an update to the September 2008 list. The updated list was received on October 26, 2009.

The October, 2009 list was developed looking at all listed, proposed, and candidate species in Arizona. Species were removed from consideration if the potential for interactions with stocked sport fish or their progeny or anglers pursuing stocked sport fish or their progeny was not likely to require further consideration. AESO noted that the list was subject to modification as specific stocking sites and species stocked were identified during the consultation process.

During discussions from September, 2008 to September, 2009, the original list of species was informally modified based on discussions on connectivity of stocked waters with other waters in Arizona. Some species on the original list, for example the Zuni bluehead sucker, were removed from consideration because their extant populations were sufficiently isolated from stocking sites or connected waters such that exposure to stocked fish or their progeny was not likely to occur.

The original species list did recognize that the act of stocking sport fish could be a vector for transport of nonnative invasive species, parasites, or diseases to native species habitats. These organisms include fish, amphibians, reptiles, mollusks (New Zealand mud snail, Quagga mussels), and crustaceans (crayfish, mitten crabs) that are of themselves injurious to native species or may transmit parasites or diseases. This concept was refined between September 2008, and September, 2009, to look more closely at nonnative species, parasite, or disease transmission related to the sport fish stocking program.

Between October 26, 2009 and March, 2010, AESO examined the two species lists and evaluated the potential for any exposure to direct or indirect effects of the proposed action for all listed, proposed, candidate, and 10j species in Arizona. AESO also include in these tables species in Arizona for which a 90-day finding of may be warranted for listing has been made and a 12-month finding initiated or those species which AESO is considering developing a candidate

form. Since these species may, within the time period covered by the consultation, become candidates for listing, AESO determined if there could be effects from the proposed action that might require future evaluation. AESO's evaluation indicated that the northern leopard frog and narrow headed garter snake warranted evaluation for this consultation.

SPECIES CATEGORIES FOR SECTION 7 CONSULTATION ON THE PROPOSED ACTION

The tables below divide the list of Arizona species into categories based on the potential for effects from the proposed action. Table 9, Table 10 and Table 11 contain the lists of Arizona species to be specifically considered in this consultation. Table 12 contains the list of aquatic species for which a specific risk from the proposed action has not been identified; however, these species will be globally considered in discussions of accidental introduction of injurious species and illegal transport of stocked sport fish and their progeny. Table 13 contains species that will not be considered further due to lack of exposure. In Table 11, Table 12 and Table 13, the rationale for the decision to consider or not consider them in the consultation is also provided. Table 9, Table 10 and Table 11 also differentiates between species with "may affect, likely to adversely affect" or "likely to adversely modify critical habitat" findings and formal consultation was requested by WSFR and species with "may affect, not likely to adversely affect" or "not likely to adversely modify critical habitat" findings and concurrence was requested by WSFR. For proposed, candidate, and 10j species, the differentiation is between "not likely to jeopardize" and "likely to jeopardize" the continued existence of the species. According to the regulations establishing section 10j experimental non-essential populations, the loss of that population cannot result in jeopardy to the species as a whole, so all 10j populations in Table 9, Table 10 or Table 11 have a finding of non-jeopardy.

Table 9. List of aquatic species found in Arizona considered in biological and conference opinion with initial determination of "may affect" for exposure to stocked sport fish or their progeny and illegal transport of nonnative organisms, parasites or diseases.

Common Name	**Scientific Name**	**ESA Status**	**Critical Habitat**[13]
Page springsnail	Pyrgulopsis morrisoni	C	
Three Forks springsnail	Pyrgulopsis trivialis	PE	
Apache trout	Oncorhynchus apache	T	
Bonytail	Gila elegans	E	
Colorado pikeminnow	Ptychocheilus lucius	10j	
Gila chub	Gila intermedia	E	Yes
Gila topminnow	Poeciliopsis o. occidentalis	E	

[13] Species may have critical habitat in Arizona, however, unless there could be effects to critical habitat, this space is left blank

Common Name	Scientific Name	ESA Status	Critical Habitat[13]
Headwater chub	Gila nigra	C	
Humpback chub	Gila cypha	E	Yes
Little Colorado Spinedace	Lepidomeda vittata	T	Yes
Loach minnow	Tiaroga cobitis	T	Yes
Razorback sucker	Xyrauchen texanus	E	Yes
Roundtail chub	Gila robusta	C	
Spikedace	Meda fulgida	T	Yes
Woundfin	Plagopterus argentissimus	10j	
Arizona treefrog-Huachuca DPS	Hyla wrightorum	C	
Chiricahua leopard frog	Lithobates (= Rana) chiricahuensis	T	
Northern leopard frog	Lithobates (= Rana) pipiens	90-day	
Sonora tiger salamander	Ambystoma malvortium stebbinsi	E	
Narrow-headed garter snake	Thamnophis rufipunctatus		
Northern Mexican garter snake	Thamnophis eques megalops	C	

Table 10. List of non-aquatic species found in Arizona considered in biological and conference opinion with initial determination of "may affect" due to anglers accessing stocking sites.

Common Name	Scientific Name	ESA Status	Critical Habitat[14]
Bald eagle, Sonoran DPS	Haliaeetus leucocephalus	Delisted	
Mexican spotted owl	Strix occidentalis lucida	T	Yes
Southwestern willow flycatcher	Empidonax traillii extimus	E	Yes
Yellow-billed cuckoo	Coccyzus americanus	C	
Yuma clapper rail	Rallus longirostris yumanensis	E	
Mexican gray wolf	Canis lupis baileyi	10j	
Mount Graham red squirrel	Tamiasciurus hudsonicus grahamensis	E	
New Mexico meadow	Zapus hudsonius luteus	C	

[14] Species may have critical habitat in Arizona, however, unless there could be effects to critical habitat, this space is left blank

Common Name	Scientific Name	ESA Status	Critical Habitat[14]
jumping mouse			

Table 11. List of aquatic species found in Arizona considered in biological and conference opinion with initial determination of "may affect" for potential effects of the illegal transport by anglers and other persons of stocked species or their progeny that may also transfer parasites or diseases.

Common Name	Scientific Name	Status	Discussion
Desert pupfish	Cyprinodon macularius	E	Reintroduced populations are in watersheds containing stocked sport fish. Illegal transport of stocked sport fish or bait species used to fish for stocked sport fish is possible. Contamination of xx population sites by nonnatives after pupfish were stocked is documented.
Quitobaquito pupfish	Cyprinodon eremus	E	Only natural population in United States is in Quitobaquito Spring pond. Nonnative fish (bullheads, golden shiner) were illegally introduced in the past. Golden shiner is a legal bait fish species for stocking sites on the lower Gila and lower Colorado rivers.
Sonora chub	Gila ditaenia	T with CH	Stocked species (largemouth bass and bluegill) documented in California Gulch. Bait species (green sunfish, goldfish, and mosquitofish) documented in California Gulch. Bait species (green sunfish, mosquitofish) documented in Sycamore Canyon. Nonnative fish identified as concern in recovery plan (USFWS 1992) for predation and spread of parasites.
Sonoyta mud turtle	Kinosteron sonoriense longifemorale	C	No nonnative species large enough to consume turtles or their eggs is known from Quitobaquito Spring Pond. However, concerns exist for the illegal introduction of bullfrogs, crayfish, and large predatory fish (largemouth bass) (USFWS 2009c)

Table 12. Aquatic species in Arizona unlikely to be affected by direct or indirect effects of the proposed action (including illegal transport of stocked fish or their progeny, parasites or diseases) but will be considered globally and rationale for that determination.

Common Name	Scientific Name	Status	Rationale
Huachuca springsnail	Pyrgulopsis thompsoni	C	Aquatic dependent but not found in areas where stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers or others that pursue stocked sport fish or their progeny. Nonnative species were not identified as a threat in the most recent candidate form (USFWS 2009a).
San Bernardino springsnail	Pyrgulopsis bernardina	PE	Found in one spring at Slaughter Ranch near San Bernardino NWR. Ranch is a park with open access to the pond near the spring, and there is a risk of introduction of nonnative species, but not likely from the proposed action as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk.
Stephan's riffle beetle	Heterelmis stephani	C	Aquatic dependent but not found in areas where stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sport fish or their progeny. Nonnative species introductions not identified as a threat in the most recent candidate form (USFWS 2009b).
Beautiful shiner	Cyprinella formosa	T with CH	Access to populations on the San Bernardino NWR is restricted and there is no fishing allowed, limiting the incentive to move fish here or establish bait populations. Past introduction of Asian tapeworm via nonnative fish species indicates that there is connectivity in a global sense with aquatic populations elsewhere.
Virgin River chub	Gila seminuda	E with CH	Found only in the Virgin and Muddy rivers in northern Arizona, eastern Nevada and southern Utah. Risk of exposure to stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sport fish in or their progeny or other illegal movement of disease or parasite vectors in Arizona is not reasonably identified.
Woundfin	Plagopterus argentissimus	E with CH	Found only in the Virgin River in northern Arizona, eastern Nevada and southern Utah. Risk of exposure to stocked fish, other species of concern, or

Common Name	Scientific Name	Status	Rationale
			disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sport fish in or their progeny or other illegal movement of disease or parasite vectors in Arizona is not reasonably identified.
Yaqui catfish	Ictalurus pricei	T with CH	Extent and proposed populations on San Bernardino and Leslie Canyon NWRs and at Safe Harbor sites on Leslie Creek and HCP sites on West Turkey Creek have low risks of nonnative introductions due to limited access (private land) and no extant fishing opportunity. West Turkey Creek already contains nonnative fish species and is closed to fishing, reducing incentive for illegal stockings of sport fish or bait fish. Population at House Pond on the Slaughter Ranch is at higher risk due to open access to pond by visitors; but exposure risk from the proposed action is low as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk.
Yaqui chub	Gila purpurea	E with CH	Extent and proposed populations on San Bernardino and Leslie Canyon NWRs and at Safe Harbor sites on Leslie Creek and HCP sites on West Turkey Creek have low risks of nonnative introductions due to limited access (private land). West Turkey Creek already contains nonnative fish species and is closed to fishing, reducing incentive for illegal stockings. The population at House Pond on the Slaughter Ranch is at higher risk due to open access to pond by visitors; but exposure risk from the proposed action is low as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk.
Yaqui topminnow	Poeciliopsis occidentalis sonoriensis	E	Extent and proposed populations on San Bernardino and Leslie Canyon NWRs and at Safe Harbor sites on Leslie Creek have low risks of nonnative introductions due to limited access (private land). The population at House Pond on the Slaughter Ranch is at higher risk due to open access to pond by visitors; but exposure risk from the proposed action is low as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk.
Zuni	Catostomus	C	Nonnative species not found in occupied areas in Kin

Common Name	Scientific Name	Status	Rationale
bluehead sucker	discobolus yarrowi		Li Chee watershed, but fathead minnows were found downstream nearer to Ganado Lake. Use of live bait fish are not allowed by Navajo Nation at Ganado Lake located at the downstream end of the creek. Unlikely that sport fish or bait species connected to the proposed action would be moved to the Navajo Nation by anglers fishing in non-tribal areas. Green sunfish and fathead minnow identified as problems in New Mexico. Fishing on Navajo Nation requires separate tribal fishing permit.
Relict leopard frog	Lithobates (Rana) onca	C	Found only on Lake Mead National Recreation Area in springs and small seeps. Aquatic dependent but not found in areas where stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sport fish or their progeny or other illegal movement of disease or parasite vectors in Arizona is not reasonably identified.

Table 13. All other listed, proposed, or candidate species in Arizona determined not to be affected by direct or indirect effects of the proposed action and rationale for that determination.

Common Name	Scientific Name	Status	Rationale
Black footed ferret	Mustela nigripes	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Hualapai Mexican vole	Microtus mexicanus hualpaiensis	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Jaguar	Panthera onca	E	Exposure risk for disturbance to individuals from anglers at/near stocking sites is unlikely due to developed nature of lakes proposed for stocking and normally high recreationist use of those sites that reduces likelihood of jaguar use of site.
Lesser long-nosed bat	Leptonycteris curasoas yerbabuenae	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Ocelot	Leopardus (= Felis)	E	Not aquatic or riparian dependent. No

Common Name	Scientific Name	Status	Rationale
	pardalis		population in vicinity of proposed stocking sites
Sonoran pronghorn	Antilocapra americana sonoriensis	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
California black rail	Laterallus jamaicensis coturniculus	C	Marsh dependent but not found in or near stocking areas where stocked fish or anglers are likely to be present to cause disturbance to individuals.
California condor	Gymnogyps californicus	10j	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Gunnison sage grouse	Centrocercus minimus	C	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Masked bobwhite	Colinus virginianus ridgewayi	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Mountain plover	Charadrius montanus	PT	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Northern Aplomado falcon	Falco femoralis septentrionalis	10j	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Sprague's pipit	Anthus spragueii	90-day	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Desert tortoise (Mohave)	Gopherus (= Xerobates = Scaptochelys) agassizii	T with CH	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Desert tortoise (Sonora)	Gopherus (= Xerobates = Scaptochelys) agassizii	90-day	Not aquatic or riparian dependent. Populations in upland areas in general vicinity of some low elevation stocking sites. Individuals not likely to be found in association with aquatic or riparian habitats
Flat-tailed horned	Phrynosoma mcallii	PT	Not aquatic or riparian dependent. No

Common Name	Scientific Name	Status	Rationale
lizard			population in vicinity of proposed stocking sites
New Mexico ridge-nosed rattlesnake	Crotalus willardi obscurus	T with CH	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Tucson shovel-nosed snake	Chionactis occipitalis klauberi	90-day	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Kanab ambersnail	Oxyloma haydeni kanabensis	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Acuna cactus	Echinomastus erectocentrus var. acunensis	C	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Arizona cliffrose	Purshia subintegra	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Arizona hedgehog	Cehinocereus triglochidiatus var. arizonicus	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Brady pincushion cactus	Pediocactus bradyi	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Canelo Hills ladies'-tresses	Spiranthes delitescens	E	Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species.
Cochise pincushion cactus	Coryphantha robbinsorum	T	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Fickeisen plains cactus	Pediocactus peeblesianus var. fickeiseniae	C	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Gierisch mallow	Sphaeralcea gierischii	C	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Huachuca water-umbel	Lilaeopsis schaffneriana ssp.	E with CH	Aquatic dependent but introduction of stocked fish, other species of concern, or

Common Name	Scientific Name	Status	Rationale
	recurva		disease/parasite vectors is not identified as an issue of concern for this species.
Holmgren (Paradox) milkvetch	Astragalus homgreniorum	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Jones' cycladenia	Cycladenis humilis var. jonesii	T	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Kearney blue star	Amsonia kearneyana	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Lemmon fleabane	Erigeron lemmonii	C	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Navajo sedge	Carex specuicola	E with CH	Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species.
Nichol Turk's head cactus	Echinocactus horizonthalonius var. nicholii	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Peebles Navajo cactus	Pediocactus peeblesianus var. peeblesianus	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Pima pineapple cactus	Coryphantha scheeri var. robustispina	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
San Francisco Peaks groundsel (ragwort)	Packera franciscana	T	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Sentry milk vetch	Astragalus cremnophylax var. cremnophylax	E	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Siler pincushion cactus	Pediocactus sileri	T	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites
Welsh's milkweed	Asclepias welshii	T	Not aquatic or riparian dependent. No population in vicinity of proposed

Common Name	Scientific Name	Status	Rationale
			stocking sites
Wright's marsh thistle	Cirsium wrightii	90-day	Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species.
Zuni (rhizome) fleabane	Erigeron rhizomatus	T	Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites

ARIZONA SPORT FISH STOCKING PROGRAM OVERVIEW

SPORT FISH PROGRAM

The mission of the AGFD Sport Fish Program is to: Maintain, manage, and enhance the quality, abundance, availability, and diversity of sport fishing opportunities, and disseminate information about Arizona's sport fish and sport fishing opportunities for present and future generations.

The programmatic goals and objectives of the AGFD Sport Fish Program are:

Sport Fish Goals:

- Maintain, manage, and enhance the quality, abundance, availability, and diversity of sport fishing opportunities while contributing to the conservation of Arizona's native fishes.
- Develop integrated, watershed-based fisheries management approaches for watersheds in Arizona and identify reaches or zones for management of sport fishes and native fishes.
- Increase public awareness of Arizona's sport fishing resources and opportunities.
- Develop and implement actions to increase angler recruitment and retention.

Sport Fish Objectives:

- Annually, provide sport fishing opportunities to accommodate 1.6 million coldwater and 4.4 million warm water angler days by the year 2012.
- Achieve a 10 percent increase in satisfaction rating among Arizona's angling public by 2012 (i.e. percent of Arizona's anglers indicating they were satisfied with their angling experience, currently 68%, new target 75%).

The AGFD Sport Fish Stocking Program is a subprogram within the overarching AGFD Sport Fish Program.

Current Demand

In Arizona, 422,000 anglers take advantage of recreational fishing opportunities each year (USFWS 2006). There were 4,156,000 angler use days of fishing in Arizona with a total annual economic impact of $1.3 billion (Southwick Associates 2007). The AGFD estimates a resident demand of 6 million angler use days through 2012 (AGFD 2009). Demand for angling opportunities in Arizona is anticipated to further increase given current trends in population growth and projected growth models, especially for those areas in close proximity to urban area boundaries.

Sport Fish Stocking Program Funding

The Dingell-Johnson Sport Fish Restoration Act as amended (16 U.S.C. 777-777n) (SFRA) directs the FWS to provide Federal aid to States for the management and restoration of fish having "material value in connection with sport or recreation in the marine and/or fresh waters of the United States." In accordance with this Act, for nearly 50 years, the FWS has been distributing SFRA funds in support of the State's efforts to stock sport fish to maintain, expand, and enhance angling opportunities.

Evolution of the Sport Fish Stocking Program

The history of legally stocking fish across the landscape dates back to 1872 when the U.S. Commission of Fish and Fisheries (Fisheries Commission) was tasked by Congress to supplement declining "native stocks of coastal and lake food fish through fish propagation" and the National Fish Hatchery System was formed (www.fws.gov/fisheries/fisheries.html). Federal hatcheries were created that same year and operated in most states (Stein 2010). The Fisheries Commission was renamed the U.S. Bureau of Fisheries in 1903 and as the federal hatchery system grew, fish were transported and stocked across the country using fish cars via the railroad system (1871–1933).

In 1913, the Arizona Legislature created an agency called the Department of State Game Warden. In 1929, its name was changed to the Arizona Game and Fish Commission. The State of Arizona enacted legislation to manage fish in state waters, and in 1922, began construction of the first state-operated fish hatchery.

In 1940, the FWS was created and the Bureau of Fisheries was merged into it. Stocking programs continued and increased to offset the decline of fish resulting from the creation of dams and other federal water projects (www.fws.gov/fisheries/nfhs/).

In 1950, the Dingell-Johnson Federal Aid to Fisheries Act was passed by the U.S. Congress to provide Federal funds to states for fisheries restoration and management programs. Later amendments authorized funding for aquatic education, wetlands restoration and boating safety. As a result, stocking efforts and the development of fishery management programs, including but not limited to hatcheries, expanded and intensified due to the availability of federal funds.

Stocking records in Arizona, from both federal and state-operated hatcheries, were sparse due to the lack of stipulations for types of projects and lack of clarity for reporting requirements under the Act that came later in the late 1980s and 1990s. In Arizona during the 1940s, emphasis on raising and stocking fish shifted to cold water species, primarily trout (Bassett et al 1998). The availability of Federal Aid funds and continued growing public demand for fishing prompted the creation of a lake development program within the AGFD in the 1950s, 1960s, and early 1970s and provided for the creation of many recreational lakes within the state including Luna, Big, Crescent, Ashurst, Kinnikinick, Woods Canyon, Riggs Flat, Fool's Hollow, Rose Canyon, Arivaca, Pena Blanca, Parker Canyon, Lynx, Knoll, Bear Canyon, Chevelon Canyon, Black Canyon, and Willow Springs lakes. The creation of these lakes greatly increased the number of stockings and number of species stocked during this time period. Most of these lakes provided substantial recreational opportunities to the public as well as food on their tables. Threadfin shad were initially harvested from the lower Colorado River to stock in warm water lakes as a forage base for bass and crappie populations. Trout stockings in Arizona and across the western U.S. were most numerous in the 1960s for several reasons: increased funding, the improvement of existing hatcheries, creation of new hatcheries, and improved propagation techniques (Schade and Bonar 2005), as well as growth in human population and recreational interest.

A turning point in the AGFD Sport Fish Stocking Program occurred in the early 1990s, when a number of previously stocked sites and species were eliminated from the stocking program in response to conservation concerns, fish population viability, environmental variability, economics, and cost benefit. At roughly that same time, the AGFD began to expand the stocking of urban lakes and ponds. The dual mandates of the FWS and the AGFD played a notable role in bringing about the changes in the stocking program over the last 15–20 years. The existing stocking program reflects these changes and formed the basis for the development of the action alternatives.

Decisions on whether to stock certain waters or species are based on various factors which may include but are not limited to one or more the following:

- Exposure/impacts to native species and critical habitat
- Lack of consistent availability and quality of water, limiting the suitability of continued stocking at some water bodies or limiting sustainability of populations at a given waterbody
- Angler demand for additional angling opportunities (species or locations)
- Loss of angler access to stocking areas
- Emphasis on existing native aquatic species management in the area
- Limited availability of funds to purchase additional fish above what can be provided by the hatcheries

- Regional fisheries programs determining where the allocation of hatchery fish would be stocked; deciding not to stock one water over another, depending on water availability, quality, and angler use/satisfaction; and availability of hatchery fish
- Tribal sovereignty in cessation of AGFD stocking of tribal waters
- Angler demand for wild fisheries sustained by natural reproduction

Current Sport Fish Stocking Program

As part of the existing program, AGFD stocking sites are managed under two subprograms: the Statewide Sport Fish Stocking Subprogram and the Urban Sport Fish Stocking Subprogram. The AGFD is proposing to add a third category—the Fishing in the Neighborhood (FIN) Subprogram.

The first subprogram is a state-wide fish stocking program whereby identified waters and species are stocked across the state. Stocking locations receive a range of stocking intensities (species and/or numbers) and frequencies based on fish supply, water availability and quality, angler use, access, and impacts to other fish and wildlife resources. The second subprogram, Urban Fishing Program (UFP), is targeted at providing angling opportunity within municipal public parks and urban recreational areas under an intensive use concept.

The FIN subprogram, while similar to the UFP by providing angling opportunities within urban areas, is a less intensive concept. The FIN focuses on angler recruitment and retention by supplementally stocking established urban park lakes to increase recreational angling opportunity by attracting new anglers and retaining existing anglers. The UFP and FIN programs are only partially supported by the use of SFRA funds. The proposed action analyzed within this consultation includes stocking activities for all three of the subprograms.

Statewide Sport Fish Stocking Subprogram – Overview

The current stocking proposal includes 132 Statewide Stocking Subprogram waters which are proposed for stocking at varying frequencies and intensities. Many of these waters provide primary and secondary fisheries that meet both cold and warm water needs on any given year. In some cases, the primary fishery may be a seasonal intensive use, put-and-take, channel catfish fishery, and the secondary fishery may be a year round naturally reproducing warm water fishery consisting of bass or sunfish. Of the 132 proposed stocking locations, 17 are stream reaches and the remaining 115 locations are tanks, lakes or reservoirs.

Few of the waters managed by the AGFD are owned or controlled by the State. In Arizona, large water storage projects sometimes pose challenges for fisheries management, and their primary purposes are for irrigation, hydroelectric power, flood control, and municipal uses. Sport fishing is rarely the principal purpose for the construction and operation of these impounded waters (not withstanding the recreational impoundments previously mentioned). AGFD manages these

warm water fisheries under concepts related to the type of water management occurring at the waterbodies they occupy.

Stocking approaches are developed to support consistent stocking strategies that provide 1) intensive use fisheries, 2) augmentation of fisheries with insufficient natural production to provide consistent angling opportunity, or to bolster existing fisheries in response to fluctuating environmental conditions 3) unique or seasonal opportunity, and 4) a new fishery or recovery of self maintaining populations from partial or complete loss due catastrophic events (e.g. fish kills resulting from algal blooms; fires; Figure 3). AGFD considers several factors when identifying suitable stocking locations and species that include but are not limited to the following: water quality, quantity and persistence; existing aquatic communities; species biology; impacts to native species; angler use and access; partnership commitments and needs; and social demands.

It is very unlikely that all statewide waters would be stocked in any given year, rather only a subset of the locations and species identified as the proposed action would likely be implemented. These regular stockings comprise the core stocking program and are expected to occur on an annual basis or at least every 2-3 years. As environmental conditions (e.g. high water year) and fish availability allow, the number of sites/species stocked in any given year may fluctuate depending on whether it is possible to provide additional opportunities for angling. Stockings to reestablish or augment a fishery in response to a partial or complete loss are expected to be infrequent and may not occur at all during the next 10 years. These locations and species have been included in the consultation because these fisheries support high use. If loss of a high use fishery were to occur, the public would likely expect that the sport fishery be made whole and the AGFD would desire the ability to respond quickly to recover the fishery and minimize the loss of angling opportunity. Establishment of new fisheries (either new locations and/or new species at an existing location) is identified in response to increasing angler demand or to provide angling opportunity in geographic locations that may not currently support fishing opportunities. These stockings (referred to as Statewide Protocol Stockings in the Proposed Action Table) will be conducted according to the Statewide Stocking Protocol (Appendix B).

The AGFD schedules and operates numerous fishing clinics each year. These clinics serve to provide targeted opportunities for Arizonan's to explore a new sporting opportunity, expand their developing skills or simply enjoy a social activity with friends and family. Many clinics are held in June during National Free Fishing Day, when license requirements for fishing in the state are waived. The AGFD also has a group of volunteer fishing instructors available to groups that would like to schedule fishing clinics. These clinics serve to maintain angler participation and recruit new anglers, young or old, to the sport. As part of some AGFD hosted fishing clinics, extra fish may be stocked into approved waters to enhance the success and satisfaction of clinic participants' angling experience, hopefully encouraging them to become life-long participants. The timing of stocking, locations stocked, numbers of fish stocked, and species of fish stocked are not always consistent and may vary from year to year.

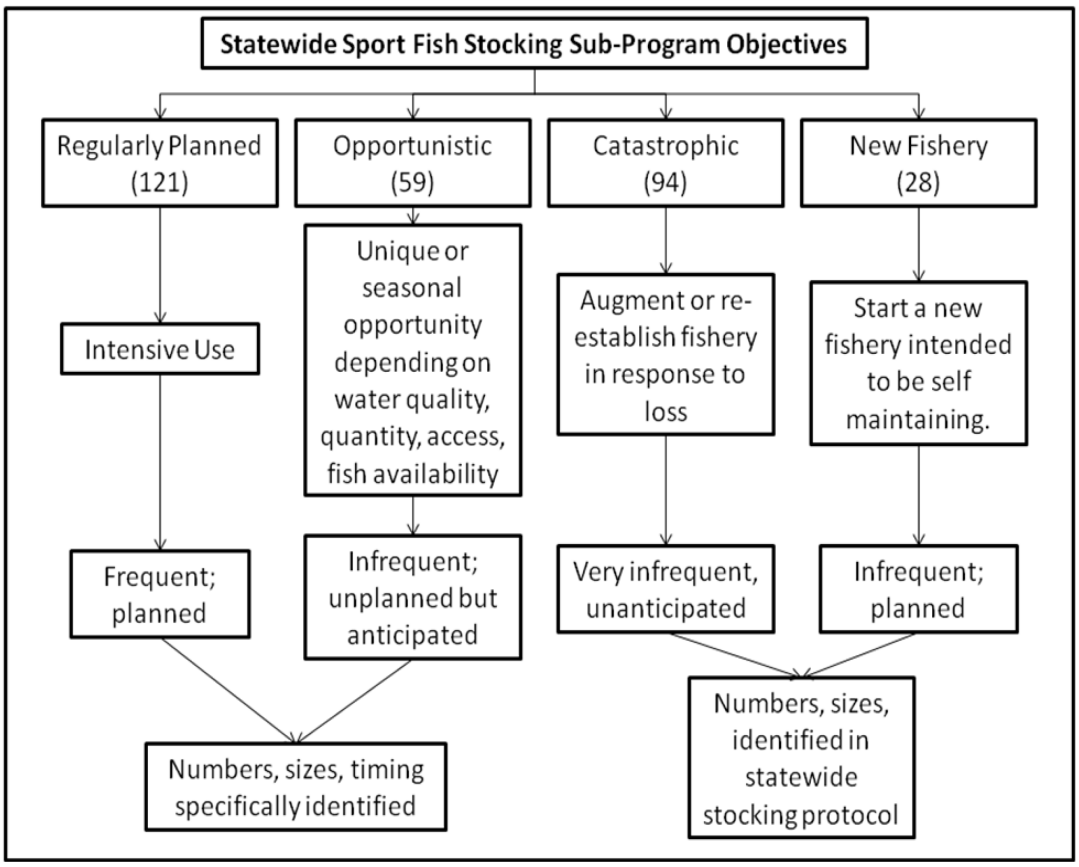


Figure 3. Overview of the objectives employed by the Statewide Sport Fish Stocking Subprogram.

Number of waters where each objective might be employed is indicated in brackets; multiple objectives may be employed at any one water. A new fishery may be a new species at a location that already has an existing population, or a brand new location not previously stocked.

Urban Fishing Subprogram – Overview

The Urban Fishing Program (UFP) is a partnership between the AGFD, local city and county parks and recreation departments to intensively stock and manage park lakes for fishing recreation. The UFP operates on the premise that "if people can't get out of town to fish, we will bring fish into town for the people." The UFP provides convenient, affordable, accessible and fun fishing for anglers of all ages and abilities.

There are currently 21 designated UFP lakes in 11 cities. These lakes are intensively stocked from 20-24 times per year with trout, catfish and sunfish, and may be stocked with other species as well. Many fishing clinics and educational programs are held each year at park lakes. Youth participation is a high priority and they represent 25% of the Program participants.

The UFP was not a federal Sport Fish Restoration program until October 2002. It was not until this time that federal aid funds were used for fish purchases, or for program operation and management. The UFP is funded through SFRA funding as well as via a cooperative effort between the cities of Chandler, Gilbert, Mesa, Payson, Peoria, Phoenix, Sahuarita, Scottsdale, Surprise, Tempe and Tucson. The UFP is supported by the sale of Urban Fishing Licenses and from fees paid into the program by the city parks and recreation departments.

There are presently 16 UFP lakes in the greater Phoenix Metro area that includes eight municipalities, 4 UFP lakes in the Tucson area, and 1 UFP lake located in the Town of Payson. These artificial lakes are all in municipal public parks and urban recreational areas. Three stocking strategies occur at UFP lakes:

- Put-and-take stockings of catchable sized fish for the purpose of fishing recreation and harvest.
- Supplemental stockings that either adds fish to a fishery to help augment low natural reproduction, or increase fishing success for a clinic or other fishing event.
- Restocking of fish communities following catastrophic events or lake draining.

Fishing in the Neighborhood (FIN) Subprogram – Overview

An AGFD priority goal is the recruitment and retention of anglers. A proposed concept to support this goal over the next ten years is the FIN Program concept. Based in established urban areas at established urban park lakes, the FIN program would be based on supplementally stocking these waters to increase recreational angling by attracting new anglers and retaining existing anglers. Fifteen prospective FIN (urban recruitment) waters may be periodically stocked in the future. All proposed FIN waters are located in the urban areas. Reasons for stocking would be for:

- Fishing derbies and similar events.
- Supplemental stockings that add fish to augment low natural reproduction and increase fishing success.
- Stockings of fish species to restart the fish population after a catastrophic event (e.g., golden alga kills) or lake draining.

The FIN concept differs from the UFP concept by: 1) primarily delivering warm water sport fish at significantly fewer stockings each year, and 2) providing moderate, rather than intensive, angling recreation use. Additional fish stockings to augment low natural reproduction or replace fish lost during renovation projects or catastrophic events may be required and would be

conducted according to the Urban Fishing Start-Up and Augmentation Stocking Guidelines (Appendix B).

STATE RULES, REGULATIONS AND AUTHORITIES

INCIDENTAL CATCH AND POSSESSION OF LISTED SPECIES OF FISH

As identified in AGFD Commission Order 40 and as summarized in the AGFD Fishing Regulations, all native fish including Federally listed, candidate, and proposed species (as per the ESA) except those designated as sport fish (i.e., Apache trout, desert sucker, and roundtail chub) are protected statewide, are illegal to possess, and if caught, must immediately be released alive and unharmed.

TRANSMISSION OF DISEASES

Regulations that address potential transmission of fish diseases are identified at R12-4-410 for aquatic wildlife stocking permit holders and at R12-4-411 for live bait dealer's license holders and require originating facilities to be able to demonstrate, through annual fish health inspections, that they are free of restricted fish diseases and their causative agents. Operational protocols and procedures (outside the current rules and regulations) that address potential transmission of diseases are discussed later in this document in the section on analysis methods.

TRANSPORT AND INTRODUCTION OF LIVE SPORT FISH BY THE PUBLIC

R12-4-405 prohibits the importing, purchasing, and transporting of live wildlife without an Arizona license or permit. Under ARS § 17-306, and R12-4-402 the transport and introduction of fish or other organisms to Arizona waters is prohibited except as expressly authorized (e.g., Title 3, Chapter 16 relating to licensed aquaculture). With some restrictions, R12-4-315 allows fish taken alive to be possessed alive on the waters from which they were taken, but prohibits the transport of said fish alive from these waters, except as allowed under R12-4-316. Additional information on potential effects is discussed later in this document in the section on analysis methods.

USE AND TRANSPORT OF LIVE BAIT FISH AND OTHER ORGANISMS

R12-4-316 governs possession, transportation, importation, and use of live baitfish, crayfish, and waterdogs. Baitfish may be purchased at authorized dealers or captured and used onsite where legal to do so. Not all waters of Arizona are open to all bait species; rather the AGFD has designated specific areas for use of certain species of baitfish. Bait fish are not allowed at any site in Apache, Cochise, Coconino, Navajo, or Pima Counties. In the other counties, the use of baitfish is allowed at specific sites. The species currently permitted for use in Arizona are: fathead minnow, mosquitofish, red shiner, threadfin shad, golden shiners, goldfish, sunfish, carp, and tilapia. It is illegal to release live baitfish into any Arizona waters. These restrictions assist in protecting both native and sport species and their habitat from the introduction of new nonnative

species or diseases that may be carried by those species. Additional information on potential effects is discussed later in this document in the section on analysis methods.

CHAPTER 2 ENVIRONMENTAL BASELINE AND RESOURCE CONDITIONS

BACKGROUND

Arizona's natural fish fauna historically consisted of 36 species of fish, only two of which were traditionally sought by early Americans for sport fishing, the Apache and Gila trout. Since the early 1900's, the AGFD has supplemented recreational angling opportunities by stocking state waters with sport fish species. The AGFD manages sport fishing resources in two broad categories, reflecting cold water fisheries (trout) and warm water fisheries. Management of these waters is based on biology, angler use, partnership commitments and needs, and social demands.

The AGFD has 159 stream management reaches that are managed primarily for trout. Those areas have a combined length of 1470 miles. Four other stream reaches, totaling 34 miles, are managed primarily for warm water species and secondarily for trout. Presently, 64 lakes, comprising approximately 3,000 acres, are managed primarily for trout. Ten other lakes managed primarily for warm water fish also provide trout fishing opportunities, on approximately 30,000 acres. AGFD manages about 354,800 acres of impounded water (lakes, reservoirs, ponds, and tanks) and 35,840 acres of flowing water (about 1400 linear miles) for warm water species. Recreational angling creates a statewide economic impact of more than $1.1 billion annually. In 2007, AGFD sold 375,158 fishing licenses, generating revenue of $8.8 million.

Each year hundreds of thousand Arizona residents and non-residents take advantage of recreational fishing opportunities provided by the sport fish stocking program. In 2006, there were 4,156,000 angler days of fishing in Arizona (2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, U.S. Fish & Wildlife Service). Sport Fish Restoration funding would make it possible for AGFD to continue to meet and sustain this demand for public recreational angling opportunities in Arizona waters.

The history of the discovery, identification and documentation of the distribution of fishes in Arizona began before the area became a state. Numerous surveys in the area and along the boundary of what would someday be the United States and Mexico were conducted from 1825-1912. These surveys documented some of the natural aquatic fauna found in the desert southwest prior to occupation by Anglo-Americans. Fish such as the razorback (humpback) sucker, Colorado pikeminnow (aka Colorado River white salmon) and roundtail chub (aka Verde trout) were abundant and common throughout the natural and (relatively speaking) unaffected waterways of the southwest.

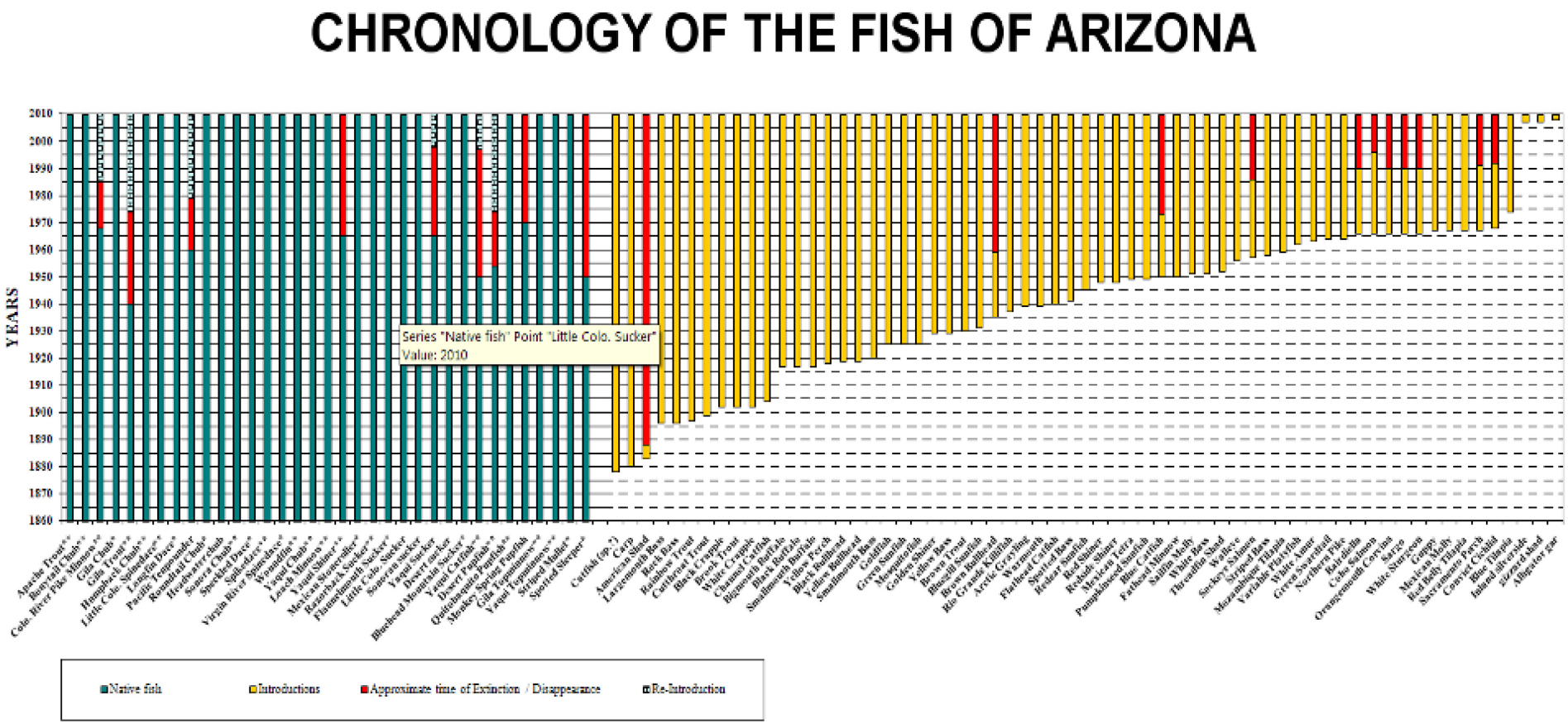
Frederic Morton Chamberlain was one of the earliest aquatic biologists to conduct systematic collections of fishes in Arizona, from January through April of 1904 (Brown 2009). By even this

early date in Arizona's history, Chamberlain documented introduced fishes co-occurring with the native species in many of the habitats in Arizona. In the Colorado River near Yuma, carp and catfish (bullheads) were collected alongside humpback suckers, salmon and bonytail. Carp were also found in the Santa Cruz River near Tucson with longfin dace, suckers, topminnow and chubs. Higher up in the mountains near Tucson, rainbow trout were planted in streams in 1901-1902. At Monkey Spring, formerly the only home known for the Monkey Spring pupfish (now extinct), catfish were introduced by the owner in 1899. Catfish (bullheads) were stocked into ponds along the Gila River near Safford in 1902 followed in 1903 by bass and more catfish. The US Bureau of Fisheries was active throughout this early period in providing fish from back east for introductions throughout Arizona. The attitude towards fish management by early biologists is maybe best represented by this quote from F.M. Chamberlain's 1904 report: "The only hope for fish in this region lies in pond culture".

In the mid-1980's, the late Bill Silvey, Fisheries biologist with the AGFD, created a chronology of fish in Arizona. His effort has been modified and modernized for inclusion (Figure 4). By 1975, only two years after passage of the Endangered Species Act, all nonnative fish currently known from Arizona except inland silverside, alligator gar and gizzard shad had already been introduced to Arizona streams and reservoirs.

Aquatic habitats, also at this early time, were also being adversely affected by man's attempts to civilize the west. As early as 1904, Chamberlain documented the loss of fish life through landscape level impacts such as ranching that denuded range and riparian vegetation, irrigation diversions that dries reaches of streams and mining waste/sedimentation that killed fish in entire stream reaches. Loss of fish diversity and abundance was also a concern through unlimited harvest of some streams by anglers, primarily harvest of native trout. Subsequent anthropogenic developments and management since this time has resulted the continued destruction, disappearance and modification of aquatic habitats throughout the state.

Figure 1. Chronology of native fish occurrences and nonnative fish introductions in Arizona.



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SPORTFISH MANAGEMENT AND STOCKING

The mission of the AGFD is to conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs, and to provide wildlife resources and safe watercraft and off-highway vehicle recreation for the enjoyment, appreciation, and use by present and future generations. Achieving this mission requires the AGFD to balance the needs of native aquatic species that are not pursued for sport by the recreating public, with that public's demand for recreational opportunities. The AGFD provides many different types of recreational angling opportunity for the public.

The AGFD employs a three-tiered planning model. The first tier is the Strategic Plan completed every 6 years. It sets AGFD direction, is approved by the Commission and provides broad direction to the AGFD. The second tier is the Operational Plan. These are Project-level plans developed every 2 years that target the strategies identified in the Strategic Plan. Operational Plans are developed at the sub-program level (i.e. Game Sub-Program, Sportfish Sub-Program, Nongame Sub-Program etc.). The third level is the Implementation Plan. These annual plans are based on available and identified budgets and identify specific activities aimed at achieving the Strategic Plan goals and objectives. Implementation Plans are developed at the work-unit level (Regional and Branch offices).

The mission of the Sportfish Sub-Program, as identified in its related 2007 draft Operational Plan is to: Maintain, manage, and enhance (when appropriate and economically feasible) the quality, abundance, availability, and diversity of sport fishing opportunities; and disseminate information about Arizona's sport fish and sport fishing opportunities for present and future generations.

2007 Sportfish Sub-Program Operational Plan Goals:

- Maintain, manage, and enhance the quality, abundance, availability, and diversity of sport fish opportunities while contributing to the recovery of Arizona's native fishes.
- Develop integrated, watershed-based fisheries management approaches for watersheds in Arizona and identify reaches or zones for management for sporfishes and native fishes.
- Increase public awareness of Arizona's sport fishing resources and opportunities.
- Develop and implement actions to increase angler recruitment and retention

2007 Sportfish Sub-Program Operational Plan Objectives:

- Annually, provide sport fishing opportunities to accommodate 1.6 million coldwater and 4.4 million warm water angler days by the year 2012.
- Achieve a 10 percent increase in satisfaction rating among Arizona's angling public by 2012 (i.e. percent of Arizona's anglers indicating they were satisfied with their angling experience, currently 68%, new target 75%).

In order to accomplish these goals and objectives, the AGFD has need to stock through hatchery propagation or contracted vendors sufficient numbers of various sport fish species. Each

identified waterbody in this consultation is managed as a warm or cold water fishery. Stocking activities for sport fish can be described as population augmentation, restoration or maintenance. Furthermore, each water body can be managed as a put-take, put-grow-take, sustained yield or intensive yield fishery. Cold-water trout fisheries are managed under one of six concepts: Intensive Use, Basic Yield, Blue Ribbon, Wildfish, Featured Species or Urban. Concepts are matched to specific fisheries to accommodate biological and social demands. Warm-water fisheries are not managed under these variable concepts, but primarily as sustained yield fisheries with exceptions for preferred or seasonal species (i.e. walleye as put-grow and take or winter trout in otherwise warm-waters).

STOCKED SPORTFISH SPECIES BIOLOGY

The list of sport fish species considered in this document is based on the proposed species for stocking. For each species the following discussion includes background, habitat requirements, breeding biology, feeding preference and movement when that information was available.

APACHE TROUT (ONCORHYNCHUS GILAE APACHE)

Background:

Apache trout were once abundant in high elevation streams in the upper Black, White, and Little Colorado River drainages in east-central Arizona, but factors such as watershed alterations and the introduction of nonnative trout reduced the total occupied range and the ability of Apache trout to effectively persist at all life stages.

The Apache trout was considered endangered under the Federal Endangered Species Preservation Act of 1966, and the species became federally protected with the passage of the Endangered Species Act of 1973. In 1975, it was downlisted to threatened after re-evaluation of its status. The downlisting was accompanied with special rule [4(d)] that enables AGFD to identify populations or waters where Apache trout can support angling without compromising recovery. Apache trout reared in hatcheries are also managed and stocked as a sport fish within Arizona, however, only a few recovery streams are open to angling with special regulations. A Recovery Plan was completed in 1979, and revised in 1983; a draft second revision was published on the Federal Register in 2007.

Habitat Requirements:

Information concerning specific stream habitat requirements for all life stages of Apache trout is limited. Apache trout currently exist mainly in headwater areas upstream from natural and artificial barriers. This environment is subject to extreme variations in both temperature and flow. Instream cover and bank cuts are important variables defining Apache trout habitat. In general, Apache trout select areas with the greatest depths and cover in the absence of nonnative trout. The temperature tolerances of Apache trout are similar to other species of trout, with critical limits above 25 ^{o}C (Alcorn 1976; Lee and Rinne 1980).

Breeding Biology:
Apache trout spawning in the White Mountains occurs from March through mid-June, and varies with stream elevation. Apache trout begin redd construction and associated spawning during receding flows in the spring, at approximately 8°C (Harper 1978). Redds are constructed primarily at downstream ends of pools in wide varieties of substrates (0.87 mm to 32 mm size), most frequently in water depths from 19-27 cm in areas that receive day-long illumination, with water velocities ranging between 50-110 cfs (Harper 1976). Spawning maturation is estimated to begin at 3 years of age, with eggs hatching in approximately 30 days, and emergence occurring about 60 days after deposition (Harper 1978).

Feeding Preferences:
The Apache trout is largely an opportunistic feeder that eats a variety of aquatic and terrestrial organisms, the utilization of which can vary with the season and fish size. Studies have shown Apache trout to be diurnal feeders, with mayflies and caddisflies dominating their diets in stream environments (Robinson and Tash 1979). In lake habitat, Apache trout have been observed to feed on aquatic and terrestrial insects, zooplankton, crustaceans, snails, leeches, nematodes, and fish (Clarkson and Dreyer 1996). In a 2004 consultation on Apache trout enhancement project, predation or interaction of Apache trout

Sportfish Management:
Apache trout management offers a unique opportunity to accomplish both the recovery of a threatened species and to provide angling opportunities for the public. The AGFD, through collaboration with FWS, U.S Forest Service, San Carlos Apache and White Mountain Apache Tribes has designated angling opportunities for Apache trout in certain waters. Only a few recovery streams are currently open to angling with special regulations, and some streams and lakes are stocked with hatchery Apache trout to enhance angling opportunities. The AGFD under A.R.S. Title 17 and the White Mountain Apache Tribe impose and continue to enforce restrictive angling regulations to protect Apache trout in these streams. All new stocking locations (none are proposed within this consultation) are subject to both the ESA and NEPA consultation. Do we designate recovery streams and high harvest streams?

Arctic Grayling (Thymallus arcticus)

Background:
Arctic grayling is a nonnative fish to Arizona, introduced in 1940. The body has scattered black spots on silver-gray, sometimes pink sides, and has scales larger than trout scales. The dorsal fin is large, dark-gray, blotched with pale spots, with cross-rows of deep blue spots and edged with red or orange. The tail fin is forked. Arctic grayling reach lengths of 12 to 16 inches, and grow to weights over 1 pound.

Habitat Requirements:
Arctic grayling prefer clear, cold, uncontaminated water of lakes and streams with water temperatures between 47 – 52ºF spawned (Wydoski and Whitney 2003). High mountain lake habitats and headwater streams are habitats best suited to arctic grayling as they experience higher growth rates at low water temperatures. Grayling are found in Lee Valley Reservoir and a few small high mountain lakes in the White Mountains. They spend most of the year in the lake then "run" upstream to spawn in the spring.

Breeding Biology:
Arctic grayling lifespan is typically 6 – 10 years, and they reach a maximum length of 24 inches, and a maximum weight of 5 pounds. Sexual maturity is generally reached in 2 years. Spawning occurs in spring from March to June over gravel or rocky bottoms. Arctic grayling do not build redds; however fertilized eggs sink into the spaces in the loose gravel, and males defend territories. Egg production varies from 416 – 15,905 eggs, and several spawning acts may occur until all of the eggs are spawned (Wydoski and Whitney 2003).

Feeding Preferences*:*
Arctic grayling are opportunistic feeders that feed primarily on zooplankton (copepods and cladocerans) and aquatic insects (mayfly and Diptera larvae). Adults feed primarily on insects as well as amphipods, caddisfly larvae, and mayfly nymphs, snails, and small fish such as sticklebacks. Fish are found only occasionally in grayling stomachs.

BLACK CRAPPIE (POMOXIS NIGROMACULATUS)

Background:
Black crappie is native to eastern United States and southern Canada, and has been introduced widely elsewhere (Sublette et al. 1990). In Arizona, it was introduced in 1905, and have established in most warm water reservoirs (AGFD 2003). While crappie is common in lakes and reservoirs, there are very few records of crappie establishing or persisting in streams or rivers in the state. They do not tend to move over long distances, but do exhibit seasonal movements between habitat types through aggregating in large groups, in deeper water during the winter and moving into the shallower waters in the warmer seasons for spawning (Lucas and Baras 2001).

Habitat Requirements:
Black crappie inhabits warmer sloughs, lakes, reservoirs and larger slow flowing rivers. Preferred habitat is lentic habitats with clear water and substantial vegetation (Etnier and Starnes 1993, Pacey and Marsh 1998). Sublette et al. (1990) suggest that compared to white crappie, black crappie is less successful in turbid waters which has limited its distribution in many New Mexico waters; thus, similar environmental limitations are probably limiting its range in Arizona.

Breeding Biology:
Black crappie grows to 15 – 30 cm in Arizona (AGFD 2003). Spawning occurs in late spring and early summer (May or June) when water temperatures are 14 – 20 C (Sublette et al. 1990) in depths of 1-3ft and at ages from 1-2yrs (Minckley 1973; Sublette et al. 1990; LaRivers 1994; Moyle 2002). Spawning occurs in larger groups near submerged bushes or banks and are prolific egg layers. Nests are located in gravel or sandy substrates in shallow water and are guarded by the male. Often the nests are placed in protected areas such as coves or deep pools. Females contain 10,000 – 160,000 eggs and may spawn multiple times annually (Etnier and Starnes 1993).

Feeding Preferences:
Young fish feed on small invertebrates, including microcrustaceans and small insects, but prey on more fishes as they mature (Etnier and Starnes 1993). Sublette et al. (1990) describe adult as mid-water carnivores, feeding on insects, crustaceans, other invertebrates, and small fish. They prefer minnows and small sunfish as adults, planktonic crustaceans and various larval insects in juvenile stages (Minckley 1973; Sublette et al. 1990;Moyle 2002). Minckley (1973) stated that in Arizona, when they achieve 100mm in length they shift almost entirely to threadfin shad.

BLUEGILL (LEPOMIS MACROCHIRUS)

Background:
The native range of the bluegill includes the fresh waters of eastern and central North America (Sigler and Sigler 1987). It was introduced into Arizona in 1932. These fish tend to have small home ranges but may exhibit seasonal movements between habitat types by aggregating in larger groups in deeper water in the winter and moving to the shallower waters during the warmer seasons for spawning (Lucas and Baras 2001).

Habitat Requirements:
Bluegill inhabits lakes, ponds, rivers, and streams in moderate flow to still waters (Sublette et al. 1990, Pacey and Marsh 1998). Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. Pacey and Marsh (1998) report that bluegill occupy pools associated with cover in lotic habitats. Preferred water temperature is 16 – 32°C, but have been observed between 4 – 34°C. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003).

Breeding Biology:
Sublette et al. 1990 reports that in New Mexico, maximum standard length of adults does not exceed 16.5 cm (6.5 in). In Arizona, bluegill grows to 10 – 33 cm (AGFD 2003). Spawning occurs from late May through mid-August in water temperatures of 64-80 degrees F at depths of up to 9ft. (Minckley 1973; Sublette et al 1990; Moyle 2002). Incubation periods may be as short as 2.5 days at water temperatures equal to or exceeding 70 degrees F (Minckley 1973; Sublette et

al. 1990; Moyle). No substrate preference has been reported as the reports indicate use in all substrates including mud (LaRivers 1994). Eggs (2,000 – 50,000) are deposited in shallow depressions and guarded by the male (Sigler and Sigler 1987, Sublette et al. 1990). Males continue to guard the newly hatched fry for an additional day and may feed on them with no parental care after hatching.

Feeding Preferences:
Sublette et al. (1990 and citations within) describe ontogenetic and habitat-specific variation in feeding preferences: larvae and juvenile (5 - 10 mm) fish feed on cladocerans and copepod; upon reaching 20 mm, feeding habits become more varied; adults consume copepods and insects (primarily chironomids). Aquatic insects, crayfish, and small fish will also be consumed in particular habitats (Sigler and Sigler 1987, Sublette 1990). Pacey and Marsh (1998) identify consumption of fish and/or fish eggs of largemouth bass (*Micropterus salmoides*) and sunfishes (*Lepomis spp.*). Bonar et al. (2004) considered bluegill to be a less significant piscivore in the Verde with less than 4% of fish in their diet.

BROOK TROUT (SALVELINUS FONTINALIS)

Background:
Brook trout is a nonnative sport fish, which was introduced to Arizona in 1903. Its coloring is gray to olive-green on the back with vermiculations or worm-like markings on the back and dorsal fin, with lighter colored sides having pink or red spots with blue halos around them. Brook Trout lower fins and tail fin have a white edge. In Arizona waters brook trout will grow to 21 inches in length and reach 4 pounds in weight

Habitat Requirements:
Brook trout are found primarily in cold, clear headwater streams and in cold lakes; in Arizona these include colder streams and lakes in the White Mountains. Preferred brook trout temperature ranges between 13.9 – 15.6ºC (Clark 1969) with a critical thermal maximum of 25ºC (Fry 1951). Brook trout reproduce in streams but are most often found in lakes stocked by the AGFD.

Breeding Biology:
Brook Trout spawn in late fall/early winter. Redds are constructed by females in areas of current, including riffles or spring seepage, and eggs are covered with gravel. After spawning, the male remains to guard the nest. Males reach sexual maturity in first year, females in their second (Becker 1983). Egg counts reported to range from 100 – 5,000 depending on the size of the female (McAfee 1966b). Brook trout are known to hybridize with brown trout *S. Trutta.*

Feeding Preferences*:*
Brook trout feed primarily on feed on aquatic and terrestrial insects, and planktonic crustaceans, but larger brook trout will eat small fish if they are available.

Movement:
Kondratieff and Myrick (2006) conducted a study to see how high brook trout could jump over various sized barriers (waterfalls). In a variety of lab experiments they came up with this data:

Length of fish	Height of waterfall	Plunge Pool Depth
15cm	63.5cm	50cm
15-20cm	73.5cm	40 or 50cm
20+cm	73.5cm	40cm
20+cm	43.5cm	10cm

This study showed that shallow pools severely reduce the trout's jumping ability. Waterfall height, pool depth, and fish size all influence a fish's ability to jump. The data showed that fish of all sizes need a fairly deep plunge pool (40-50cm) in order to jump a significant height (63.5 - 73.5 cm). Kondratieff and Myrick (2006) also pointed out that physical conditions, particularly fin conditions, affect jumping ability. Considering that the majority of salmonid species stocked in the state come from hatcheries with concrete raceways where fin loss is evident, this should be considered when looking at stocked hatchery fish in systems where there are barriers. Fin loss or damage limits fish ability to jump over barriers for a certain period of time.

Brown Trout (Salmo trutta)

Background:
Brown trout are native to Europe, and like the rainbow have been introduced widely in North America, and were introduced into Arizona in 1924. Brown trout are more tolerant of higher water temperatures and heavy angling pressure than rainbow trout (Etnier and Starnes 1993).

Habitat Requirements:
Brown trout typically inhabit small to large cold water streams, lakes, rivers, and reservoirs and have been able to form self sustaining populations in all of the habitat types (Belica 2007). They tend to occupy deeper, lower velocity, and warmer waters than other trout species. The upper incipient lethal temperature for adults is 27°C; optimal growth and survival is 12 –19°C (Raleigh et al 1986). Optimal dissolved oxygen levels appear to be at least 9 ppm at temperatures < 10°C and at least 12 ppm at temperatures > 12°C (Raleigh et al 1986). The preferred water temperature in reservoirs is ~7.5-21.9º C during the months of July and August and ~8.8-12º C during the month of September (Belica 2007). Incipient lethal dissolved oxygen concentration for adults is approximately 3 ppm (Sublette et al. 1990). Brown trout occur within a range in pH of 5.0-9.5 with an upper lethal limit of 9.2 although optimal growth occurs at a pH of 6.8-7.8 (Sublette et al. 1990). Adults are inclined to be rather sedentary, frequently spending much of their time in the same pool (Etnier and Starnes 1993). They tend to occupy deep water in edge secondary habitat types closer to cover and stream banks at depths of 14-54m in large reservoirs.. During

the day they will occupy single boulder and wing dam structures to hind under. At night they can be found in mid-channel clusters or areas without as much structure (Belica 2007).

Breeding Biology:
In New Mexico, *S. trutta* on average grow to 206-826 mm TL, with a maximum length of 1,029 mm. Brown trout become sexually mature during 3-5 years. Spawning occurs typically in streams or rocky shoals of lakes during late fall and early winter. Depending on the size of the individual 400 to > 2,000 eggs are produced. Optimal incubation temperatures are 2-13°C.

Feeding Preferences:
In streams, young brown trout feed principally on aquatic and terrestrial invertebrates in the drift assemblage; larger individuals (> 25 cm TL) feed primarily on benthic invertebrates and small fish (Sublette et al. 1990). Brown trout are known to prey on fish species such as small suckers, minnows, sculpin, and darters. Trout occupying pools tend to have higher diet specialization than those predominately associated with riffles. Their appetite is greatest at temperatures of 13.3-18.4º C and decreases rapidly at temperatures above 18.4º C and declining slowly at temperatures from 13.3-6-6º C (Belica 2007). Large adults are known to occasionally eat turtles and small mammals (Etnier and Starnes 1993). Sweetser et al. (2002) supported the piscivorous nature of the brown trout in Arizona. They documented brown trout consuming Little Colorado Spinedace in the Little Colorado River, and the species had the highest levels of piscivory of the three species they examined (brown, brook, and rainbow trout).

CHANNEL CATFISH (ICTALURUS PUNCTATUS)

Background:
Channel catfish is native to central North America and south-central Canada, portions of the Atlantic Coast and to the Rio Conchos drainage in Mexico (Sublette et al. 1990). It has been widely introduced in both western and eastern North America. In Arizona, it was introduced in 1878, and has established in many warm water habitats. Channel catfish are considered sedentary and seasonally migratory. Records of up to 78.3 miles in a Midwestern drainage have been traveled (Lucas and Baras 2001). This strategy allows for them to exploit spawning and feeding habitats of smaller tributaries in the summer months and retreat to the safety of deeper water habitats during the winter months (Lucas and Baras 2001).

Habitat Requirements:
Sublette et al. (1990) and Etnier and Starnes (1993) describe this species as the most versatile catfish, which typically inhabits medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Pacey and Marsh (1998) summarized life stage habitat affinities for native and nonnative fish species in the Lower Colorado River: larvae remain close to adults until moving to riffles; juvenile fish occupy riffle and runs; adults occupy a variety of microhabitats, but generally are found in slower, deep waters with adequate cover.

Breeding Biology:
Etnier and Starnes (1993) found that channel catfish in Tennessee had highly variable growth rates, with expected lengths that ranged from 8.6 – 16.3 in year 1, to 24.1 – 33.3 in year 4, to 46.2-49.5 cm by year 8 and occasionally reach 90.0 cm (36 in) and 11 kg, but on average are 0.9 –1.8 kg (2-4 lbs). In Arizona, fish generally grow to 25 – 99 cm (AGFD 2003). Sexual maturity occurs at 270 mm. Spawning occurs in spring and summer at temperatures of 21-29 C (Sublette et al. 1990). Females may lay from 2,000 – 70,000 eggs per year (Scott and Crossman 1973, Etnier and Starnes 1993). Nests in New Mexico were constructed in burrows in undercut banks, or other protective areas such as rubble, boulders, or logs (Sublette et al. 1990). The preferred or optimal temperature range for the species is 21 – 35°C; adult mortality occurs at 38°C (Pacey and Marsh 1998).

Feeding Preferences:
Feeding is done primarily at night, with most activity from sundown to midnight (Sublette et al. 1990). Juvenile feed on aquatic insects, while adults will also take fish, fish eggs, crayfish, and some plant material (Sublette et al. 1990). Pacey and Marsh (1998) summarized diet studies on the Lower Colorado River, adults have been recorded consuming: small vertebrates, salamanders, fish (including eggs), a variety of terrestrial and aquatic insects, crustaceans (including crayfish), mollusks, terrestrial plant seed and fruit, and aquatic vegetation. Marsh (1981) found that channel catfish primarily fed on Trichopteran, Odonata, filamentous algae, chironomids, and aquatic Lepidoptera in the Cochella Canal, California. Although locally abundant, threadfin shad (*Dorosoma petenense*) and Asiatic clams (*Corbicula fluminea*) were not primary food items.

Movements
Studies of the movements of channel catfish in lakes and reservoirs have been limited. Movement of reservoir populations increases during or immediately following periods of increased river flow. Reservoir and river populations of channel catfish show a general trend for upstream migration in the spring, followed by downstream movement in the fall back to their home range (Dames et al. 1989). Dames et al. (1989) reported river populations showing greater movement in spring than in other seasons. Duncan and Myers (1978) attributed these greater movements to high rainfall and high inflows into the reservoirs. Adults are capable of moving considerable distances in streams, though usually not more than 161 km. A reported individual in the Missouri River, Missouri, traveled 469 km upstream in a 72 day period (averaging 6.5 km/day). It has been suggested that channel catfish in the size range of 280-380mm (age 4-6) are more likely to move in and out of tributaries. Similarly channel catfish in the size range of >380mm are more likely to stay in rivers (Dames et al. 1989).

CUTTHROAT TROUT (ONCORHYNCHUS CLARKII)

Background:

Cutthroat trout is a nonnative Arizona sport fish that was introduced in 1900. Its body shape is similar to that of rainbow trout with lightly spotted back and sides and heavily spotted dorsal, adipose and tail fins. The species is noted for the red or reddish-orange slash on throat. The length and weight range from 8 to 22 inches and 4 ounces to 6 pounds respectively.

Habitat Requirements:

Cutthroat trout prefer clear, cold streams and lakes. This species is rarely found in Arizona's streams, but widely occur in the White Mountain lakes, which are stocked by the AGFD. They prefer the same habitat as rainbow trout and are found in similar areas.

Breeding Biology:

Cutthroat trout spawn in streams from March – July depending on water temps, runoff, elevation, generally beginning at water temperatures of 5.5 – 9ºC (Behnke and Zarn 1976). Females build gravel nests in flowing water where dissolved oxygen concentrations are high, and then lay eggs in the nests. Depending on size of the female, 200 – 4500 eggs are produced. Males mature at 1 to 2 years, while females typically mature at age 3 (Irving 1954; Drummond and McKinney 1965). In cooler waters of headwater streams, trout mature at a smaller size than at lower elevations. Cutthroat trout readily hybridize with other spring spawning trout such as rainbow trout and other sub-species.

Trout survival in May streams is impaired because of lack of productive riffle areas, suitable spawning sites, undercut banks (to escape predation), pools (for resting, feeding and overwintering), and shade. Population densities regulated by stream size and morphology, overwintering habitat, stream productivity and cover.

Feeding Preferences:

Cutthroat trout are opportunistic feeders, feeding on terrestrial and aquatic insects, zooplankton and crustaceans, which are most diverse in riffle areas. Consequently, they often feed downstream of these areas. As the fish increases in size, it becomes more piscivorous (Baxter and Simon 1970).

Survival of stocked trout

The survival and persistence of catchable-sized trout (8-14 inches) stocked for sport fishing has been evaluated in several studies. Fifty-percent of hatchery-raised brown trout stocked into Norway streams were caught within 15 days, and 90% within 67 days (Skurdal et al. 1989). Hatchery-raised Apache trout stocked into the East Fork White River had a 34% survival rate three months after stocking (stocked May-August) and a 3% survival rate nine months after stocking (Meyer 1995). Approximately 11% were captured in the fishery and it was suggested that natural mortality was most likely the primary cause of mortality for the stocked trout. This is

also a typical finding from other studies, that stocked trout are generally either angled or experience natural mortality soon after stocking (Bachman 1984; Skurdal et al. 1989). Overwinter mortality may also be higher for stocked trout that survive the summer creel (Simpkins and Hubert 2000).

In general, the high natural mortality rate observed in stocked trout is suggested to result from a combination of the following: stocked trout are poorly adapted to stream environments, competition with resident trout populations, high stocking densities, warming water temperatures, foraging techniques and natural feed, appropriate energy expenditures, and seasonal dominance hierarchies associated with drift feeding and territory establishment (Bachman 1984). Stand alone or combined, these adaptations may result in malnutrition and subsequent mortality. In a study examining the interactions between stocked greenback cutthroat trout and wild brown trout, cutthroat trout were typically displaced by brown trout and were at a competitive disadvantage for food and space (Wang and White 1994). In a separate study, cutthroat trout *in situ* in a linear foraging hierarchy set up with the dominant fish at the front and intermediate and subordinate fish behind. The dominant trout will have a foraging advantage because it can catch the most optimal invertebrates in the drift first (Lewynsky and Bjornn 1986). Foraging dominance hierarchies have also been documented for other salmonids including rainbow trout, brown trout, brook trout, coho salmon (*Oncorhynchus kisutch*) (Jenkins 1969; Fausch 1984). It is postulated that trout stocked into a stream with previously established resident trout would not be able to establish a superior foraging position and would also be at an aggressive disadvantage (Jenkins 1969). Warm water temperatures has also been implicated as the primary cause of mortality of stocked trout (Runge et al. 2008).

Variation in trout diets

Freshwater trout within the *Oncorhynchus* genus (cutthroat, rainbow, Apache, and Gilae trouts) in the contiguous U.S. are opportunistic sight-feeders, with drifting aquatic and terrestrial invertebrates constituting the majority of their diets (Behnke 2002). The diets of brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) also feed on drifting aquatic insects, and fish often constitute the majority or a large portion of their diets (Fraser 1981). If stocked catchable-sized trout escape creel and survive to persist in the stocking location, food availability and competitive foraging ability will likely influence survival. Overwinter mortality may also be higher for stocked trout that survive the summer creel, particularly because the abundance of invertebrates decreases in winter (Simpkins and Hubert 2000).

Gila Trout (Oncorhynchus gilae)

Background:

The iridescent gold and copper-colored Gila trout reaches average total lengths of 300 mm, but has been reported at 550 mm total length. The Gila trout head is yellow with black spots, and a yellowish ‘cutthroat mark’ near the throat. Its back and sides above the lateral line is a golden iridescence color sometimes washed with metallic blue, and scattered with numerous dark spots.

Larger spots are found on the dorsal side, diminishing in size toward the lateral line, which typically has a pinkish lateral band. The lower sides are a deep yellow color, and the abdomen is grayish white to pinkish orange. Gila trout were historically located in high elevation coldwater streams in New Mexico and Arizona, including the headwaters of the Gila River (NM), and the headwater streams of the Agua Fria, Verde, Blue and San Francisco rivers in Arizona. By 1960, Gila trout were restricted to a handful of isolated headwater streams in the upper Gila River drainage system.

As with other native trout in the American southwest, the species suffered extensively from habitat loss and degradation, uncontrolled fishing, and the introduction of nonnative trout that either competed or hybridized with Gila trout. Thus, the species was given protection under the Federal Endangered Species Preservation Act in 1967 and designated as an endangered species under the Endangered Species Act in 1973. Recently, Gila trout were downgraded from endangered to threatened (DOI USFWS 50 CFR Part 17). Downlisting came as a result of restoration efforts by biologists in New Mexico and Arizona, where Gila trout populations now occur in about 68 miles of stream. The downlisting was accompanied with special rule [4(d)] that will enable New Mexico and Arizona state wildlife agencies to identify populations or waters where Gila trout can support angling without compromising recovery.

The historical range of Gila trout has been classified as the headwater streams of the Gila (NM), Agua Fria (AZ), Blue (AZ), and San Francisco (NM and AZ) rivers. Today, four relict populations of the species remain and all lineages have been replicated at least once in 12 streams in New Mexico (n = 10) and Arizona (n = 2). Dude and Raspberry creeks in Arizona were stocked with Gila trout from the Spruce Creek lineage in the early 2000s. A small population of Gila trout remains in Raspberry Creek, but no fish were found in Dude Creek during surveys conducted in 2005 and 2006. A large flood in Dude Creek in 2005 severely altered the most suitable trout habitat, which purportedly compromised the Gila trout population.

Habitat Requirements:
Gila trout are found in small mountain headwater streams in coniferous and mixed woodland, montane coniferous forest, and subalpine coniferous forest that rarely exceed 21 ^{o}C. They prefer streams with low siltation and gravels and cobbles as the predominant substrate. Gila trout use cover extensively, and during drought years they will seek refuge in pool habitat. Tolerances to water chemical parameters are similar to other salmonids; Gila trout having critical thermal maxima between 25 – 28 ºC.

Breeding Biology:
Spawning occurs in late spring and summer. Females construct reds in water 2 – 6 inches deep beginning when water temperatures reach 8 ºC or higher; as early as March in lower elevation streams. Eggs incubate for approximately 56 to 70 days before larvae emerge. Females reach

maturity between ages 2 and 4 and fecundity is dependent on body size and condition. Males typically reach maturity at age 2 or 3.

Feeding Preferences:
Gila trout are opportunistic feeders utilizing aquatic invertebrates and occasionally small fishes. Adult dipterans, trichopteran larvae, ephemeropteran nymphs, and aquatic coleopterans are the most predominant food items identified during stomach analyses. A foraging hierarchy has been observed in Gila trout, with larger fish aggressively guarding their feeding stations.

Sportfish Management:
The downlisting with special rule [4(d)] of Gila trout offers a unique opportunity to accomplish both the recovery of a threatened species and to provide angling opportunities for the public. On July 1, 2007, special regulation angling for Gila trout opened in Black Canyon Creek in New Mexico. The angling season will occur from July 1 through September 30 as a Special Trout Water; angling is catch-and-release only with artificial flies or lures and a single barbless hook. These regulations were recommended based on the results of a hooking mortality study conducted on Gila trout bloodstock by AZ and NM biologists in 2006. Future streams will open to angling when population numbers are sufficient and can sustain limited angling pressure without compromising recovery.

Grass Carp (Ctenopharyngodon idella)

Background:
White amur typically reaches weights in excess of 25 kg and will reach lengths of more than a meter (Chilton and Muoneke, 1992; Minckley 1973). Terminal mouth, over-all coloration oliveaceous to greenish-brown dorsally, with lines of dots arranged laterally along sides. Its belly and chin are whitish or creamy-yellow. White amur fins generally dark with pigmentation with exception of pelvic fins, which are similar in coloration to belly.

Diploid white Amur were introduced to Arizona prior to 1973 (Minckley 1973); however, current Arizona State law (R12-4-424) requires that white amur cannot be stocked into open systems and that a state permit is required for stocking, and all stocked fish must be triploid.

Habitat Requirements:
In Arizona, white amur are used widely used across the state in canals, golf courses, urban lakes and other private waters for vegetation control. Numbers must be controlled in order prevent habitat degradation and complete loss of aquatic vegetation. Amur are reportedly tolerant of high salinity and temperature extremes (Minckley 1973).

Breeding Biology:
White amur reach maturity at approximately 4 years old (4–5 kg; Chilton and Muoneke, 1992). Spawning occurs when water temperature rises above 20°C; because grass carp eggs are semi pelagic, current during spawning is required to keep eggs in suspension while they incubate. In

general, successful spawning takes place under rising water conditions in very long rivers. Fecundity is very high in normal diploid individuals; females may produce over one million eggs in a season. However as indicated above, all white amur stocked in Arizona must be triploid, and therefore not reproductively successful.

Feeding Preferences:
White amur fry begin feeding on microscopic animals and gradually switch to plant material as they grow (Chilton and Muoneke, 1992). Adult diploids, triploids, and hybrids are all herbivorous, and may consume more than their own weight in plant material each day.

LARGEMOUTH BASS (MICROPTERUS SALMOIDES)

Background:
Largemouth bass are indigenous to eastern and central North America, but has been introduced widely in the United States and around the globe as a game species. In Arizona, it was introduced in 1897, and is widely distributed in warm water reservoirs. The largemouth bass is not known to move extensively within a drainage as most individual home ranges are equal or less than 8 miles in length, potentially due to spawning behavior (Lucas and Bara 2001).

Habitat Requirements:
Largemouth bass are considered generalists and can live in a variety of habitats, prefer sluggish waters of lakes and reservoirs, but are able to colonize larger streams that have low gradients and velocity (Etnier and Starnes 1993, Pacey and Marsh 1998). They prefer warmer streams and lakes with lower turbidity and beds of aquatic vegetation (Sublette et al. 1990; Moyle 1976; Bryan et al. 2000). It is more tolerant of turbidity and salinity than other species in the Micropterus (Etnier and Starnes 1993). Pacey and Marsh (1998) report no data to support the occupying higher velocity stream habitats (e.g., riffles, runs, glides, eddies). This bass tends to center around larger rocks or logs, often found close to soft bottoms, stumps and extensive growths of a variety of emergent and sub-emergent vegetation, especially water lilies, cattails, and other pondweeds in water depths generally less than 18 feet which may pertain to its ambush-style hunting tactics (Moyle 1976; Sublette et al. 1990).

Breeding Biology:
In Arizona, largemouth bass can grow to 25 – 71 cm (< 7 kg). The optimal temperature for growth is 27-30 C (Cincotta and Stauffer 1984). Sexually maturity is reached at 18 –21 cm in length and spawn occurs from late spring to mid-summer, occurring in water temperatures of 58 degrees F to 75 degrees F and in depths of .5 to 23 ft. and are most active at 18°C. Spawning ceases as temperatures reach 24°C in mid- to late June (Sublette et al. 1990, AGFD 2003). Incubation time for eggs can be as short as 2 days at water temperature of 71.6 degrees F (Minckley 1973; Sublette et al. 1990; Moyle 2002). Nests are constructed by males on firm substrate such as gravel or sand but also over soft, muddy bottoms or other substrata and are often located along shallow margins of rivers and lakes and the male is highly territorial during

the breeding season (Sublette et al. 1990, Etnier and Starnes 1993). Females lay up to 96,000 eggs and require 2-4 days depending on water temperature (Sublette et al. 1990). The eggs are deposited and the male chases the female away , returning to the nest to care for the eggs until they hatch and the young disperse, approximately 13-20 days (Sublette et al. 1990;LaRivers 1994).

Feeding Preferences:
Larvae feed on zooplankton and switch to macrobenthos, and become piscivorous at 3.8-5.0 cm (Sublette et al. 1990). Adults are primarily carnivorous, feeding on insects, crayfish, frogs, snails, small mammals, reptiles, young waterfowl and other fishes (Sublette et al. 1990, Pacey and Marsh 1998). Bonar et al. (2004) considered the largemouth to be the most significant piscivore in the Verde with 16.8% of the diet consisting of other fish (Sonora sucker, desert sucker and longfin dace).

RAINBOW TROUT (ONCORHYNCHUS MYKISS)

Background:
Rainbow trout are originally native to the western North America, primarily from the coastal streams of the Northwest. It is one of the most intensively cultured fish throughout the world. It is one of the most economical and easiest trout to raise, making it a substantial component of a sport fishing program. They were first introduced into Arizona in 1899. Few self-reproducing populations exist in the wild.

Habitat Requirements:
Rainbow trout inhabit cool clear lakes and cool-water streams with larger substrates (gravel-boulder). In New Mexico, the trout are found in steams with pool-to-riffle ratios of 1:1 (Sublette et al. 1990.). Deep, low velocity pools are important overwintering habitat and instream cover (overhanging banks, submerged vegetation, log jams, and boulders) is an essential habitat component for escape and resting cover (Sublette et al. 1990).

The species is tolerant of a range of stream conditions including water temperatures from 0 to the upper incipient lethal temperature for adults of 25°C (Embody 1934 Carlander 1953, Piper et al. 1982, Westers 1983, Raleigh et al. 1984) and a ph range of 5.8-9.6. However, the optimal conditions for growth are 13 – 21°C, slightly alkaline waters (ph of 7-8), and ≥ 7 ppm dissolved oxygen concentrations at temperatures ≤ 15°C, and ≥ 9 ppm dissolved oxygen at temperatures ≥ 15 C (Raleigh et al. 1984). May (1973) observed that adults in Lake Powell will avoid water temperatures of 18°C.

Fry will inhabit low velocity waters with substrate ranging from mud and silt to bedrock and cobble. They also utilize protective cover typically found along stream margins and seeps, side channels, backwaters, and small tributaries. Insufficient fry habitat will result in high mortality of this life stage and will reduce the recruitment of juveniles and subsequently adults. During the

summer periods they tend to occupy water with temperatures averaging 13->19º C. Fry are also more likely to be swept away in the event of floods (Montgomery and Bernstein 2008).

Juveniles will move into deeper and more swiftly moving water that has a greater complexity of cover when temperatures increase in the spring. They establish territories in undercut banks but can also be found in open areas over cobble and gravel and near large boulders. They occupy water with summer temperatures between 10-18º C (Raleigh et al. 1984).

In adults there is a direct relationship between annual stream flow and the amount and quality of available trout habitat. Low water levels expose undercut banks, large portions of instream cover and desired shoreline, creating unsuitable habitat for the different life stages of the rainbow trout. The most critical period is during base flows (lowest flows of late summer to winter). Base flows of 50% or more of the average annual daily flow are ideal for maintaining quality habitat. Base flows below 25% are considered poor for providing quality habitat.

Key components of river substrate for adults are large structures (woody debris and boulders) that help diversify local instream flow patterns. This will help produce microhabitats differing in velocity and cover, and pools and undercut banks that provide quiet refuges (Montgomery and Bernstein 2008).

Coldwater species like trout are less likely to form self sustaining populations in reservoirs and ponds in part due to their requirements for clean gravel spawning substrate preferably swept by currents that are not characteristic of pond and reservoir systems (Ross 1997).

Breeding Biology:
Rainbow trout average in total length 25.0-75.0 cm, with a maximum of 1 m (Behnke 1980). In Arizona, they generally grow to 20 – 81 cm (AGFD 2003). Rainbow trout are typically spring spawners. Female usually become sexually mature during year 3, whereas male in year 2 - 3 (Raleigh et al. 1984). Fecundity of females averages 2,000 – 4,500. The species is highly territorial, and will aggressively defend feeding areas (Sublette et al. 1990). Females choose spawning sites in water greater than 18cm in depth with greater than average velocities such as 48-91 cm/s. They are primarily stream spawners and require tributary stream with gravel substrate in riffle areas for successful reproduction. However streams in the more arid Rocky Mountain region are likely to experience low flow and higher temperatures which can create a greater threat of fish stranding. As water temperatures increase, dissolved oxygen levels decrease resulting in altered swimming speed, declined growth rates, reduced fecundity, and can constrain spawning (Raleigh et al. 1984). Rainbow trout can spawn in temperatures ranging from 2-20º C but is generally initiated when water temperatures exceed 6-7º C. Trout that spawn in lakes with inlet and outlet stream may spawn as much as one month earlier in the outlet than the inlet due to temperature differences. The period of egg incubation begins at the end of spawning and normally last 30-100 days, however this time period is largely temperature dependent. Rainbow

trout eggs can withstand temperature extremes of ~1.6-16º C, but temperatures of 7-10º C will produce the highest survival rates among embryos. The higher the temperature, within the acceptable range, the faster the rate of development which will lead to a shorter incubation period and time to emerge (Raleigh et al. 1984).

Downstream movement may vary by habitat type (lentic versus lotic systems) and by strain (Moring 1993 and citation therein). Moring (1993) suggested a sizable portion of stocked populations (approximately 22%) frequently move >12 km and average 1.1 – 1.7 km a day. However, few fish (<1%) had moved > 35 km downstream over four years, most moved < 15 km. This species will hybridize readily. Lakes and reservoirs with no inlet or outlet streams generally limit and in most cases inhibit reproducing populations of trout (Montgomery and Bernstein 2008). Rainbow trout populations that successfully reproduce in lakes with inlet and outlet streams typically spend 2 summers in a stream and 2 summers in a lake before they are considered mature.

Feeding Preferences:
Rainbow trout are opportunistic feeders and the primary food items depend in part on the stage of the life history as well as the habitat being occupied. Fry restricted to quiet waters feed on small insects and other invertebrates including nematodes, amphipods, cladocerans, terrestrial insects (adult beetles, flies, and larval moths and butterflies), and aquatic insects (larval and pupae of midges, black flies, caddis flies, beetles, crane flies, soldier flies, mayflies, and stoneflies). Juveniles and adults feed on terrestrial and aquatic insects and other aquatic invertebrates such as nematodes, leeches, annelids, gastropods and other mollusks, benthic and planktonic crustaceans (cladocerans, isopods, amphipods, shrimp, and crayfish), small ray-finned fishes fish eggs and larvae, detritus, benthic algae, and occasionally lizards, mice, and bats (Montgomery and Bernstein 2008).

Young feed on immature and emergent aquatic insects and will continue to take insects but become piscivorous when larger (Raleigh et al. 1984, Sublette et al. 1990). In streams, rainbow trout feed primarily on drift organisms. In lakes, they prefer benthic invertebrates and zooplankton (Sublette et al. 1990). During extended periods of low food availability, trout will often exhibit hyperphagia and considerable compensatory growth following these stressful periods (Jobling and Koskela 1996). Sweetser et al. (2002) found this species was least piscivorous of the three trout species (brown, brook, rainbow) they examined in the Little Colorado River in Arizona. Bryan et al. (2000) noted that rainbows can adversely affect the native fish populations through aggressive displacement through interference competition, using resources more quickly and efficiently through exploitative completion, increasing stress hormones, or by opportunistic piscivory. However these interactions are not always negative. Habitat displacement of cutthroats by rainbows results in more piscivory and higher growth rates of the cutthroat (Nilssen and Northcote 1981). by opportunistic piscivory. Bonar et al. (2004) considered rainbow trout to be a less significant piscivore in the Verde River with less than 4%

of fish in their diet in spite if their statement that continued stocking has the "potential to impact abundance and distribution of native fish due to their stocking overlaps with the peak of spawning activities by native fishes". Competitive interactions of rainbow trout with various fish may be weakened in warm waters (Montgomery and Bernstein 2008).

Survival of stocked trout

The survival and persistence of catchable-sized trout (8-14 inches) stocked for sport fishing has been evaluated in several studies. Fifty-percent of hatchery-raised brown trout stocked into Norway streams were caught within 15 days, and 90% within 67 days (Skurdal et al. 1989). Hatchery-raised Apache trout stocked into the East Fork White River had a 34% survival rate three months after stocking (stocked May-August) and a 3% survival rate nine months after stocking (Meyer 1995). Approximately 11% were captured in the fishery and it was suggested that natural mortality was most likely the primary cause of mortality for the stocked trout. This is also a typical finding from other studies, that stocked trout are generally either angled or experience natural mortality soon after stocking (Bachman 1984; Skurdal et al. 1989). Overwinter mortality may also be higher for stocked trout that survive the summer creel (Simpkins and Hubert 2000).

In general, the high natural mortality rate observed in stocked trout is suggested to result from a combination of the following: stocked trout are poorly adapted to stream environments, competition with resident trout populations, high stocking densities, warming water temperatures, foraging techniques and natural feed, appropriate energy expenditures, and seasonal dominance hierarchies associated with drift feeding and territory establishment (Bachman 1984). Stand alone or combined, these adaptations may result in malnutrition and subsequent mortality. In a study examining the interactions between stocked greenback cutthroat trout and wild brown trout, cutthroat trout were typically displaced by brown trout and were at a competitive disadvantage for food and space (Wang and White 1994). In a separate study, cutthroat trout *in situ* in a linear foraging hierarchy set up with the dominant fish at the front and intermediate and subordinate fish behind. The dominant trout will have a foraging advantage because it can catch the most optimal invertebrates in the drift first (Lewynsky and Bjornn 1986). Foraging dominance hierarchies have also been documented for other salmonids including rainbow trout, brown trout, brook trout, coho salmon (*Oncorhynchus kisutch*) (Jenkins 1969; Fausch 1984). It is postulated that trout stocked into a stream with previously established resident trout would not be able to establish a superior foraging position and would also be at an aggressive disadvantage (Jenkins 1969). Warm water temperatures has also been implicated as the primary cause of mortality of stocked trout (Runge et al. 2008).

Variation in trout diets

Freshwater trout within the *Oncorhynchus* genus (cutthroat, rainbow, Apache, and Gilae trouts) in the contiguous U.S. are opportunistic sight-feeders, with drifting aquatic and terrestrial invertebrates constituting the majority of their diets (Behnke 2002). The diets of brown trout

(*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) also feed on drifting aquatic insects, and fish often constitute the majority or a large portion of their diets (Fraser 1981). If stocked catchable-sized trout escape creel and survive to persist in the stocking location, food availability and competitive foraging ability will likely influence survival. Overwinter mortality may also be higher for stocked trout that survive the summer creel, particularly because the abundance of invertebrates decreases in winter (Simpkins and Hubert 2000).

Migratory Movements:
(Simpson 2006) found a general pattern in stream movement of rainbow trout during low flows and high flows. During a high flow period the trout typically moved downstream, however they did not stay in a high flow habitat for more than a few days. During a low flow period the trout moved back upstream to reside in riffles or pools.

(Mellina et al 2006) described the typical seasonal movement patterns of stream dwelling rainbow trout. Their behavior in streams show long range movements and restricted movements in any given population. Individual fish will also show signs of switching these behaviors. Furthermore these behavior combinations are presumably adaptive when conditions are often unpredictable and changeable. Typical migratory movement showed predominately lakeward movement during spring and early summer seasons. However, juveniles continued their movement until late August and early September. Long range movements appear to be closely linked to discharge patterns. These long range movements will cease with the onset of low summer flows.

Little research has been done on specific movements of trout out of reservoirs. However in 2005 the first stocked rainbow trout was captured below Blue Ridge Reservoir. This occurred after a flood event from a heavy winter snow pack in 2004 and 2005 causing Blue Ridge Reservoir and Knoll Reservoir to spill (Rinker 2005).

Kerr and Lasenby (2000) outlined several parameters that could influence post stocking emigration of rainbow trout such as elevated discharge or water or flooding, reductions in water levels, water temperatures, formation of frazil ice, pollution, and genetic strains. These parameters should be considered if emigration is a concern.

Redear Sunfish (Lepomis microlophus)

Background:
The redear sunfish's historically ranged from the southern Atlantic states to Texas and northward in the Mississippi Valley to Indiana and Illinois (Etnier and Starnes 1993). It has been widely introduced throughout the U.S. In Arizona, it was introduced in 1946.

Habitat Requirements:
Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Etnier and Starnes 1993, AGFD 2003). Pacey and Marsh (1998) also include rivers and

streams as potential habitat, with microhabitat preferences of deeper, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks). They are not reported in riffle, run, or glides, and avoid turbidity.

Breeding Biology:
Redear sunfish can grow 5 – 10 cm their first year, and 3 –5 cm per year between ages 2 – 4. After year 5, growth slows and studies indicate that growth may be negatively related to turbidity (Etnier and Starnes 1993). In Arizona, LEMI reach 15 –35 cm in length. Pacey and Marsh (1998) report that the optimal temperature for LEMI is 24-27 C. Males construct nest, usually in colonies in shallow water. Etnier and Starnes (1993) Females lay 15,000-30,000 eggs in May - June. Redear sunfish are known to hybridize with at least four other species of *Lepomis* (Etnier and Starnes 1993).

Feeding Preferences:
These sunfish primarily feed on benthic organisms (midge larvae, snails) and have evolved specialized muscles and molars for crushing mollusk shells (Lauder 1983, Etnier and Starnes 1993). Minckley (1979) report adults consuming Desert Pupfish (*Cyprinodon macularius*) juvenile and eggs, and adult and eggs of threadfin shad (*Dorosoma petenense*).

SMALLMOUTH BASS (MICROPTERUS DOLOMIEU)

Background:
Smallmouth bass is a Nonnative sport fish introduced to Arizona waters in 1921 and are known from the mainstream of the lower Colorado river, Verde River and throughout the Salt River basin below 7,200ft. in elevation (Minckley 1973). Smallmouth bass most is bronze to brownish green in color, with dark vertical bars on sides. In contrast to the largemouth bass, the upper jaw does not extend beyond rear margin of eye, which is reddish in color, and it has a shallow notch in the dorsal fin. Smallmouth bass are range from 12 – 22 inches in length.

Habitat Requirements:
Inhabit mid order streams and lakes cooler in temperature, free of turbidity with shallow rocky areas, clear and gravel-bottom runs and flowing pools of rivers, cool flowing streams and reservoirs fed by such streams. This bass prefers shady areas with submerged structures of stumps, trees or crevice within clay banks for retreat (Sublette et al. 1990; Moyle 1976). Severe temperature drops and siltation that occur during flood events may result in nest desertion and loss of eggs and fry (Brynildson 1957). They are abundant in the Verde River, Black River, and Apache Lake and to some degree in Roosevelt Reservoir and Lake Powell. They prefer rocky habitats in streams and lakes with clear waters.

Some populations appear to be largely sedentary, occupying a short reach of stream or river for extended periods, possibly their entire lives. In other populations, many individuals undertake long-distance migrations each year to reach spawning or over-wintering habitats. Migration

distance is correlated with winter severity; smallmouth bass move little in streams that do not freeze, but often travel more than 5 km in systems with ice (Lyons and Kanehl 2002). In some systems smallmouth bass occupy the deepest water available or areas of cover (boulders, logs), where they remain inactive for the winter. However, in other systems, smallmouth bass avoid the deepest holes and are often active in areas with little cover. Many smallmouth bass populations undertake spawning migrations in the spring, usually to smaller tributaries. Migration distances vary, but may be greater than 10 km. Many smallmouth bass populations exhibit homing tendencies towards particular habitats; however stocked smallmouth bass usually show little site fidelity, and quickly disperse long distances from the stocking location. Stocked smallmouth bass tend to leave the stocking area rapidly, and often the stream itself, typically moving downstream (Lyons and Kanehl 2002).

Breeding Biology:
Spawning occurs in late spring (March through May) when water temperatures warm to between 55 degrees F to 74 degrees F and at depths up to 16ft. (Minckley 1973; Sublette et al. 1990; Moyle 2002). Males generally build nests over gravel substrates, but may use sand, silt and organic material associated with rocky bottoms or woody cover (Scott and Crossman, 1973; Winemiller and Taylor 1982; Reynolds and O'Bara 1991). Nest building usually occurs in the same area where the previous year's nest was built. The males fan a depression in sand or gravel with violent lateral movements and are highly defensive of the nest (Moyle 1976; Sublette et al. 1990). After spawning, the female leaves the nest and may spawn with another male in another nest. Males guard the eggs and young. Onset and duration of spawning, as well as reproductive success in warm water streams is greatly influenced by water temperature (Cleary 1956; Brown 1960; Coutant 1975; Graham and Orth 1986). The spawning period may last from 1 to 4 weeks depending on temperature. Spawning continues as long as the temperature remains between about 15°C and 20-22°C, a period ranging from about 1 to 4 weeks depending upon the year and thermal regime. Females produce between 2,000 to 20,825 eggs based on body weight (Sublette et al. 1990) and the eggs can take between 2.25 to 9.5 days to hatch in 75 degrees F to 41 degrees F (Minckley 1973; Sublette et al. 1990; Moyle 2002).

Feeding Preferences*:*
Young feed on plankton and immature aquatic insects while adults take in crayfish, fishes (shad), and aquatic and terrestrial insects in lakes; and crayfish and minnows in streams. In streams, smallmouth can be very aggressive when hellgrammites and terrestrial insects are available. Once the bass reaches 8in. in length, the diet becomes nearly exclusively piscivorous when sufficient prey is present (Sublette et al 1990; Moyle 1976). Bonar et al. (2004) considered smallmouth a significant piscivore in the Verde River with a greater than 4% of fish in their diet including Sonora sucker.

THREADFIN SHAD (DOROSOMA PETENENSE)

Background:
Threadfin shad are a small prey fish found primarily in Arizona reservoirs. Its back is dark gray to bluish black, sides and abdomen is silvery; a distinct post opercular dark spot is present, and the mouth is terminal. Threadfin shad fins, except the dorsal, are yellowish in color with the caudal fin a deeper yellow than the other fins. Adults typically do not exceed 110 mm standard length.

Habitat Requirements:
Threadfin shad inhabit large lakes and rivers with moderate current. They usually congregate in schools over deep water during day and into shallower, littoral areas during night.

Breeding Biology:
Threadfin shad life span is typically 2 – 3 years with spawning commonly taking place in the second summer; however sexual maturity may be reached in the first year, resulting in a spawn at the end of the first summer (Johnson 1971). Threadfins shad spawn during summer months in open water or along shorelines over aquatic plants at water temperatures between 21 – 26ºC. Females produce between 900 – 21,000 eggs depending on size.

Feeding Preferences:
Threadfin shad are feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971).

WALLEYE (SANDER VITREUS)

Background:
Introduced to Arizona in 1957, walleye is a nonnative sport fish. Its back is yellow-olive with a brassy cast, its sides are brassy-yellow with dark mottling, and its belly is white. A dark spot can be found at rear of the spiny dorsal fin, with the anal fin and lower lobe of tail fin white in color. Walleye is a spiny fish having moderate canine-like teeth. In Arizona walleye typically reach lengths of 29 inches, and weights just over 12 pounds.

Habitat Requirements:
Found in Lake Powell, Saguaro Lake, Canyon Lake, Apache Lake, Lake Mary, Show Low Lake and Fool's Hollow Lake. Bottom oriented fish, due to their sensitivity to light, preferring to stay in deep water during the day, moving to shallow waters during the night. During summer, they preferred gravel-cobble substrates, used a variety of depths, and were near current breaks and upstream edges of pools. When temperatures reached 30ºC, walleye sought deep pools. Generally, walleye prefers moderate current with cobble-gravel substrates (Paragamian 1989). Light conditions are an important factor affecting walleye distribution, abundance and feeding (Ryder 1977).

Breeding Biology:
Walleye exhibit optimal growth at temperatures between 20 – 24ºC (Dendy 1948; Kitchell et al. 1977), with critical temperature tolerance ranging between 31-34ºC (Hokanson and Koenst 1986). Walleye spawn in spring, in relatively shallow water, over clean gravel or rocky bottoms.

Feeding Preferences:
Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad.

YELLOW PERCH (PERCA FLAVESCENS)

Background:
Yellow perch is a nonnative sport fish to Arizona, and was introduced in 1919. It has an olive-green back with brassy-yellow sides having 6 to 9 dark vertical bars, a white stomach, and small non-canine like teeth. The anal, pectoral and pelvic fins are amber-orange tinted. Yellow perch will reach lengths of ~12 inches. In Arizona, yellow perch were found in Stoneman Lake but disappeared when it dried up.

Habitat Requirements:
Yellow perch prefer clear water with moderate amounts of aquatic vegetation. Preferred water temperatures are around 70ºF. Fingerlings are found in shallow water and move to open, deeper water in fall. Adults generally associate with the lake bottom. When yellow perch spawn in the spring, they move into shallower waters near the shoreline, and then back out to deeper waters in late spring as the water waters. On occasion, yellow perch migrate upstream to spawn. Tagging data indicate that yellow perch do not move much and populations in large lakes remain in a local area, and that individuals generally have a strong homing tendency. Have a strong homing tendency.

Breeding Biology:
Yellow perch exhibits schooling behavior with schools comprised of fish of the same sex, size or age. Spawning occurs in spring on vegetation or submerged brush, sand, gravel or rubble when water temperatures reach ~45 – 52ºF. Eggs are deposited in a gelatinous strand with the number of eggs ranging from 18,000 – 140,000 eggs depending on the size of the female. Males mature between 1 – 2 years, and females between 2 – 3 years of age. Females grow faster than males. On average, yellow perch live 7 – 8 years, are very prolific, and can become overabundant or stunted unless suppressed by predation or angling.

Feeding Preferences:
Yellow perch feed on small fish, crawfish and insects (dragonfly, damselfly and caddisfly larvae). Young perch feed on zooplankton, copepods and cladocerans in particular and immature insects as they grow. Adult perch feed on forage fish if available.

Chapter 2 ANALYSIS METHODS AND CRITERIA

INTRODUCTION TO METHODS

Locations proposed for stocking across the state were identified and arranged by major watershed. The watersheds were then divided into sub watersheds for further evaluation of hydrologic connections associated with the stocking sites and instream and/or downstream species.

STRUCTURE FOR ASSESSMENT

The goal of this assessment document is to review and evaluate potential impacts of proposed stocking activities for ten years on any listed, candidate, proposed species and/or critical habitats not addressed through previous assessment and/or consultation efforts. The document incorporates the required information as outlined in the Federal Aid Section 7 Biological Evaluation Form, guidance from the Federal Aid Toolkit and Section 7 Consultation Handbook. For each species, we provide background information, biology, life history, watershed by watershed distribution, direct and indirect effects of the proposed action and an assessment of other effects for those stocking sites where there may be impacts to the species. Further, we identify regulations and fish stocking procedures undertaken by AGFD designed to ensure responsible stocking practices thereby minimizing, reducing or eliminating disease transmission through stocking of fish and unauthorized transportation and release of stocked fish and associated bait (fish, waterdogs, and crayfish) (regulations were identified in Chapter 1). Interdependent, interrelated actions and/or cumulative effects (non-federal fish stocking or riparian projects) of the proposed stocking actions to listed, candidate, proposed species and/or critical habitat are broadly identified and defined within Chapter 4.

WATERSHED ANALYSIS OF HYDROLOGIC CONNECTIVITY

Information guiding this analysis included the descriptions of the watershed, subwatershed and each stocking site. The stocking sites included specific information as to the waterbody, recreational management of the area, existing conditions, management of the waterbody, proposed action and potential impact analysis. The potential impact analysis was extended to a complex level (grouping of sites where appropriate) depending on hydrologic connection and/or stream connections. Complete descriptions of all stocking sites, their history, connectivity and the local conditions are provided in the watershed chapters (Chapters 5-10).

SPECIES AND CRITICAL HABITAT EVALUATED

Primary sources of listed, candidate, proposed species and/or critical habitats distribution include AGFD's Heritage Data Management System (HDMS), the Nongame and Endangered Wildlife Program's Native Fish Database, AGFD Riparian Herpetofauna database, and Willow Flycatcher

Database. The HDMS is part of a global network including over 80 natural heritage programs and conservation data centers. The information comes from published and unpublished reports, data collected by cooperating agencies, museum and herbarium collections, the scientific and academic communities, Federal Register, and many other sources.

The list of species assessed and reviewed through this assessment process includes all listed or proposed species, proposed or designated critical habitat and candidate species associated with aquatic, wetland and/or riparian habitats where sport fish would be stocked or anglers would access in pursuit of stocked sport fish. Analyses of two additional species that are most likely to become listed in the next ten years were also included.

A spatial approach to the analysis was utilized to identify and map species and/or critical habitats in relation to the proposed stocking locations. The multi-step process to develop this spatial representation (maps) included: proximity of stocking locations to habitats occupied (or historical localities) by species and/or critical habitats. Data from numerous sources were incorporated into ArcGIS for use in spatial analysis and included the best information available to AGFD. The HDMS point data is based on representation of occupied areas of breeding populations with a 1-mile buffer around the point (species) for the protection of the exact location. The state was then broken into watershed units using the US Geological Survey Hydrologic Unit Codes (HUCs) at the HUC 6 level and then further divided into subwatersheds at the HUC 8 level.

Recreational angling impacts are limited to the water's edge or within a reasonable distance from a water source (travel to the water source). This area is referred to as the ***stocking area***. Where there is connectivity between stocking locations and waters supporting listed/proposed/candidate species and/or critical habitat, effects from the stocking location may extend further along those waterway connections. This area is referred to as the ***connected area.*** These areas of potential impact to listed/proposed/candidate species and/or critical habitat by the proposed activities or associated recreational activities are referred to as the ***action area***. A GIS product was developed as the framework for the analysis.

The analysis then proceeded species by species within each watershed. The primary analysis tool for the assessment was based on the working maps developed as described above with review from the AGFD Regional Fisheries and Nongame species leads. The review process included AGFD, WSFR and USFWS Ecological Services personnel.

General preliminary criteria questions were developed for taxonomic groups to establish links between the action and potential listed taxons. The first criteria established the geographic link and included connectivity, probability of movement and suitability of habitat (e.g. potential for stocked fish to survive in the habitat it moved to). The second criteria established the link biologically through interactions between stocked fish and listed, proposed or candidate species

(competition, predation, reproduction, disease, angler access) and impact to critical habitat, where appropriate.

According to USFWS [50 CFR 402.12(g)], it is the responsibility of WSFR to evaluate all potential impacts of funding sport fish stocking activities to all identified listed, candidate, proposed species and/or critical habitat. Species identified by the USFWS as candidates for listing are evaluated based on a standard of "likely or not likely to jeopardize" under provisions for conferences.

Listed, candidate, proposed species and/or their critical habitats are assessed in detail within this document. The review process includes review and assessment with regard to the general analysis criteria as listed above.

SPECIES INTERACTION APPROACH

In order to determine the nature of the exposure between stocked sport fish and listed species of concern, it was necessary to consider the biology of each species stocked and the nature of the response or interaction with each of the listed species. Consideration of this biological interaction resulted in the following descriptions, arranged by general taxonomic groupings for the listed species.

Fish Interactions Background Information

Apache Trout

Methods & Criteria

Impacts to Apache trout require a unique evaluation because the species is currently listed as threatened under the Endangered Species Act with a special (4(d)) rule that provides for angling of the species as long as the angling comports with the laws of the state of Arizona. The proposed action includes stocking Apache trout for the purpose of furthering the conservation of the species through supporting angling opportunity for the species.

Currently conservation and/or recovery of the species in Arizona include several management actions. These include designating and managing recovery populations which are primarily located above constructed or natural barriers. Another management strategy is to promote conservation of Apache trout by actively stocking Apache trout for the purpose of angling with anticipated harvest of the stocked individuals as provided by the ESA 4(d) special rule. In some cases other sport fish species are stocked with Apache trout, and/or stocked Apache trout may impact other listed species. As such, there is a need to evaluate potential impacts to the species given several scenarios. These include:

1. Impacts from sport fish species co-stocked with Apache trout in non-recovery areas for the intent of providing angling opportunity.

2. Impacts from stocked sport fish species to recovery Apache trout that escape from recovery areas above barriers.

3. Impacts from stocked sport fish species to recovery Apache trout if those stocked species move above a failed barrier or into recovery reaches

4. Impacts from Apache trout stocked into recovery Apache trout populations with the intent that the entire population be fishable by the public (this only occurs in 1 case).

5. Impacts from stocked Apache trout on other candidate or listed species and critical habitat.

6. Impacts on stocked Apache trout from wild fish populations present in the receiving waters.

The analysis approach was informed and developed in the following manner:

- Reviewing the down listing packages for Apache and Gila Trout, both of which have been down listed from Endangered to Threatened, are managed as sport fish in the State of Arizona, and have a 4(d) special rule.

- Identifying possible scenarios that could result in impacts to Apache trout.

- Reviewing the applicability of Section 6 of the Endangered Species act, the Apache trout 4(d) special rule and 10(a)(1)(a) permit.

- Developing an impact analysis for each of the scenarios identified above and applying them to applicable stocking reaches or complexes.

In evaluating impacts to Apache trout, two separate proposed actions are considered, first the action of stocking nonnative sport fish (rainbow trout, brook trout, arctic grayling, etc.), and second, the action of stocking native Apache trout into non-recovery streams or waters to provide angling opportunity. The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. The States have specific authority for management of endangered species, in part, manifested through State Section 6 Cooperative Agreements, which authorize management activities for threatened and endangered species. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD. Because stocking of Apache trout is for conservation purposes and consistent with the Act and the Cooperative agreement, take of Apache trout from the proposed stocking of Apache trout is legally permitted. The action of stocking all other nonnative sport fish and potential effects to Apache trout, impacts from

stocked Apache trout on other listed species, and any impacts to critical habitat are analyzed under Section 7 of the Act. Under the ESA, Apache trout hybrids are not protected as a threatened species (FWS Arizona Ecological Service Memo, September 2008) and impacts to hybrid Apache trout are therefore not evaluated.

Bird and Mammal Interaction Methods

Bald Eagle

The bald eagle was delisted during the development of this BA. An analysis of the bald eagle will be included in the Environmental Assessment.

Mexican Spotted Owl

Range wide Discussion:

The Mexican Spotted Owl (MSO) is one of three spotted owl subspecies widespread and occurring in a wide variety of habitats and occupying a broad geographic area but occurs inconsistently throughout its range in Arizona with distinct localities corresponding to pockets of appropriate habitat in mountains and canyons (USFWS 1995). The largest concentrations of MSOs in Arizona occur in the central and east-central forests along the Mogollon Rim, the White Mountains, and volcanic peaks near Flagstaff. The MSO is known from the Colorado Plateau in northern Arizona, areas along the Mogollon Rim, and from "sky island" mountains in the southeastern part of the state. The vegetative communities vary across the range of the owl from pinon juniper, mixed conifer forests to Madrean evergreen and woodland. At lower elevations, the owls are found in steep forested canyons with rocky cliffs. The characteristics of the habitat include high canopy closure, high stand density of multi layered uneven aged stands, numerous snags and downed woody matter in old growth mixed conifer forests. Nesting is more common in the mixed conifer community types, but nesting also occurs in the pine oak riparian and white fir community types. Owls may remain within their respective breeding area throughout the year, but some may migrate outside of the area opportunistically (USFWS 1995). Studies have suggested winter migrants move into the lower, warmer elevations into more open habitats (USFWS 1995).

Recovery units (RUs) were designated based on several factors (physiographic provinces, biotic regimes, perceived threats, administrative boundaries and know patterns of distribution). Arizona contains three of the four physiographic provinces which are identified RUs: Colorado Plateau, Upper Gila Mountains and the Basin and Range West.

Three levels of habitat management were established within the Recovery Plan: protected areas, restricted areas and other forest and woodland types. Protected areas receive the highest level of protection and other forest and woodland types as the lowest. Protected Activity Centers (PAC) protects all MSO sites known from 1989 through the life of the Recovery Plan. The identified activity area is defined as the nest site, a roost grove commonly used during the breeding season

in absence of a verified nest site, or the best roosting/nesting habitat if both nesting and roosting information are lacking. The delineation of an area no less than 600ac around the activity center using the boundaries of known habitat polygons and/or topographic boundaries, such as ridgelines were identified as appropriate. The boundaries of the PAC should enclose the best possible habitat configured as compact as possible with the nest or activity center located near the center to include as much roost/nest habitat as reasonable, supplemented by foraging habitat where appropriate (USFWS 1995). All PACs should be retained for the life of the Recovery Plan, regardless if the owls are not located within them in subsequent years.

The stocking locations identified with overlap for MSO for this consultation are located mostly on Forest Service managed lands. The PACs are incorporated with recommendations from the Recovery Plan in the South Western Region Forest Service Land Resource Management Plans (USFWS 2004) that provides a level of protection for these owls and their habitat. Further, Restricted Areas (defined as other areas of use, unoccupied areas) were additionally incorporated into the planning efforts by the Forest Service in order to maintain and develop potential nesting and roosting habitat now and into the future providing an additional level of protection.

Critical Habitat

Critical habitat for the owl was designated in 2004 (re-designation from 1995 and 2001) based on the recovery needs and guidelines identified in the Recovery Plan. The designation considered currently suitable habitat, large contiguous blocks of habitat, occupied habitat, range wide distribution, need for special management or protection, and adequacy of existing regulatory mechanisms when identifying the critical habitat units and primarily relied on the Recovery Plan and Primary Constituent Elements (PCEs) (USFWS 2004).

The PCEs are identified as those physical and biological features necessary to ensure the conservation and may require special management considerations or protection including those that support nesting, roosting and foraging. General requirements include space for individual and population growth and for normal behavior; food, water or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species (USFWS 2004). Included in the designation are both the protected and restricted habitat areas as defined within the Recovery Plan and areas containing the PCEs.

The majority of owl records are on federal and tribal lands; therefore, state and private lands were not considered essential to the conservation of the species and were not designated as critical habitat (USDI 2005).

Home Range Size:
Home range is defines as the area used by an animal during its normal activities (Burt 1943) and territory is defined as a defended area within an individual's home range (Nice 1941). The territories for MSO are smaller than the home ranges with the relationship not known and consistency to territories being high with most owls remaining on the same territory in subsequent years (USFWS 1995). There is considerable variability among the habitats and/or geographic areas monitored owls displayed (Ganey and Dick 1995). Home ranges sizes vary among areas studied, potentially dependent on cover types (Ganey and Balda 1989b). Estimated home range size comparisons are difficult due to the variability in sampling methods. Results for individuals and pairs varied (USFWS 1995):

- 2,282-3672 acres for individuals on three study areas in the Colorado Plateau RU (Wiley 1993)
- 645-2,601 acres for individuals on five study areas in the Upper Gila Mountains RU (Ganey and Balda 1989a, Ganey and Block, unpublished data, Peter Stacey, Univ. of Nevada, Reno, pers.com)
- 1,116-2,314 acres for individuals on two study areas in the Basin and Range East RU (Zwank et al. 1994, Ganey and Block, unpublished data)
- 941-3831 acres for pairs on five study areas in the Upper Gila Mountains RU (Ganey and Balda 1989a, Ganey and Block, unpublished data, Peter Stacey, Univ. of Nevada, Reno, pers.com)
- 1,415-3,461 acres for pairs on two study areas in the Basin and Range East RU (Zwank et al. 1994, Ganey and Block, unpublished data)

Identified Recreational (Angler) Related Impacts:
The stocking locations identified with overlap for MSO for this consultation are mostly located on Forest Service managed lands. Sport fish stocking sites covered by this consultation may be in proximity to Mexican spotted owl (MSO) habitats, and the presence of anglers drawn by the continued fishing opportunities may result in potential disturbances to MSO and/or their habitats. Sport fish stocking sites, or the stocking reach (which includes those areas where anglers may move up, down or around waterbodies and/or stream reaches) may be in or near MSO PACs or designated critical habitat. Sport fishing activities in general are close to the stocking waterbody or stream reach; though anglers may move throughout fishable areas of the waterbody or stream reach. In addition, recreational angling is part of the larger recreation presence, with developed campgrounds, roads, parking areas, or other amenities present contributing to potential disturbance of MSO.

Recreational activities, including angling, may impact MSOs directly by disturbing owls at nesting, roosting, or foraging sites. The magnitude of the impact is influenced by the location, intensity, frequency, or duration of the disturbance to the particular MSO (USFWS 1995) and/or habitat. Recreational activities in general can also have indirect impacts if habitat is altered by trampling of vegetation, soil compaction, or other physical degradation. Increased fire risk from inappropriate disposal of smoking materials or campfires is also a concern. If a particular recreational activity does not result in habitat alteration, the activity generally is considered to have a relatively low impact potential (USFWS 2004).

Critical habitat

Indirect impacts to habitat within designated critical habitat may include some of those identified above. In addition, indirect impacts to foraging as identified in the PCEs and related to the disturbance or altering of habitat associated with the maintenance of adequate prey species may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation.

The South Western Region of the Forest Service Land Resource Management Plans (LRMPs) associated Biological Opinion, issued by the FWS contains reasonable and prudent measures necessary and appropriate to minimize impacts of incidental take of MSO on FS lands that include the protection of the owl and its habitat and monitoring of occupancy. The terms and conditions further identify the designing of projects within the various programs including but not limited to recreation to minimize or eliminate adverse effects and reduce negative effects with the goal of implementing projects that will have beneficial, insignificant or discountable effects within occupied habitat. The incidental take amount was identified to be in the forms of harm or harass occurring through direct habitat alteration and disturbance to owls from roosting or nesting sites. Both forms would be of limited extent and intensity. Below are the forest programs in Arizona that addressed standards and guidelines in the LRMPs providing a level of protection specific to MSO (note-not all of the forests addressed these Programs specifically).

Apache-Sitgreaves

The Engineering Program seasonally or permanently closes access roads where owls are known to occur, reducing the amount of potential disturbance particularly in the breeding season.

Coconino

The Engineering Program identifies the relocation roads outside of riparian areas and obliterating unnecessary roads in riparian areas to reduce impacts to MSO. The Recreation Program identifies camping areas to be located outside of PACs. Further, specifically identifies increases in day use opportunities emphasizing nature based activities in the area of Oak Creek Canyon with some behavioral disturbance potentially anticipated as a result.

Coronado
Recreation program identifies disturbance from hikers, campers and bird watchers on the various districts and activities such as those not causing habitat alteration and generally a low potential for impacts to MSO.

Kaibab
The engineering program identifies the need to obliterate unneeded system roads in areas that would access owl PACs and reducing the disturbance from human presence.

Criteria
A total of 32 proposed sport fish stocking locations are in proximity to Mexican spotted owl (MSO) habitat. The presence of anglers drawn by the fishing opportunities provided by the stockings may result in two types of potential effects: noise/human presence that may result in disturbance of MSO and physical effects to habitat components that may result from anglers creating or using trails or paths to access the fishing opportunity. All the identified stocking sites have been stocked in the past and do not represent new areas of potential disturbance. To determine where such disturbance and/or habitat effects may occur, maps containing the stocking sites were overlain by maps showing where MSO habitat exists.

For management purposes, MSO habitat is categorized as protected or restricted (USFWS 1995), with designated critical habitat overlain on those categories. Protected habitats include the Protected Activity Areas (PACs) which contain known nesting and roosting habitats and are mapped in GIS layers. The PACs are an area of approximately 600 acres and are where activities during the breeding season are concentrated. All PACs are considered to be occupied by MSO. The PAC is not the home range of an MSO; home ranges are larger and contain additional areas used by MSO outside of the breeding season and, to some extent, during the breeding season.

Other protected habitat areas include steep canyons and reserved lands (e.g., wilderness, Research Natural Areas) that are outside of PACs. Restricted areas, as described in the Recovery Plan (USFWS 1995) are areas outside of PACs where additional guidelines should be implemented to maintain or develop potential nesting and roosting habitat now and into the future. Neither other protected areas nor restricted areas are included on GIS layers available for this analysis. However, most of these identified areas were included within the boundaries of designated critical habitat (CH), which is an available map layer and is used in determining exposure potential. However, the map layer does not provide guidance on whether or not a particular parcel of land within the boundaries actually contains the primary constituent elements (PCEs). In this analysis, we assume those are present unless a site is specifically examined.

For the purposes of this analysis, the CH boundaries are considered to include any other protected or restricted habitats that might be affected by anglers accessing fishing opportunities resulting from stocking. There is use by MSOs of forested areas outside of the PAC boundary

and outside of critical habitat; however, the intent of the PAC and restricted area management guidelines is to protect the most likely areas used by the MSO from significant effects from land management activities. While assuming that CH contains this entire habitat around the stocking site, there may be a small amount of habitat area not in CH that would be excluded from this analysis. The amount of such habitat is likely to be very minimal and not significant to the outcome of this analysis.

Critical Habitat

The critical habitat boundaries designated by the USFWS (2005) was also incorporated into a usable GIS layer for spatially analyzing the stocking locations within the designated areas. If a waterbody or stream reach was located within the boundary impacts were evaluated. Those waterbodies or stream reaches outside of the boundary were not analyzed further.

Based on existing data, limiting potentially disturbing activities to areas greater than 0.25 mile from MSO nest sites during the breeding season (March 1 through August 31) is beneficial to MSO. This corresponds well with the Delaney et al.'s (1999) 0.25 mile threshold for alert responses to helicopter flights. The additional 0.25 mi buffer provides a conservative approach in that it extends the potential use area to account for MSOs use along the edge of the PAC and nearby protected or restricted areas during the breeding season. The potential area for angler disturbance was also extended along the stream above or below the stocking site if fish could move from the site and angler access was available (called herein the fishing opportunity area). This extension was evaluated on a site-by-site basis. If the fishing opportunity area or identified access to it was within the 0.25 mile buffer area or the PAC itself, the potential for disturbance effects during the breeding season was deemed possible. If the fishing opportunity area or identified access to it was outside the 0.25 mi buffer or the PAC itself, disturbance effects during the breeding season were deemed unlikely. If the fishing opportunity area or identified access to it was inside CH or in a PAC or buffer area, habitat effects were deemed possible.

Anglers may access PACs, buffer areas or CH by moving through the area to reach a fishing opportunity area or the fishing opportunity area may be in the PAC, buffer, or CH unit. It must be noted that stocking sites are often in conjunction with other developed recreational sites that include developed campgrounds, roads, parking areas, or other amenities present that may affect MSO use of the area. Anglers are only one component of the recreational use of the PACs, buffers and CH surrounding stocking sites.

The critical habitat designation final rule also identifies actions not likely to destroy or adversely modify critical habitat to include most recreational activities, including hiking, camping, fishing, hunting, cross-country skiing, off-road vehicle use, and various activities associated with nature appreciation as not expecting restrictions to any of those identified activities as a result of the

ruling. In addition, within the 2005 BO for continued implementation of the LRMP for the 11 NF of the SW Region, program standard and guidelines incorporated additional protection for MSO.

New Mexico Meadow Jumping Mouse

Methods and Criteria
Sportfish stocking sites covered by this consultation may be in proximity to New Mexico meadow jumping mouse (MJM) habitats and the activities of anglers drawn by the fishing opportunities may result in impacts to resident MJM. To determine where such impacts may occur, information on location of stocking sites and occupied/potentially occupied MJM habitats was compared to determine areas of potential impact (Table 14).

Table 1. Stocking sites with potential New Mexico meadow jumping mouse exposure for impacts related to sport fish stocking

Stocking site	Season of use for stocked species	Stocking site at or near habitat	Human activities likely during breeding season
Little Colorado River sites			
West Fork/East Fork Little Colorado River at Greer	Summer	On site	Yes
West Fork Little Colorado River at Sheep's Crossing	Summer	On site	Yes
Lee Valley Lake	Summer	Off site	No
Black River sites			
West Fork Black River	Summer	On site	Yes
East Fork Black River	Summer	Off site	No

Southwest Willow Flycatcher
Methodology and Criteria for Evaluating Sport Fish Stocking and Potential Effect this may have on Southwestern Willow Flycatchers

General Information

The southwestern willow flycatcher is a small grayish-green passerine (Family Tyrannidae) measuring approximately 5.75 inches. The song is a sneezy "fitz-bew" or a "fit-a-bew", the call is a repeated "whitt". It is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in dense riparian habitats in the southwestern U.S. (from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado) and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Ridgely and Tudor 1994, Howell and Webb 1995). The historical breeding range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

The primary constituent elements of critical habitat are based on riparian plant species, structure and quality of habitat and insects for prey. A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (USFWS 2005). The primary constituent elements are:

1. Riparian habitat in a dynamic successional riverine environment (for nesting, foraging, migration, dispersal, and shelter) that comprises:

    a. Trees and shrubs that include, but are not limited to, willow species, box elder, tamarisk, Russian olive, cottonwood, stinging nettle, alder, ash, poison hemlock, blackberry, oak, rose, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut;

    b. Dense riparian vegetation with thickets of trees and shrubs ranging in height from 2 to 30 meters (m) (6 to 98 feet (ft.). Lower-stature thickets (2 to 4 meters or 6 to 13 feet tall) are found at higher elevation riparian forests, and tall-stature thickets are found at middle- and lower-elevation riparian forests;

    c. Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub level, or as a low, dense tree canopy;

    d. Sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (*i.e.*, a tree or shrub canopy with densities ranging from 50 percent to 100 percent); or

e. Dense patches of riparian forests that are interspersed with small openings of open water or marsh, or shorter/sparser vegetation that creates a mosaic that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac).

2. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, including: flying ants, wasps, and bees; dragonflies; flies; true bugs; beetles; butterflies/moths and caterpillars; and spittlebugs.

A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (USFWS 2005).

Abundance and distribution in Arizona

In Arizona, southwestern willow flycatchers breed at the lowest elevations along the lower Colorado River to the high elevation White Mountains of central-eastern Arizona. The peak nesting period for southwestern willow flycatchers in Arizona is from approximately 15 May through 31 July, with limited nesting activity occasionally noted before and after these dates. Flycatchers nest very locally along most of the major perennial rivers below 4000 ft (1219 m) elevation such as the Colorado, Big Sandy, Bill Williams, Gila, Santa Maria, Salt, San Pedro and Verde rivers (McCarthy 2005). They also nest locally from 7900 to 8300 ft (2408-2539 m) elevation along the upper Little Colorado and San Francisco rivers. Within Arizona, nesting at mid-elevations between 4000 and 7000 ft (1219-2134 m) has yet to be recorded, and would expected to be infrequent due to the lack of preferred nesting habitat (flat broad floodplains and expansive riparian habitat).

Likely due to a more concerted survey and monitoring effort, the number of known southwestern willow flycatcher territories has significantly increased in Arizona (145 to 459 territories from 1996 to 2007) (English *et al.* 2006, Durst *et al.* 2008), but the overall distribution of flycatchers throughout the state has not changed much over this time frame. Currently, population stability in Arizona is believed to be largely dependent on the presence of two large populations (Roosevelt Lake and San Pedro/Gila River confluence).

Willow flycatchers are also statewide migrants in Arizona. They begin to arrive in late April, with peak migration in May and early June, with north-bound stragglers still regularly passing through the state into mid-June (McCarthey 2005). Like many passerine neotropical migrants, when available these flycatchers often occur in riparian areas during migration. However, in contrast to the more habitat specific requirements for nesting, habitat use and quality during migration is more varied and broad. Willow flycatchers are regularly encountered in all habitats with scattered trees including desert washes and shaded urban parks and residential backyards. Migrant flycatchers are often found in isolated small stands of trees or foraging along edges of

more extensive woodlands. However, they are seldom encountered in heavily forested habitats, particularly higher elevations conifer forests, or those open habitats lacking trees or tall shrubs. Depending on weather and several other factors such as the amount of available food, cover and water, stopover sites are typically utilize by individual passerine migrants for one to three days before moving on (Carlisle et al. 2009). Willow flycatchers are likely to use a similar variety of habitats in Arizona during fall migration which begins in late July and August, peaking in early September with stragglers through mid-October (McCarthey 2005).

Nesting habitat

Historical egg/nest collections and species' descriptions throughout its range describe the southwestern willow flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, San Diego Natural History Museum 1995). Currently, southwestern willow flycatchers primarily use Geyer willow (*Salix geyeriana*), coyote willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), boxelder (*Acer negundo*), live oak (*Quercus agrifolia*) and such widespread exotic species as tamarisk (*Tamarix* sp.) and Russian olive (*Elaeagnus angustifolio*) for nesting. High elevation willow species and nesting habitat is shorter in stature and typically cannot grow as quickly as habitat at lower elevations due to shorter growing seasons and colder winters (USFWS 2002). In Arizona, high elevation thickets used for nesting include Geyer (*Salix geyeriana*) and Bebb (*Salix bebbiana*) willows. Other plant species less commonly used for nesting include: buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.* 1997).

Tamarisk is now an important component of the flycatcher's nesting and foraging habitat in much of Arizona and other parts of the bird's range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in a tamarisk tree (Smith *et al.* 2002). Tamarisk had been believed by some to be a habitat type of lesser quality for the southwestern willow flycatcher, however comparisons of reproductive performance (USFWS 2002), prey populations (Durst 2004) and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference (Sogge *et al.* 2005).

The flycatcher's habitat is dynamic due to it being subjected to river flooding and therefore its quality and location can change rapidly: nesting habitat can grow out of suitability; tamarisk habitat can develop from seeds to suitability within five years; heavy runoff can remove/reduce habitat suitability in a day; or river channels, floodplain width, location, and vegetation density may change over time. The flycatcher's use of habitat in different successional stages may also

be dynamic. For example, over-mature or young habitat not suitable for nest placement can be occupied and used for foraging and shelter by migrating, breeding, dispersing, or non-territorial southwestern willow flycatchers (McLeod *et al.* 2005, Cardinal and Paxton 2005).

Specific habitat used for nest placement is denser, typically more interior with the height of nests primarily in the mid to lower portions of trees. At lower elevation in Arizona (below 4000 ft), willow flycatcher nest heights averages approximately 15 ft (4.6 m) and range from 4.8 to 38.7 ft (1.5-11.8 m), but nests are found lower in the trees 3-10 ft (1-3 m) in the shorter-statured, higher elevation habitat (above 7500 ft) sites (McCarthey 2005).

Occurrence in the action area

In order to determine where suitable flycatcher nesting habitat may be found within the action area, a collection of sources were examined. Information sources used for evaluation included HDMS data (occurrences), FWS designated critical habitat polygons, range wide WIFL database of nesting flycatcher territories and the WIFL Recovery Plan's Table 10 description of important streams, as well professional opinion of the FWS and AGFD where known territories and habitat were found. We then selected segments of streams that can support nesting habitat (instead of patches of habitat), understanding that flycatcher nesting habitat is dynamic and can shift location over time due to floods, drought, fire, and land uses (river diversion, agriculture return flow, etc.).

After placing these information sources together and compared to the proposed stocking locations, suitable southwestern willow flycatcher nesting habitat was determined to occur in two general areas (Verde River and the White Mountains). Along the middle Verde River, flycatcher nesting habitat can be found throughout the Verde Valley (i.e. towns of Clarkdale, Cottonwoood, and Camp Verde). Land ownership throughout this stretch of river is primarily privately owned, however some state (Dead Horse State Park), tribal (Yavapai and Apache) and Forest Service (Prescott NF) land exists. At higher elevation in the White Mountains, nesting flycatcher habitat can be found within the action area along the upper Little Colorado River (and a portion of its forks) downstream to the Town of Greer area (Map x). These areas primarily occur within the Apache Sitgreaves National Forest, although private land parcels are also included.

Consistent breeding areas were identified through HDMS data and analyzed site by site by species experts for evaluation. Documented occurrence sites were only included if they were designated as a territory (singing or paired birds after 15 June) or if nesting activities were actually observed. Southwestern willow flycatchers have been documented nesting at four sites in the Verde Valley between Clarkdale and Camp Verde and three sites in the upper Little Colorado River drainage downstream to Eager.

Because migrant willow flycatchers can occur statewide and are most frequently found along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where willow flycatchers

could not occur. Additionally, the habitat requirements for migrant flycatchers are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance. In fact as noted before migrating passerines typically remain at one location for only one to three days before continuing their journey to breeding or wintering grounds (Carlisle et al. 2009).

Flycatcher nesting habitat can quickly change and vary in suitability, location, use, and occupancy over time (Finch and Stoleson 2000). As a result, it is important to reiterate how this may influence the location of southwestern willow flycatchers with respect to the proposed action. The preferred nesting and migration habitat of southwestern willow flycatchers shifts over time in location and quality which subsequently influences the locations and densities of flycatchers. Flooding, drought, fire, lake levels, etc. can help to accelerate the recycling, growth, and/or shift in location and abundance of riparian vegetation. As a result, past or current nesting flycatcher locations may not be the same exact locations used by flycatchers in the future. Evaluating nesting flycatchers across river segments that can support suitable nesting habitat helps to ensure that future unknown locations are considered in this analysis.

Critical habitat occurrence in the action area

Designated southwestern willow flycatcher critical habitat maps were compared to stocking locations to identify which river stretches of critical habitat are within the action area. Similar to areas where suitable nesting habitat occurs, critical habitat occurs within the action area along the Verde River in the middle Verde Valley and in the White Mountains along the Little Colorado River drainage downstream to the Town of Greer. However, because of specific methodology used to designate critical habitat, it does not mirror all the locations where suitable nesting habitat is found or where all territories have been located. Therefore, critical habitat is a smaller area to evaluate.

Potential effects

Angler activity/behavior along rivers

Riparian areas receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than those farther away from development (Turner 1983). The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations. Impacts can be more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country.

Anglers for stocked trout are a subset of the variety of activities and management actions that may affect riparian areas and flycatcher habitat. For example, those activities include, but are not limited to water management actions (i.e. water diversion, groundwater pumping, etc.), livestock grazing, housing, woodcutting, vehicle use, road development, hiking, camping, shooting, day-

use, horseback riding, etc. (Willard and Marr 1970, Manning 1979, Briggs 1996, Cole and Spildie 1998).

Recreational impacts flycatcher habitat

Riparian habitat impacts from recreation, as described in the Southwest Willow Flycatcher Recovery Plan (USFWS 2002) include: loss of surface soil horizons, soil compaction, altered soil moisture and temperature, altered soil microbiota, habitat fragmentation, reduced dead woody debris, altered plant species composition, altered foliage height diversity, reduced plant diversity/cover, lack of plant regeneration, erosion, increased sedimentation/turbidity of water, altered organic matter content of water, altered water chemistry, altered flow regimes, pollution, increased risk of accidental fire, increased trash, increased human waste and diseases, increased feral domestic animals and pet dogs, increased native predators, displacement of wildlife by facilities, unauthorized roads and trails, human presence and noise disturbance. The potential for the recreational activity to produce negative impacts is highly dependent on the frequency, intensity, location and type of use the area receives. Infrequent but unpredictable recreational actions without patterns can cause more negative impacts per event than those predictable and frequent.

Impacts to streams and stream side habitat have been attributed specifically due to angling. Some of these impacts include: water turbidity, erosion of banks, pollution, over water movement disturbance and reduced stability of habitats (USFWS 2002). Changes in the structure, density and composition of vegetation can occur from recreation induced soil compaction and erosion. Locally, day-use recreation such as angling could reduce or fragment regenerating or growing riparian habitat due to trampling and soil compaction (USFWS 2002). Fragmentation of habitat due to the development of trails can cause habitat to not be suitable for birds requiring dense contiguous vegetation. Where vegetation is sparse, even light use can prevent further development of dense lower strata which are important to flycatchers (USFWS 2002). During spring and summer, cottonwood and willow seedlings often establish on open, unvegetated sand or gravel bars and shorelines which are attractive to anglers as they provide unobstructed locations for casting.

As the number of recreation users increases, so does the probability of an accidental fire (USFWS 2002). Fire within the riparian areas have become more frequent due to the combination of increased drying of riparian areas, increased distribution and growth of flammable exotic plants adapted to these drier conditions, and an increased distribution and abundance of ignition sources (largely man-caused). Fire can devastate southwestern willow flycatcher nesting habitat.

Flycatcher behavior toward human activity/recreation

The types of possible direct recreation impacts to animals, also described in the Flycatcher Recovery Plan (USFWS 2002) include direct/indirect mortality, low productivity, reduced habitat use, and reduced use of preferred habitat and aberrant behavior/stress resulting in reduced reproductive or survival rates (USFWS 2002).

The flycatcher itself does not appear to be overly sensitive to low level human activity occurring outside of the immediate breeding patch (USFWS 2002). Like the majority of nesting passerines, flycatchers will alter their behavior due to human activity when nesting, but will typically resume normal behavior once the presumed danger has passed. Similarly, migrant and foraging flycatchers will fly a reasonably safe distance to adjacent perches if approached too closely by humans.

Human activity that occurs within breeding patches in close proximity to flycatcher nests has the potential to lead to failure or reduced productivity. Spending long durations of time near nests can cause adults to abandon nesting attempts or prevent adults from returning to nests, causing mortality of eggs/nestlings. Frequently walking to and from and/or through nest areas can attract predators or nest parasites to a flycatcher nest. Bushwacking through dense vegetation can cause the failure of precariously placed nests or nests built low to the ground by knocking the nest and/or its contents to the ground.

Fishing line and flycatcher nests

Female flycatchers construct a small cup nest constructed of leave, grass, plant fibers, feathers and animal hair; coarser material is use for the nest base and body with finer material in cup lining (Bent 1963). The use of discarded fishing line for nest construction and subsequent impacts to nestlings has not been documented, even at locations such as Roosevelt Lake where angling activity is extremely high (Pringle 2004).

<u>Western Yellow-Billed Cuckoo</u>

Methods and Criteria

In order to determine where suitable yellow-billed cuckoo (cuckoo) nesting and foraging habitat may be found within the action area, several sources were examined. Information sources used for evaluation included HDMS data (occurrences) and professional opinion of the FWS and AGFD where appropriate habitat is found. We then selected segments of streams or lake shorelines that can support nesting habitat (instead of patches of habitat), understanding that cuckoo nesting habitat is dynamic and can shift location over time due to floods, drought, fire, and land uses (river diversion, agriculture return flow, etc.).

After placing these information sources together and comparing to the proposed stocking locations, suitable yellow-billed cuckoo nesting or foraging habitat was determined to occur at or adjacent to nine stocking sites (Table 15). Consistent breeding areas were identified through

HDMS data and analyzed site by site by species experts for evaluation. Documented occurrence sites were only included if they were designated as a territory (calling or paired birds between 15 June and 31 August) or if nesting activities were actually observed.

Table 2. Stocking sites with potential yellow-billed cuckoo exposure for habitat or disturbance effects.

Stocking Site	**Stocking Season**	**Breeding/Foraging Habitat**	**Effect**
Lower Salt River	Winter/spring	Y	Habitat
Patagonia Lake	All seasons	Y	Disturbance, Habitat
Watson Lake	All seasons	Y	Disturbance, Habitat
Willow Lake	All seasons	Y	Disturbance, Habitat
Middle Verde River	Winter/spring	Y	Habitat
Deadhorse SP	All seasons	Y	Disturbance, Habitat
Oak Creek	Spring through fall	Y	Disturbance, Habitat
West Clear Creek	Spring/fall	Y	Habitat
Wet Beaver Creek	Spring/fall	Y	Habitat

Because migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance. The potential effects of disturbance to cuckoos during migration are discussed separately from disturbance during the breeding season.

Cuckoo nesting habitat can quickly change and vary in suitability, location, use, and occupancy over time. As a result, it is important to reiterate how this may influence the location of cuckoos with respect to the proposed action. The preferred nesting habitat of cuckoo shifts over time in location and quality which subsequently influences the locations and densities of cuckoos. Flooding, drought, fire, lake levels, etc. can help to accelerate the recycling, growth, and/or shift in location and abundance of riparian vegetation. As a result, past or current nesting cuckoo locations may not be the same exact locations used by cuckoos in the future. Evaluating nesting cuckoos across river segments and lake/pond shorelines that can support suitable nesting habitat helps to ensure that future unknown locations are considered in this analysis.

Habitat Impacts

Riparian areas receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than

those farther away from development (Turner 1983). The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations. Impacts can be more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country.

Anglers are a subset of the recreation component of activities and management actions that may impact riparian areas and cuckoo habitat. For example, those activities include, but are not limited to water management actions (i.e. water diversion, groundwater pumping, etc.), livestock grazing, housing, woodcutting, vehicle use, road development, hiking, camping, shooting, day-use, horseback riding, etc. (Willard and Marr 1970, Manning 1979, Briggs 1996, Cole and Spildie 1998).

Riparian habitats impacts from recreation, include: loss of surface soil horizons, soil compaction, altered soil moisture and temperature, altered soil microbiota, habitat fragmentation, reduced dead woody debris, altered plant species composition, altered foliage height diversity, reduced plant diversity/cover, lack of plant regeneration, erosion, increased sedimentation/turbidity of water, altered organic matter content of water, altered water chemistry, altered flow regimes, pollution, increased risk of accidental fire, increased trash, increased human waste and diseases, increased feral domestic animals and pet dogs, increased native predators, displacement of wildlife by facilities, and unauthorized roads and trails (USFWS 2002). The potential for the recreational activity to produce negative impacts is highly dependent on the frequency, intensity, location and type of use the area receives. Infrequent but unpredictable recreational actions without patterns can cause more negative impacts per event than those predictable and frequent.

Impacts to streams and stream side habitat have been attributed specifically due to angling. Some of these impacts include: water turbidity, erosion of banks, pollution, over water movement disturbance and reduced stability of habitats (USFWS 2002). Changes in the structure, density and composition of vegetation can occur from recreation induced soil compaction and erosion. Locally, day-use recreation such as angling could reduce or fragment regenerating or growing riparian habitat due to trampling and soil compaction (USFWS 2002). Fragmentation of habitat due to the development of trails can cause habitat to not be suitable for birds requiring dense contiguous vegetation. Where vegetation is sparse, even light use can prevent further development of dense lower strata which are important to flycatchers and cuckoos (USFWS 2002). During spring and summer, cottonwood and willow seedlings often establish on open, unvegetated sand or gravel bars and shorelines which are attractive to anglers as they provide unobstructed locations for casting. These stocking actions are an ongoing action that has a long history of occurring in these areas. As a result, we anticipate that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, we do not anticipate anglers once they reach

their destination to be fishing in tight areas where vegetation is dense that causes casting to be difficult.

As the number of recreation users increases, so does the probability of an accidental fire (USFWS 2002). Fire within the riparian areas have become more frequent due to the combination of increased drying of riparian areas, increased distribution and growth of flammable exotic plants adapted to these drier conditions, and an increased distribution and abundance of ignition sources (largely man-caused). Fire can devastate cuckoo nesting habitat.

Cuckoo nesting habitat contains dense riparian vegetation in the under- and mid-story levels that make it difficult to create trails and paths through the area. Human traffic can affect tree regeneration in the understory (Corman and Magill 2000, Holmes et al. 2008) and creation of trails can increase potential predator access to the habitat (Corman and Magill 2000). Overuse of riparian areas by livestock, water management actions, vegetation clearing, and woodcutting are more likely to result in fragmented habitats with degraded under- and mid-story conditions that affect nesting habitat quality for the cuckoos than is human traffic. Areas with heavy human traffic may already be impacted by other actions that contributed to the decline of habitat quality that also allows for easier access by humans. In areas without existing trails or paths, the density of cuckoo habitat tends to deter human entrance (Laymon 1998).

As noted earlier, the structural components of cuckoo migration habitat are much broader than for nesting habitat and many riparian areas not suitable for nesting may be used during migration. While the activities described above contribute to degradation of migration habitat, the greater extent of usable migration habitat, that reduction in habitat quality has less impact on cuckoo use of the habitat.

Disturbance Impacts

Human-related disturbance during the migration period (either spring or fall) is likely to have a very limited impacts on cuckoos since individuals are highly mobile, do not remain long in one area, and suitable migration habitat is more available than nesting habitat. This reduces the opportunity for exposure, and avoidance of areas of high human use is more feasible. Information from surveys and observations indicate that migrant and foraging cuckoos will fly a reasonably safe distance to adjacent perches if approached too closely by humans.

The information on the degree to which human presence in cuckoo nesting habitat can impact behavior of the adults and thus the success of the nesting attempt is not entirely consistent. Wiggins (2005) noted that any capture of adult birds for banding should not be done at the nest since the danger of abandonment of the nest is high. Similarly, he cautioned against banding the young birds while they are in the nest for the same reason. Latta et al. (1999) reported that cuckoos will abandon nests if disturbed repeatedly and suggested avoidance of intense and repeated human disturbance in nesting areas between May 20 and September 1. Halterman

(2010) indicated that a steady human presence during nest building or normal, regular human activity in the vicinity the effect to cuckoos is low, but more intensive use could result in nest failure. One report from Texas (Luneau 2002) documented nest abandonment during incubation by cuckoos after less than three minutes observation at a distance of 35 feet from the nest. Cuckoos are not likely to abandon the nest once the first egg hatches and foraging birds are largely oblivious to human presence (Laymon 1998). The cuckoo survey protocol notes that adults do not go to their nest if under observation, and that nest abandonment is a concern particularly during the nest building stage.

The types of possible direct recreation impacts to animals include direct/indirect mortality, low productivity, reduced habitat use, and reduced use of preferred habitat and aberrant behavior/stress resulting in reduced reproductive or survival rates (USFWS 2002).

Although reclusive at times, cuckoos do not appear to be overly sensitive to low level human activity occurring outside of the immediate breeding area. Like most nesting birds, cuckoos will alter their behavior due to human activity when nesting, but will typically resume normal behavior once the presumed danger has passed. Human activity that occurs within breeding patches in close proximity to cuckoo nests has the potential to lead to failure or reduced productivity. Spending long durations of time near nests can cause adults to abandon nesting attempts or prevent adults from returning to nests, causing mortality of eggs/nestlings. Frequently walking to and from and/or through nest areas can attract predators to a cuckoo nest.

Yuma Clapper Rail

Methods and Criteria

Sportfish stocking sites covered by this consultation may be in proximity to Yuma clapper rail (YCR) habitats and the activities of anglers drawn by the fishing opportunities may result in impacts to resident YCR. To determine where such impacts may occur, information on location of stocking sites and occupied/potentially occupied YCR habitats was compared to determine areas of potential impact, including if the habitat was at the site or along an adjacent waterway (Table 16). The potential for impacts at stocking sites vary with the species stocked and if stocking would occur during the breeding season.

Table 3. Stocking sites with potential yellow billed cuckoo exposure for impacts related to sport fish stocking

Stocking site	Season of use for stocked species	Location of habitat relative to stocking site	Human activities possible during breeding season	Potential for effects

Lower Colorado River sites				
La Paz County Park	Seasonal (fishing derbies only)	No habitat at site; habitat on Colorado River is not adjacent to site.	No	No
Hidden Shores Golf Course	Seasonal (fishing derbies only)	No habitat at site; habitat on Colorado River is not adjacent to site.	No	No
Yuma West Wetlands Pond	Seasonal (fishing derbies only)	No habitat at site; habitat on Colorado River is not adjacent to site.	No	No
Lower Gila River sites				
Fortuna Pond	Year round	Minimal cattail at site, adjacent portions of Gila River contain marsh habitat	Yes	Yes
Redondo Lake	Year round	Minimal cattail at site, adjacent portions of Gila River contain marsh habitat	Yes	Yes
Wellton Golf Course Pond	Seasonal (fishing derbies only)	No habitat at site; habitat on Gila River is several miles away	No	No
Salt River sites				
Apache Lake	Year round	No cattail areas on lake	No	No
Canyon Lake	Year round	No cattail areas on lake	No	No
Saguaro Lake	Year round	On site	Yes	Yes

Lower Salt River	Winter/spring	On site	Yes	Yes
Tempe Town Lake	Winter/spring	No cattail areas on lake. Habitat above lake on Salt River	No	No

Riparian Reptiles and Amphibians Methodology

***Batrachochytrium dendrobatidis* and the spread of Amphibian Chytridiomycosis**

The following review and information were prepared to provide an understanding of basic biology, transport mechanisms and impacts to amphibians in Arizona of the amphibian fungal pathogen, *Batrachochytrium dendrobatidis* (sometimes referred to as "chytrid" and hereafter as "*Bd*"), and to use that information to evaluate current hatchery operations and the likelihood of spread of Bd through fish stocking. This is not meant to be an exhaustive review of the global literature on Bd or chytridiomycosis, instead this will concentrate on those aspects of the biology of the organism that are relevant to its survival and distribution in Arizona, and how those might affect the (AGFD) hatchery operations related to the statewide sport fish stocking program.

Introduction and Basic Biology of Bd

Fungi in the primitive group Chytridiomycota are characterized by uniflagellated reproductive cells, and typically occur in water or moist soils, where they are parasites of protists, other fungi, algae, plants, insects and other invertebrates, as well as biodegraders of plant and animal remains containing cellulose, chitin or keratin (Powell 1993). Only one species, *Bd*, is known to infect vertebrates, and prior to 1998 it was unknown to science (Berger *et al.*1998, Longcore et al. 1999). *Bd* causes the serious and sometimes virulent amphibian disease chytridiomycosis (Berger *et al.*1998, Longcore et al. 1999, Stuart *et al.* 2004). In the last decade, the role of infectious diseases has been recognized as a key factor in amphibian declines throughout the world, and chytridiomycosis has been linked to much of that decline (Daszak *et al.* 1999, Carey 2000, Collins and Storfer 2003, Daszak et al. 2003; Skerratt et al 2007). Recent studies support the contention that Bd is an emerging infectious disease, i.e., a novel pathogen (Vredenburg et al. 2010), and not a widespread endemic that has emerged as a result of environmental change (e.g., Pounds et al. 2006).

Although many other chytrid species have been well studied as parasites of economically important plants (Powell 1993), surprisingly few studies have investigated the basic biology or ecology of Bd, although significant advances continue to be made (e.g., Woodhams et al. 2008, Voyles et al. 2009, Briggs et al. 2010, Vredenburg et al. 2010).

Bd has a complex life cycle in which "infective," free-living motile zoospores encounter, and encyst on the keratinized epidermis of amphibians and then develop into reproductive sporangia

(zoosporangia) which produce more zoospores through asexual reproduction. The zoospores are then released back into the water through a discharge tube and the cycle continues; no resting spores have been identified in laboratory studies (Longcore et al. 1999). Amphibians (frogs and salamanders) are the only known hosts for Bd; Bd has not been reported in caecilians (Gower and Wilkinson 2005).

There are few data regarding the ability of Bd to occupy alternative hosts (i.e., other than amphibians). Although Bd had been reported from freshwater shrimp in Australia (Rowley and Alford 2006), subsequent work by the same research group falsified their original findings (Rowley et al. 2007). Collins et al. (2005) used PCR to test for the presence of Bd on a variety of plants and animals collected from sites from which Bd was already known. They reported a Bd positive result from a batch sample of 6 wild caught fathead minnows (*Pimephales promelas*) from Sycamore Creek, Maricopa County, AZ. Whether one or more of those fish was infected with Bd, or simply had zoosporangia or zoospores (or their remains) on the surface of their fins is not known. They also exposed several potential host animals to large quantities of Bd zoospores in a series of experiments. Results suggested that backswimmers (Notonectidae, *Notonecta* sp.), dragonfly naiads (Odonata, including individuals in families Aeshnidae and Libellulidae) and crayfish (*Orconectes virilis*) were capable of carrying Bd for several days. Sample sizes in all cases were small and experimental procedures varied considerably (including different species of odonates). Although the authors used terms like "infected" to describe the results, the results were only Bd positive, suggesting that at a minimum zoospores or zoosporangia persisted on an organisms' surface rather than a host – pathogen relationship. However, the results are suggestive and demonstrate the need for additional rigorous testing.

For the purposes of discussion, unless otherwise defined below, experiments examining basic biological characteristics of Bd use two terms to describe aspects of the life cycle (taken from Johnson and Speare 2003 and Johnson and Speare 2005): 1) "**Viability**" -- in which flagellated zoospores move freely in the medium (water, growth medium, etc.), *or* zoospores move within zoosporangia, *or* growth occurs when aliquots from water with seemingly inactive Bd are subsequently injected into growth media/broth; and 2) "**Growth**" -- in which zoospores attach to a substrate (sometimes termed "encyst") and then develop in zoosporangia, *or* zoosporangia change size and form, *or* zoosporangia release new zoospores into the medium. Work reported by Longcore et al. (1999) and Piotrowski et al. (2004) quantified growth through optical density of zoospores and zoosporangia grown in liquid medium. Finally, it is important to note that Bd zoosporangia might survive in a "state of arrested or nondiscernable development" for extended time periods in less than suitable environments, and then when inoculated into appropriate growth media growth begins again, i.e., the culture remains "viable" (Johnson and Speare 2003). Therefore, lack of observable activity or growth does not indicate a dead or nonviable culture (Johnson and Speare 2003), nor should that be confused with a resting spore stage, which is

unknown for Bd (Longcore et al. 1999). Also, use of the term "**Bd-positive**" only denotes presence of the organism or its DNA, and does not necessarily equate with documented chytridiomycosis or mortalities linked to Bd.

The time and distance that zoospores will swim before encysting on the substrate was measured by Piotrowski et al. (2004). Although exact figures were not reported, the majority of zoospores tested (on 3, 5 cm diameter plastic culture dishes, each of which had about 200,000 zoospores) moved less than 2 cm before they encysted. About 50% had encysted by 18 hours, and 50% remained motile. By 24 hours, only about 5% were still moving; 95% had encysted. These results are consistent with one of the author's (J.E. Longcore) observations that infected amphibian skin cells often occur in clusters, suggesting that many zoospores do not disperse long distances, but rather they infect cells in the immediate vicinity of the zoosporangia from which they were released. This also suggests that Bd might spread among hosts during close contact, e.g., anuran amplexus, combat, aggregating tadpoles, etc. (Piotrowski et al. 2004).

Experiments by Johnson and Speare (2003) examined the ability of Bd to survive and grow in tap water, deionized water and sterilized "lake" water. Although in all cases, zoospores developed into zoosporangia which attached to the plastic flask in which they were housed, only the lake water treatment subsequently released zoospores, and did so for up to seven weeks. The tap and deionized treatments did not grow, but remained viable for three to four weeks (i.e., when reinoculated in broth). Presumably, unquantified nutrients and organics in the sterilized lake water allowed Bd to survive longer. It is important to note that no experiments have tested the lake water result under "field" conditions, i.e., with living lake, pond, stream water, etc.. Presumably, under those conditions Bd zoospores would be subject to predation by a variety of free-living protists, fungi, zooplankton, etc.

Although Bd is generally considered to be obligately aquatic, it has been reported to survive for at least 12 weeks (= 17 – 21 generations) in sterilized, damp (33% moisture content) sand (Johnson and Speare, 2005). At least one strain grew in sand with moisture contents as low as 10%, but those results were not quantified and need to be repeated (Johnson and Speare, 2005). However, earlier experiments demonstrated that mortality occurred when zoospores were dried (i.e., "complete dessication") for at least 3 hours (Johnson et al. 2003).

Interestingly, there is a recent report of Bd in the direct-developing plethodontid salamander, *Batrachoseps attenuatus*, a salamander with no aquatic habits nor an aquatic stage in its life cycle (Weinstein 2009), suggesting Bd is spread by direct contact, or that Bd can, in fact, survive and probably disperse in moist soils. Nonetheless, mechanisms by which Bd can infect largely terrestrial amphibians (or disperse through seemingly unfavorable habitats) are not known, and Johnson and Speare (2005) suggest that risk of infection in terrestrial habitats will vary among soil types, moisture content and pH.

Bd appears to tolerate a wide range of pH. Experiments have demonstrated survival and growth from pH 5 through pH 10 (none survived at pH 3 or 4), although the best zoosporangia growth and zoospore activity occurred between pH 6 and pH 7.5 (Piotrowski et al. 2004, Johnson and Speare 2005). At pH 5, 5.5 and 8 growth was slower than between pH 6 and 7.5. At pH 9 and 10 there was early growth, but activity ceased by day 7 and 3, respectively. However, cultures that were grown at pH 9 and 10 for 1 - 2 weeks (during which they were not growing or active) and then inoculated into cultures at pH 6.7 then became active and grew (Johnson and Speare 2005). These results suggest that although Bd does best at near normal pH, moderate extremes do not necessarily kill the fungus, thus Bd can probably survive in a wide variety of aquatic habitats. Further, it is also likely that Bd occurring inside an amphibian host might be buffered from external pH (Piotrowski et al. 2004), including the more basic waters that are common in Arizona.

The biology of Bd is greatly influenced by ambient temperature. In culture, Bd grew at temperatures as low as 4°C (Piotrowski et al. 2004), optimum growth occurred at 23°C but slowed at 28°C, and there was (reversible) cessation of growth at 29°C (Longcore et al.1999). Later experiments indicated that optimal growth occurred at 17° - 25° C (Piotrowski et al. 2004). Bd is sensitive to heat, and in culture isolates maintained at 28° C failed to grow and contained no live zoospores after 2 days (Piotrowski et al. 2004); mortality occurred at 30° C (Piotrowski et al. 2004; time of exposure not reported) and at 37°C when exposed for 4 hours (Johnson et al., 2003). Bd is pathogenic over a broad range of temperatures (12° - 27° C) but is most virulent from 12° - 23° C. Both pathogenicity and virulence decrease as temperature increases beyond 27° C (Skerratt et al. 2007 and references therein). In culture, short-term growth was maximal at 17°-25° C, and zoospores encysted and developed faster into zoosporangia (Woodhams et al. 2008). However, at cooler temperatures (7° - 10° C) although zoosporangia grew more slowly, they produced greater numbers of zoospores and they remained infectious longer. Piotrowski et al. (2004) noted that the ability to grow, albeit slowly, at 4° C would permit Bd to survive overwintering in aquatic habitats, and as temperature rose Bd could reproduce rapidly. Also in culture, zoospores can be induced to release by a sudden decrease in temperature (Woodhams et al. 2008). Finally, Woodhams et al. (2008, p.1627) summarized their work by saying, "The effect of temperature on amphibian mortality will depend on the interaction between fungal growth and host immune function and will be modified by host ecology, behavior, and life history. These results demonstrate that *B. dendrobatidis* populations can grow at high rates across a broad range of environmental temperatures and help to explain why it is so successful in cold montane environments."

Piotrowski et al. (2004) also demonstrated that Bd responds dramatically to different sources of nitrogen, although how those experimental nitrogen sources translate to environmental sources of

nitrogen is not clear. Experiments testing the effects of phosphorus are underway at Arizona State University (O. Hyman pers. comm.).

The precise mechanism by which Bd kills amphibians is not yet known, but recent work provides important information. The fungus may release toxins that are absorbed through the skin, but since amphibians absorb water and often respire cutaneously, Bd has been thought to affect water uptake, ionic balance or respiration. Voyles et al. (2007) reported that severe chytridiomycosis in Australian green tree frogs (*Litoria caerulea*) causes decreases in blood pH, plasma osmolality and plasma sodium, potassium, magnesium and chloride concentrations, and that this imbalance in osmotic homeostasis is caused by a disruption of normal cutaneous function. Their more recent work has shown that pathophysiological changes associated with electrolyte transport across the epidermis resulted in mortality. These researchers were the first to demonstrate experimentally that disruption of cutaneous function is a likely mechanism by which Bd kills amphibians. They noted that in "diseased individuals, electrolyte transport across the epidermis was inhibited by >50%, plasma sodium and potassium concentrations were respectively reduced by ~20% and ~50%, and asystolic cardiac arrest resulted in death" (Voyles et al 2009, p. 582).

The degree to which Bd affects amphibians at the population level varies considerably, and the factors that influence individual and population responses are incompletely understood (Briggs et al., 2010). Some amphibians appear to tolerate Bd with few negative effects (Davidson et al. 2003, Daszak et al., 2004; Weldon et al., 2004), while its presence has been correlated with high levels of mortality in many species (Stuart et al., 2004, Lips et al. 2006,) and has also been implicated in amphibian extinctions (La Marca et al., 2005). This range of variability is also apparent in populations of Arizona anurans (see below).

In Arizona, Bd has been implicated in mortalities in Bufo punctatus, Hyla arenicolor, H. wrightorum, Pseudacris triseriata, Rana berlandieri, R. blairi, R. chiricahuensis, R. pipiens, R. tarahumarae and R. yavapaiensis, and has been identified in Ambystoma tigrinum stebbinsi and Rana catesbeiana (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data, O. Hyman pers. comm.). Among these species, Bd has been implicated in severe population declines of Rana yavapaiensis (Sredl 2000) and the extirpation of Rana tarahumarae from Arizona (T. Jones, P.J. Fernandez unpublished; see also Hale et al. 2005), yet populations of other species seem to have survived despite occasional losses of individuals to Bd. For example, Bd was confirmed in Sycamore Canyon from a 1972 Rana yavapaiensis specimen (S. Cashins, E. Davidson, M.J. Sredl unpublished) and from dead and dying R. yavapaiensis and R. tarahumarae collected in 1974 (T. Jones, P.J. Fernandez unpublished). It is clear that Chiricahua leopard frog populations can coexist with the disease for extended periods, and in this case they have coexisted with Bd in

Sycamore Canyon at least since 1972 (U.S. Fish and Wildlife Service 2007), despite periodic mortalities.

Some amphibian species or populations are known to harbor Bd without evidence of lethal effects (e.g., Longcore et al. 2007). In Arizona, this includes native tiger salamanders (*A. t. stebbinsi*) and exotic bullfrogs (Davidson et al. 2003, Mazzoni et al. 2003). Consequently, through dispersal both species would be capable of moving or maintaining Bd in the environment (Collins *et al.* 2003, Daszak et al. 2004). Other native and nonnative frogs that are susceptible to the disease also serve as disease vectors or reservoirs of infection (e.g., Bradley *et al.* 2002).

Vectors

The mechanism by which Bd is spread across the landscape is incompletely understood, but we know that Bd can be transmitted in at least two ways: 1) through the movement of infected amphibians, or 2) through movement of water (or mud) that contains zoospores or zoosporangia from infected amphibians.

As mentioned above, the most likely avenue for Bd dispersal is through movement of infected amphibians (either naturally or for management purposes) that then spread the pathogen to previously uninfected amphibians. Through this process the largest numbers of viable zoospores would ultimately be transferred, i.e., living, infected amphibians would continue to shed zoospores into the environment thus increasing densities of free living zoospores, and increasing the likelihood that the zoospores would contact local amphibians; a typical density dependent pattern of pathogen transmission in which an increase in density of the pathogen increases the probability of transmission.

Recent work on mountain yellow-legged frogs (*Rana mucosa* and *R. sierrae*) strongly supports the hypothesis that the frogs themselves were probably the most important agents of dispersal at the local scale (i.e., within metapopulations), although other unknown vectors contributed to movement of Bd across the larger landscape. At one site the data indicated that Bd spread through the metapopulation, mediated by dispersing frogs, in a distinct wave at a rate of approximately 688 m/year (Briggs et al. 2010, Vredenburg et al. 2010).

In Arizona, dispersal of infected native amphibians across the landscape is limited to some extent by unfavorable (usually arid) habitats that separate many amphibian populations during much of the year, and is limited to some extent by low densities of some native amphibians (e.g., native leopard frogs). Nonetheless, there are some environments (e.g., higher elevation sites, like the Kaibab Plateau, parts of the Mogollon Rim, White Mountains) where there are large contiguous tracts of favorable habitat that might remain sufficiently mesic for periods of time long enough to facilitate dispersal e.g., following snow melt or during the monsoon season. Under those

conditions, infected amphibians, particularly those that harbor sub-lethal Bd infections (e.g., tiger salamanders) can probably move among aquatic habitats, thus dispersing the pathogen.

Invasive exotic bullfrogs are extremely effective dispersers and might also be responsible for the spread of Bd. Studies done by biologists at the University of Arizona suggest that an individual bullfrog might move as much as seven miles over relatively flat terrain during the summer monsoon season (Suhre, et al. 2006. Unpublished abstract. Joint Meeting Of Ichthyologists & Herpetologists, New Orleans, Louisiana). Although bullfrogs can succumb to chytridiomycosis (Pearl and Green 2005), to a large degree they appear to be able to support sub-lethal infections and are therefore probably effective Bd vectors (Daszak et al. 2004). In addition, international trade in bullfrogs for food is likely spreading Bd worldwide (Schloegel et al. 2009).

The AGFD has compiled data for the presence of Bd in bullfrogs from several sites including, San Bernardino NWR, San Pedro River, Mammoth Hot Springs, Cienega Creek watershed, San Rafael Valley, Scotia Canyon (Huachuca Mtns), Sycamore Canyon and Salty Tank (Atascosa/Pajarito Mtns), Tonto Basin, and Bubbling Ponds Fish Hatchery (BPFH) (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data; P. Rosen pers. comm.). Bullfrogs at all of these sites that might disperse to nearby sites that support native amphibians.

The biology of Bd also suggests strongly that Bd might be spread by people or terrestrial animals that move among sites, one or more of which must support infected amphibians and therefore motile zoospores. Viable zoospores in water or mud could potentially be spread by wet or muddy boots or clothing, vehicles, cattle and other animals moving among aquatic sites, during scientific sampling of fish, amphibians, or other aquatic organisms, or through the direct movement of water (e.g., Johnson and Speare 2003, 2005).

The only experiments of which we are aware that test the hypothesis that terrestrial animals other than amphibians might contribute to Bd dispersal are by Johnson and Speare (2005). They demonstrated that Bd zoospores could quickly (1 minute) associate with bird feathers (chicken and duck down), and those zoospores were viable after the feathers had been removed from media for up to an hour. If given sufficient exposure to feathers (up to 4 days in media), zoospores formed attached zoosporangia. Zoosporangia on duck down survived drying up to 3 hours (note: drying was only defined as removal from media, after which the feathers were placed in a laminar flow hood), thus suggesting the disease could be spread by waterfowl or other water birds moving among wetlands. These results also support the contention that wet clothing or sampling equipment could be effective vectors for zoospores or zoosporangia. In addition, experiments mentioned above by Johnson and Speare (2005) strongly support the hypothesis that viable zoosporangia could survive transport in wet mud or sand, although the

degree to which other microorganisms would affect their survivorship is unknown. Nonetheless, it is still not known how the fungus survives in the absence of amphibian populations.

Carey et al. (2006) tested the effects of Bd zoospore dosage (i.e., numbers of zoospores to which an animal is exposed) and length of exposure on survival time of boreal toads (*Bufo boreas*). In this experiment, juvenile toads were placed in 236 ml (~ 1 cup) containers, into which a 20 ml solution containing zoospores was added; 20 ml was sufficient volume to immerse the toads ventral side. They found that dosage and exposure strongly influenced survival. Unsurprisingly, at high dosages (i.e., 10^3 and 10^6 zoospores) there was 100% mortality, irrespective of exposure time. At low dosages results varied according to exposure time, however, even the lowest doses (1 zoospore/20 ml) often resulted in infection. Significantly, at the lowest doses (1, 20, 40, 60, 100 zoospores) and exposure for 1 day, percentage of toads that survived for 42 days (the duration of the experiment) ranged from 30% (100 zoospores) to 93% (1 zoospore). It is important to note that regardless of zoospore dosage, the toads were sitting in only 20 ml of solution for ≥ 1 day, and therefore could not escape contact with the zoospore(s). That volume of solution in a 236 ml cup would place the toad well within the swimming distance reported by Piotrowski et al. (2004). Nonetheless, there was significant survival at low doses, suggesting that higher doses of zoospores are necessary to cause lethal infections.

In a study that focused primarily on ranavirus screening, Picco and Collins (2008) tested whether the bait trade in larval tiger salamanders (waterdogs) in Arizona facilitated the dispersal of Bd. They used real-time PCR to screen water samples and to test salamander tissue samples from 9 bait shops that sold waterdogs. They reported positive results for Bd from water samples from 3 of the 9 shops, and Bd positive tissue from one of those 3 shops. Importantly, they discovered that many anglers surveyed (67%, n = 27) released tiger salamanders bought as bait into the waters where they fished, and one out of 24 shops (4%) sampled in the entire study released unsold tiger salamanders into the wild after they had been kept in shops with Bd or ranavirus infected animals.

Bd and fish stocking

Depending on whether the fish being stocked originated at an AGFD hatchery or from an external vendor, operations vary, but there are three routine stocking operations by which Bd might be transferred from the point of origin to a stocking site. However, in each case the stocking operation process limits the probability of transmission of Bd (see below).

The first operation includes fish raised in open (natural) ponds that are available habitat for amphibians. These activities are limited to “incentive” fish that are raised in “show ponds” on hatchery grounds (e.g., Tonto Creek and Canyon Creek fish hatcheries). Incentive fish are generally larger fish that, when stocked into waters along with “typical” stocked fish, provide an extra incentive for anglers. Stocking incentive fish occurs infrequently, and often those fish are

not stocked, but are provided to commercial entities for display (e.g., Bass Pro Shops, Cabela's, etc.). Earthen raceways at Silver Creek hatchery are similar to open ponds, although they are flow-through systems and do not provide suitable amphibian habitats.

The second operation includes raceway raised fish (which may also include incentive fish, e.g., at Tonto Creek), in which fish are raised in artificial structures that generally are inhospitable for amphibians (i.e., they might be raised structures, concrete, rubber lined, etc.).

Finally, some fish are purchased from external vendors. These include cold water fish that are only stocked in urban fishing lakes, and warm water fish that are generally stocked in urban lakes but have been stocked in various lakes statewide. In all cases, stocking trucks are filled with clean well or spring water before fish are loaded and transferred. Table 1 outlines the procedures followed during stocking operations initiated by AGFD hatcheries and how those procedures influence the persistence of Bd in that operation.

At most AGFD hatcheries, the fish are raised entirely in raised tanks or in raceways that are not available to amphibians that might or might not be infected with Bd. Therefore, fish raised under those conditions do not present a credible threat with respect to transferring Bd through stocking activities.

In the rare event that incentive fish are used for stocking purposes, they are typically netted from "show ponds" or from raceways, and placed directly into stocking trucks with clean water. Show fish numbers are usually in the hundreds, and they are not mixed in trucks with regular stock (truck loads of which typically number in the thousands).

Fish are also purchased from external vendors (primarily from the southeastern U.S.). Those fish are removed from the rearing ponds and placed into truck tanks filled with well water. After loading, the tanks are flushed with well water before transit. Finally, in Texas, all tanks are again flushed with well water. Importantly, vendors are contractually obligated to provide fish that are free of disease or other pathogens as prescribed by AGFD (details depend upon species being purchased), and the loads must be free of non-target organisms (plants or animals). Loads are off-loaded in nets at the receiving point, at which time they are visually inspected for overall health and non-target organisms. Loads that fail to pass this inspection may be rejected.

The AGFD has Bd-positive records for amphibians occurring in the following river systems: Agua Fria (Lake Pleasant), San Francisco, Gila (tributary to mainstem), Hassayampa, Río de la Concepción, Salt, San Pedro, Santa Cruz, Verde and Río Yaqui (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data).

Bd has been documented in bullfrogs in open hatchery ponds only at BPFH. To date, we have very few data on Bd on amphibians at any other AGFD hatchery, including nearby Page Springs Hatchery, but reports of amphibians in other facilities have been rare. Because bullfrogs can apparently harbor Bd for long periods of time without apparent ill effects (Daszak et al. 2004), the presence of bullfrogs at a hatchery presents a risk for spread of Bd either through spread of infected bullfrogs or tadpoles, or through spread of zoospores shed by infected bullfrogs into water that is then moved from one site to another. Note that fish stocked from AGFD hatcheries, approximately 98% of them are trout from the 5 hatcheries other than BPFH. Those fish from BPFH are primarily warm water native fish and are not stocked for sport fish purposes.

The pathways by which there is transfer of Bd from one environment to another depends on success of a series of events in the life cycle of the fungus: 1) a motile zoospore with a single flagellum disperses by swimming, 2) the zoospore encysts on a suitable host, 3) the resulting zoosporangium produces new zoospores, and 4) new zoospores are released into the water, where the process repeats. Under ideal conditions, the zoospore encysts on amphibian skin.

Thus, the questions that must be addressed are: 1) is there a measureable risk of transporting amphibians that harbor Bd, and 2) is there a measureable risk of transporting viable zoospores or zoosporangia to habitats that support native amphibians, including Chiricahua leopard frogs?

1) Is there a measureable risk of transporting amphibians that harbor Bd?

This pathway of infectivity, transport of infected amphibians (e.g., bullfrogs) along with stocked fish, is the most effective way to transmit Bd. This pathway has serious consequences and if it takes place is very likely to spread the disease from one place to another. Existing AGFD HAACP plans and best management practices incorporated into hatchery operations make this highly unlikely, thus the risk of transporting infected bullfrogs or other amphibians is not significantly different than zero.

2) Is there a measureable risk of transporting viable zoospores or zoosporangia?

Although Bd zoospores can encyst and grow on non-living surfaces and survive for considerable periods of time under controlled conditions in vitro (Longcore et al.1999, Johnson and Speare 2003, 2005, Piotrowski et al. 2004, Woodhams et al. 2008), we are unaware of any studies that have experimented with the ability or likelihood of zoospores to encyst and grow successfully on non-target surfaces under natural conditions (i.e., in the presence of competitive and predatory organisms). We are also aware of no data to indicate that Bd can encyst on fish skin, where epidermal mucous, bacterial flora, etc. of non-host organisms would probably inhibit attachment. Therefore we think it is highly unlikely that Bd would be carried by an alternate fish host, but acknowledge that the question remains to be tested.

Based on their experimental laboratory studies (again, in a monoculture under controlled conditions), Johnson and Speare (2003) made the following conservative recommendations regarding the movement of water that has come into contact with Bd infected amphibians: 1) water should be regarded as contaminated for at least 7 weeks following last contact with infected amphibians; 2) water storage alone should not be used as a means of disinfecting water; 3) all contaminated water should be disinfected with appropriate chemical disinfectants before being discharged into the natural environment.

However, Piotrowski et al. (2004) suggested that the limited dispersal characteristics of zoospores indicate Bd is most likely spread by close amphibian contact. Although they acknowledge that zoospores could be carried longer distances by water currents, they also point out that passive dispersal like that "would decrease the chances of a zoospore contacting a host, because the spores would be diluted to low concentrations" (Piotrowski et al. 2004, p. 13). Serial dilutions of water that take place in standard hatchery operations would simulate the conditions noted by Piotrowski et al. (2004), i.e., zoospores would be reduced to exceedingly low concentrations. And, infection rates at those lower concentrations might be quite low (e.g., Carey et al. 2006).

Fish purchased from vendors undergo at least 2 dilutions; they are initially netted into a truck with clean water and that water is changed approximately midway during the trip to Arizona. Over the past three years of stocking, approximately 17% of the fish stocked in Arizona were provided by contract vendors. Of those contract vendor fish about 90% were stocked in Urban Fish Program (UFP) lakes that have few or no aquatic connections to sensitive native amphibian sites, and none to Chiricahua leopard frog habitats. During the 10 year period covered in this consultation, risk of transporting viable zoospores or zoosporangia via contract vendor pathway is expected to remain low because: 1) the number of fish purchased is expected to remain similar to current stocking numbers with the exception that there may be some additional locations stocked, including primarily the Fishing in the Neighborhood (FIN) waters that are located in primarily urban areas with limited hydrologic connectivity to sensitive native amphibian sites, and 2) because warm water stockings that would likely require fish purchase in response to a partial or complete loss of a fishery due to catastrophic events could occur during the 10 year period; however these stockings are not anticipated to occur only rarely.

Finally, considering the stocking protocol outlined above, there is a very small chance that some Bd zoospores would be released into waters stocked with fish. Those zoospores would again be diluted by the large volume of water at the stocking site. In order to complete their life cycle, the zoospores would have to encounter an amphibian and encyst on that host. The likelihood of a few zoospores in an exceedingly large volume of water coming in contact with a streamside/lakeside amphibian is, again, extremely low. In addition, depending on the stocking locations, the community of Arizona amphibians that would inhabit those waters would be

limited to a few species. Most native ranids, i.e., those species that would be most likely to become infected with Bd, no longer occur in many of those habitats.

Conclusions

Chytridiomycosis is an extremely serious amphibian disease, and there is no doubt that it has caused significant losses among Arizona's native fauna. Many aspects of the natural history and ecology of Bd remain to be answered, and mechanisms of dispersal beyond the actual movement of infected amphibians (e.g., Vredenburg et al. 2010) are woefully understudied. Thus, it is important to approach questions of potential spread of Bd with caution, and to take steps to prevent that spread. AGFD staff working with aquatic organisms (including mollusks, fishes, amphibians and reptiles) practice strict disinfectant protocols (as outlined in the Chiricahua leopard frog recovery plan [USFWS 2007]) to prevent the spread of Bd (and other pathogens) among populations of aquatic wildlife.

However, there are specific concerns that the AGFD hatchery stocking program might spread *Bd*. This risk has been assessed and found to be very low considering the life cycle of Bd (Berger et al. 2005), behavior of the zoospores (Piotrowski et al. 2004), the procedures followed in normal hatchery operations, and the precautions taken in the AGFD HACCP plan and best management practices within the hatcheries. The particular case of spreading Bd is one that relies on a long series of unlikely events taking place that would lead to amphibians being infected by Bd in areas where the disease does not already exist. Specifically: 1) a hatchery would have to be infected with Bd; 2) water from an infected hatchery would need to have enough Bd zoospores so that some individual spores would survive treatments during fish transfer and those called for in the HAACP plan; 3) zoospores would have to survive freshwater dilution in raceway raising, sorting or tagging procedures; 4) remaining zoospores would have to survive the trip in the hatchery truck to the stocking site; 5) zoospores would have to survive in the stocking area long enough to encounter an amphibian host; and 6) the amphibian host would have to develop chytridiomycosis then spread the disease to others.

Finally, **Error! Reference source not found.** outlines the steps in stocking hatchery fish and how these steps relate to the prevention of the spread of chytridiomycosis.

Table 4. Operations and procedures followed by AGFD hatcheries to collect, sort, transport, and stock native and nonnative fish.

Step	**Notes on hatchery procedures**	**Notes relevant to the persistence of Bd**
1. fill sanitized stocking truck with spring or well water (proceed to step 2a		if truck had been previously exposed to Bd zoospores, they will be killed during sanitization

Step	Notes on hatchery procedures	Notes relevant to the persistence of Bd
or 2b)		truck is filled with water that has low or no likelihood of having exposure to fish, bullfrogs, or Bd
2a. if fish are collected from raceways, they are usually individually netted or in some cases harvested using automated equipment (contained, drained, and moved) and placed in transport truck (proceed to step 5)	raceways are inspected during feeding [daily] and cleaning [1-3 times per week] for non-target organisms	this step should get rid of Bd infected amphibians Bd zoospores will be in the residual water on the skin of fish and collecting gear or runoff from the collecting process Bd zoosporangia in shed amphibian skin could hatch and become free swimming Bd zoospores could remain free-swimming or encyst on the skin of a fish or on the inside of the transport truck at any step
2b. if fish are collected from ponds: fish and possibly frogs and tadpoles are netted or seined and moved to transport truck (proceed to step 3)	these are generally native fish, but also include incentive fish, e.g. trout fish from raceways and ponds have residual water during collection and movement	this step should get rid of Bd-infected amphibians Bd zoosporangia in shed amphibian skin could be discharged and become free swimming Bd zoospores will be in the residual water on the skin of fish and collecting gear or runoff from the collecting process
3.fish are placed in raceways fed by spring or well water and sorted, then placed in the stocking truck (proceed to step 4)	non target organisms (frogs and tadpoles) are removed during sorting	in raceways, Bd zoospores might remain on the skin of fish, but will not grow, or be placed back in “solution” and diluted or “swept away” by the flowing water of the raceway
4. refill unsanitized truck with spring or well water and put fish in stocking	truck has been drained, but not disinfected after the	truck is filled with water that has low or no likelihood of having exposure to fish, bullfrogs, or Bd

Step	Notes on hatchery procedures	Notes relevant to the persistence of Bd
truck (proceed to step 5)	previous step. It may be left "empty" for some duration	Bd zoospores have been diluted by the volume of water in the transport truck
5. one to three hour drive to stocking site (proceed to step 6)		
6. acclimate water in truck to local water quality parameters (proceed to step 7)		
7. release fish by dumping entire load or individually netting fish		once at the stocking site, free-swimming zoospores would have to find a suitable amphibian host, encyst, and form many zoosporangia and reinfect host

Chiricahua and Northern Leopard Frog

Introduction

The Arizona Game and Fish Riparian Herpetofauna Database contains observational data for native ranid frogs that were collected from 1884 to present. Historical ranid frog distributions were determined from museum registers, published and gray literature reports and observations of credible individuals (for a complete list of citations, see Sredl 1997). In addition to these sources, this dataset includes data from AGFD surveys targeting native ranid frogs: *Rana blairi*, *Rana chiricahuensis*, *Rana pipiens*, *Rana subaquavocalis*, *Rana tarahumarae*, and *Rana yavapaiensis* and includes positive and negative site visits for these taxa. For complete survey methodology, see Sredl (1997).

Historical and recent frog observations

To evaluate the status of frog populations at a stocking site or in the vicinity of that site, we considered the best available positive and negative frog survey data, habitat suitability, and survey effort (Table 18), using data from the following sources: AGFD Riparian Herpetofauna Database, HDMS, and RAPI_from_MacVean, Tonto National Forest (Tonto NF 1979-2008), Apache-Sitgreaves National Forest (Black Mesa (Negative) 2003-2007), and Coconino National Forest (Coconino NF 2005-2008). Positive frog observations from these sources were divided in four categories:

Observations made prior to 1980: By 1980, all currently recognized species of Arizona leopard frogs had been described or recognized (note: although the lowland leopard frog was not

described until after 1980 (Platz 1984), the term "lowland form" to reference this taxon was commonly used in the literature prior to 1980). This timeframe captures what has often been used by researchers to establish baselines for status and distribution studies (e.g. Clarkson and Rorabaugh 1989, Sredl et al. 1997).

Observations made between 1980 and 1999: This timeframe includes the period when the modern taxonomy for Arizona leopard frogs became widely used in inventory, status and distribution studies. This period includes survey work by Clarkson and Rorabaugh (1989), which was the seminal paper that brought declines of Arizona ranid frogs to the attention of the research and conservation communities, and the work of Sredl et al. (1997), who conducted the first comprehensive analysis of inventory, status and distribution of Arizona ranid frogs. The work of Sredl et al. (1997) and subsequent surveys are cited as Arizona Game and Fish Riparian Herpetofauna Database in our analyses.

Observations made between 2000 and 2005: After 1999, field surveys targeting Arizona ranids began to transition from wide-ranging inventories and status and distribution studies to monitoring extant populations, evaluating sites for recovery opportunities or reconnaissance of new leopard frog populations. In addition to many records included in Arizona Game and Fish Riparian Herpetofauna Database, other datasets used in our analyses that primarily fall within this timeframe are: MacVean (RAPI_from_MacVean), Tonto National Forest (Tonto NF 1979-2008), Apache-Sitgreaves National Forest (Black Mesa (Negative) 2003-2007), and Coconino National Forest (Coconino NF 2005-2008).

Observations between 2005 and the present: In many cases, observations made after 2005 represent our best assessment of leopard frog populations that are extant, and are located in all data sets used in our analyses.

Habitat suitability

Throughout the discussion of leopard frog habitat and dispersal corridors, we use the term "less suitable," which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not leopard frogs will or can occur in a particular area. The ability of leopard frogs to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to water availability, cover, prey, predators, etc.. Stocking sites or stream reaches would be considered "less suitable" for leopard frogs when there are known reasons in conditions that generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for leopard frogs because they exert predatory or competitive pressures on the frogs.

Frog occupancy

It is difficult to determine if frogs are absent from a site or area. In order to make that determination, we used a "preponderance of evidence approach" to build a case that frogs are present or absent. We acknowledge that these criteria are imperfect, but they utilize the best available data in a consistent manner.

1. Frog sites / stocking complexes will be considered occupied if they contain
    a. extant populations of frogs, defined as sites that have positive observations for Chiricahua or northern leopard frogs made from 2006 to the present, or
    b. locations where frogs were observed one or more times from 2000 through 2005 and habitat is in good condition and therefore could contribute to "recovery" (e.g. those sites in a Chiricahua Leopard Frog Management Area (MA))
2. Frog sites / stocking complexes may be occupied
    a. if they are located in the historical range (i.e. within the approximate boundaries of a Chiricahua Leopard Frog Recovery Unit [RU]) and contain positive observations from 1980 through 1999 but there have been no subsequent surveys or
    b. if they are located in the historical range and contain leopard frog records that were made prior to 1980 and the area has been poorly surveyed
3. Frog sites / stocking complexes will be considered unoccupied if they are
    a. outside the historical range (i.e. RUs) or
    b. within the historical range and contain no positive observation made through 1999 and
        i. areas that have been well-surveyed and all survey results are negative at both historical and non-historical localities or
        ii. there has been a no post-1999 positive reports from areas that are frequently visited by knowledgeable biologists or
        iii. presence of degraded habitats (e.g. those that are dewatered or contain many nonnatives) and all surveys subsequent to 1999 are negative

Table 5. Criteria used and data considered to characterize the likelihood that Chiricahua or northern leopard frogs occupy a site or area.

Status	Occurrence data	Habitat suitability	Survey effort
Occupied	extant frog population (= positive observations from 2006 to present) or	NA	NA
	frogs observed from 2000 through 2005	…and habitat is in a condition such that it could contribute to "recovery" (i.e. area is in CLF MA)	NA
May be occupied	frogs observed from 1980 through 1999 or	…and in historical range (~RU)	but there have been no subsequent surveys
	frogs observed prior to 1980	…and in historical range (~RU)	and area has been poorly surveyed
Unoccupied	frogs observed through 1999	…and in historical range (~RU)	and well-surveyed area and results include only negative surveys at both historical and non-historical localities or lack of positive reports from areas that are frequently visited by knowledgeable biologists
	frogs observed through 1999	…and in historical range (~RU) and the prevalence of degraded habitats (dewatered, many nonnatives…)	and all surveys subsequent to 1999 are negative

Developing Buffered Stocking Complexes

Local Analysis

To evaluate both the likelihood that a site or local area is occupied by Chiricahua and northern leopard frogs, and the level of exposure of stocked fish to these leopard frogs, we developed a buffered stocking complex approach by creating a minimum convex polygon (MCP) around all stocking sites within a stocking complex, and buffering this MCP by 5 miles.

In most cases we used the buffered MCP approach to circumscribe the entire stocking complex, but in three stocking situations we had to depart from this approach and create sub-complexes. These situations arose when stocking sites in complexes consisted of: 1) fewer than 3 sites, 2) sites that were isolated and distant from other stocking sites, or 3) only stream reaches. In these cases, a 5 mile buffer was made around individual stocking sites or around the entire stocking reach. A buffered MCP or a 5 mile buffer was applied only to those sites or complexes that lie within the known historical range of Chiricahua and northern leopard frogs. Some stocking complexes were so large or heterogeneous (e.g. Middle Verde River stocking complex), we divided the complex into smaller, more manageable sub-complexes comprising one of more of the three situations outlined above.

We analyzed potential impacts of stocking at two levels, the local and broad scales. For the local analyses, we used each buffered stocking complex to limit our query of historical and visual encounter survey data. We then used these data to consider at the local level the likelihood of occupancy and exposure to stocked fish. Water distribution and connectivity within each stocking complex was reviewed thoroughly to fully understand the ability and likelihood of fish and frog movement within the buffered stocking complexes, reaches or sites.

Broad Scale Analysis

The likelihood of occupancy of Chiricahua and northern leopard frogs and exposure to stocked fish were evaluated on a broader scale by assessing potential movement of fish and frogs upstream and downstream beyond the buffered stocking complex, reach, or individual site. The water distribution and connectivity portion of each stocking complex was reviewed thoroughly to fully understand the ability and likelihood of fish and frog movement outside of the buffered stocking complexes, reaches or sites.

Determining exposure: Dispersal of fish and frogs

To evaluate the likelihood that dispersing Chiricahua or northern leopard frogs could be exposed to stocked fish, we used data on flow, distance, and other attributes of corridor suitability for fish and frogs to make this determination (see Table 19 for criteria examined). By circumscribing a distance of 5 miles around all stocking sites within a stocking complex, we considered all possible distances that Chiricahua and northern leopard frogs are reasonably likely to disperse (1 mile overland, 3 miles along intermittent drainages, and 5 miles along permanent drainages, see

USDA Forest Service Southwestern Region 2004, Chiricahua Leopard Frog Recovery Plan 2007 and references therein). For details on buffering stocking complexes, see section below.

Table 6. Criteria used to characterize the likelihood of exposure of dispersing Chiricahua or northern leopard frogs to stocked fish.

Flow was categorized by the predominant flow type (perennial or intermittent, or none), while considering additional information on water distribution and potential for frogs and fish to disperse through that corridor. Distance between occupied frog sites and stocking sites was measured in ArcGIS. Known reasons that alter the "suitability of dispersal corridor" include natural and manmade barriers to dispersal of stocked fish and presence of nonnative aquatic species (crayfish, fish, and bullfrogs).

Likelihood of Exposure	**Flow**	**Distance (miles)**	**Suitability of dispersal corridor**
High	Perennial	< 5	NA
	Intermittent	< 3	NA
Moderate	Perennial	> 5	There are known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish
	Intermittent	> 3	There are known reasons that decrease the likelihood of dispering frogs being exposed to stocked fish
Low	Perennial	>> 5	There are many known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish
	Intermittent	>> 3	There are many known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish

In order to evaluate the likelihood that Chiricahua or northern leopard frogs could be exposed to dispersing stocked fish, we used data on flow and other attributes of corridor suitability found in the watershed chapters to make this determination (see Table 20 for criteria examined).

Table 7. Criteria used to characterize the likelihood of exposure of Chiricahua or northern leopard frogs to dispersing stocked fish. Flow and known reasons that alter the "suitability of dispersal corridor" determined as in Table 19.

Likelihood of Exposure	**Flow**	**Suitability of dispersal corridor**
High	Perennial	NA
Moderate	Perennial	There are known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish
	Intermittent (may contain substantial pools)	There are known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish
Low	Perennial	There are many known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish
	Intermittent	There are many known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish

<u>Northern Mexican Gartersnake</u>

Range wide discussion

Northern Mexican gartersnakes are closely associated with riparian areas and typically inhabit cienegas, perennial streams, rivers, earthen stock tanks, and ponds with thick bank vegetation (Holycross et al. 2006; Rosen and Schwalbe 1988). Their historical range wide distribution extends from central Arizona and west-central New Mexico south along the Sierra Madre Occidental to west-central Veracruz and also includes isolated populations in central Oaxaca and central Nuevo Leon, Mexico (Holycross et al 2006). In Arizona, northern Mexican gartersnakes were historically found between 500-2050 m (1640-6725 ft) elevation and have been previously documented from Tonto Creek, upper Verde River, Agua Fria River, Salt/Black River, Little Colorado River, San Bernardino Ranch, San Pedro River, Altar Wash, and Santa Cruz River watersheds (Holycross et al. 2006). While they were once considered common, northern Mexican gartersnakes are believed to have declined substantially throughout their range and are now candidates for Federal listing under the Endangered Species Act.

Using the best available data, the USFWS determined in their 12-month finding (USFWS 2008a) that northern Mexican gartersnakes are likely extant at the following locations: Santa Cruz River/Lower San Rafael Valley, Verde River from the confluence with Fossil Creek upstream to

Clarkdale, Oak Creek at Page Springs, Tonto Creek from the mouth of Houston Creek downstream to Roosevelt Lake, Cienega Creek from the headwaters downstream to the "Narrows" just downstream of Apache Canyon, Pantano Wash (Cienega Creek) from Pantano downstream to Vail, Appleton-Whittell Research Ranch and vicinity near Elgin, and Red Rock Canyon east of Patagonia. They determined that it is unknown whether the species is still extant at the following locations: downstream portion of the Black River drainage from the Paddy Creek confluence, downstream portion of the White River drainage from the confluence of East and North forks, Big Bonito Creek, Lake O'Woods near Lakeside, Spring Creek above the confluence with Oak Creek, Bog Hole Wildlife Area, Upper 13 Reservoir, Patagonia Mountain bajada, Babocomari River, Upper Scotia Canyon in the Huachuca Mountains, Arivaca Cienega, Gila River at Highway 180. The species is considered likely extirpated from the following locations: the Gila River, Lower Colorado River from Davis Dam to the International Border, the San Pedro River, Santa Cruz River downstream from the International Border at Nogales, Salt River, Rio San Bernardino from International Border to headwaters at Astin Spring (San Bernardino National Wildlife Refuge), Agua Fria River, Verde River upstream of Clarkdale, Verde River from the confluence with Fossil Creek downstream to its confluence with the Salt River, Tanque Verde Creek in Tucson, Rillito Creek in Tucson, Agua Caliente Spring in Tucson, Potrero Canyon/Springs, Babocomari Cienega, Barchas Ranch, Huachuca Mountain bajada, Parker Canyon Lake and tributaries in the Canelo Hills, and Oak Creek at Midgley Bridge (USFWS 2008a).

Home range

Home range information is lacking for northern Mexican gartersnakes, however, a study in British Columbia found that for adult terrestrial gartersnakes (*Thamnophis elegans*), a species similar to northern Mexican gartersnakes, home-range varied from 10 to 100,000 m^2 (108 to 1,076,391 ft^2) and that they often migrated nearly 3 km (1.86 mi) in a season (Graves and Fuvall 1990, Farr 1988, cited in Rossman et al. 1996). Additionally, common gartersnakes, *T. sirtalis*, from Manitoba made long distance movements between hibernation sites and feeding areas which ranged from 4.3 to 17.7 km (2.67 to 11 mi) (Gregory and Steward 1975, cited in Rossman et al. 1996). In a Kansas study, the mean activity area for *T. sirtalis* ranged from 92,000 m^2 (990,280 ft^2) for females to 142,000 m^2 (1,528,475 ft^2) for males (Fitch 1965, cited in Rossman et al. 1996), and in Michigan, their range was recorded at 8000 m^2 (86,111 ft^2) (Carpenter 1952, cited in Rossman et al. 1996). In yet another study, researchers found that recaptured gartersnakes were rarely found more than 160 m (525 ft) from their original capture locations (Freedman and Catlin 1979, cited in Rossman et al. 1996).

While northern Mexican gartersnakes are likely capable of large-scale overland movements similar to those described above for other gartersnake species, the frequency at which they occur is unclear. Though they are rarely found more than 15 m (52 ft) from permanent water, observations of this species from the San Rafael Valley, Arizona, indicate that northern Mexican

gartersnakes can wander overland and be found several kilometers from riparian areas (e.g., cienegas and rivers) (Rosen and Schwalbe 1988). For example, northern Mexican gartersnakes have been found at overland distances of 3 km (1.86 mi) (FS799 tank) and 6.2 km (3.85 mi) (Upper 13 Reservoir) from the Santa Cruz River despite a lack of aquatic connectivity (T. Jones pers. comm.). While it is unclear whether the observations were of dispersing individuals or resident snakes, these data support the suggestion that this species, similar to other gartersnakes, is capable of moving across the landscape and can persist at sites beyond riparian corridors. The large-scale movements described for similar species listed above likely reflect their need to move between limited suitable hibernation locations and feeding areas during the active season. The average distance northern Mexican gartersnakes travel between hibernation sites and active season feeding areas is currently unknown.

Snakes are cryptic by nature and their detectability is generally low, even among common species. Currently, no standard survey protocol exists for detecting northern Mexican gartersnakes, however, researchers employ similar field techniques which include trapping with mesh minnow traps, visual searching, dip-netting, and turning cover objects (boards, rocks, logs, etc.). The area covered and duration of trapping and visual searching periods often vary by site and over time. It is difficult to quantify the degree to which populations of northern Mexican gartersnakes have declined over time because long-term demographic data are generally lacking. There are few comparisons of relative abundance between/among sites and those are typically quantified through catch per unit effort (e.g., person-search hours and trap-hours), however, this measure does not account for habitat variables or other covariates that might influence detectability. Often, and as is the case for gartersnakes, these indices of relative abundance constitute the best available information from which management decisions must be made for a species. While the assumption is often made that snakes will be detected if present at a site, it is necessary to use caution when interpreting relative abundance or presence/absence data and extrapolating across sites.

To demonstrate how detectability varies with survey design and effort, we offer two examples from a similar area along the Santa Cruz River in the San Rafael Valley, Arizona. In 2000, Rosen et al. (2001) reported results from trapping and surveying efforts along the main-stem of the Santa Cruz River (~11 hrs dip-netting and general searching; 1 trapping array for 24 hr), Heron Spring (10 min general searching; 1 gartersnake fyke trap for 48 hr), and Sharp Spring (45 min general searching; 1 trapping array for 48 hr). Across six survey days, only five northern Mexican gartersnakes were observed and none trapped. The number of traps deployed within each array was not reported, thus it is not possible to quantify trap effort accurately. Based on their results, Rosen et al. (2001) concluded that the population was persisting and may not be declining rapidly, though there were no means of comparison from previous years. Conversely, AGFD staff implemented two intensive 8-day trapping sessions (~100 traps spaced 25 m [82 ft]

apart during each session) along a 2.7 mile (4.5 km) stretch of the Santa Cruz River extending north from the U.S./Mexico border within the San Rafael State Natural Area. During 15.4 days (1553.6 trap days), 52 northern Mexican gartersnakes were captured and individually marked. An additional three gartersnakes were observed but not captured. It might appear that this population increased in size based on raw numbers of captures in 2008 vs. those including the same area in 2000; however, the difference in capture numbers likely results from differences in survey design and trapping efforts. All but two of the snakes captured in 2008 were large adults, which suggests low recruitment rates within the population (M. Ingraldi, R. Mixan pers. comm.). Both studies indicate that northern Mexican gartersnakes persist along the upper Santa Cruz River in the San Rafael Valley, but it is not possible to evaluate the viability of the population without further study. As these two examples demonstrate, detectability varies with survey design and effort, thus it is necessary to use caution when interpreting relative abundance or presence/absence data and extrapolating across sites.

Criteria Developed:
We evaluate the potential for exposure of northern Mexican gartersnakes to stocked sport fish for each watershed in which the USFWS determined that populations are extant or of unknown status (USFWS 2008a). For those watersheds in which gartersnake populations existed historically but are currently believed extirpated, we determined that northern Mexican gartersnakes are unlikely to occupy the stocking complex and that there was no likelihood of exposure to stocked sport fish. The likelihood of exposure to stocked sport fish was not evaluated for watersheds that lie outside the known historical range of the species. As described above, similar gartersnake species are capable of long-distance movements exceeding several kilometers during their active seasons. While home range and movement data are lacking for northern Mexican gartersnakes, we assume they too are capable of such large movements both overland and along drainages. The frequency at which these movements occur is unclear but likely correlates with prey availability in a system, reproductive activity, postpartum dispersal, etc.

Throughout the discussion of gartersnakes, AGFD uses the term “less suitable,” which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not gartersnakes will or can occur in a particular area. The ability of gartersnakes to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to cover, prey, predators, etc.. While some sites might be capable of supporting large adult snakes, those same sites might not allow for successful recruitment. Stocking sites or stream reaches would be considered “less suitable” for gartersnakes when local conditions generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for gartersnakes because they exert predatory or competitive pressures on the snakes. However, gartersnakes might continue to persist in “less suitable” sites in the presence of nonnative species if those sites have greater habitat complexity and provide escape cover or feeding sites for

neonates or juvenile snakes. An example of this would be Mexican gartersnakes on the middle Verde River, where although we have few data on population status, snakes appear to persist in exceedingly complex riparian habitat in some areas (e.g., Dead Horse Ranch State Park) despite the presence of bullfrogs, crayfish and predatory fishes.

In addition, there are sites within the elevational range of gartersnakes where distributional data suggest gartersnakes do not occur, but other structural habitat features seem to be appropriate. Although lack of data does not necessarily equate with absence, if there are additional habitat characteristics (predators, lack of cover, etc.) that would preclude gartersnakes from occupying those sites or thriving, we also refer to those sites as "less suitable" which contributes to a conclusion that snakes probably do not occur there.

Stocking complex analysis:
Following methods similar to those described for Chiricahua and northern leopard frogs, we used ArcGIS to map and identify sport fish stocking complexes from which positive observations of northern Mexican gartersnakes exist and that lie within the historical range of the species (Rosen and Schwalbe 1988, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database). We then developed a similar buffered stocking complex approach by creating a minimum convex polygon (MCP) around all stocking sites within a stocking complex, and then buffering the MCP by 20 km (12.43 mi). This buffer was developed after evaluating the best available home range and movement data for similar gartersnake species and northern Mexican gartersnake observations described above, and it represents a conservative estimate of distances that northern Mexican gartersnakes might make along ephemeral or perennial drainages. Overland movements will likely be <20 km, however, over ecological time, gartersnakes within a population could move long distances in search of food or suitable habitat. Within some stocking complexes, stocking sites were widely separated from one another and were therefore considered separately, in which case a circular buffer with a 20 km (12.43 mi) radius was created around each stocking site (e.g., Santa Cruz stocking complex). Within each of these buffered stocking complexes, we evaluated the potential for northern Mexican gartersnakes to be exposed to stocked sport fish by considering the criteria described below and detailed in Table 21.

It is difficult to determine whether gartersnakes occupy a site/area because their detectability is low and recent systematic surveys have generally not been conducted in most areas.

Therefore, to make our determination, we built a case using positive observations reported from HDMS, the Arizona Game and Fish Riparian Herpetofauna Database, and the USFWS (2008a) 12-month finding to determine whether or not northern Mexican gartersnakes are likely to occupy each buffered stocking complex. Rosen and Schwalbe (1988) began the first large-scale surveys for gartersnakes in 1985, which contributed to our understanding of their recent

distributions in Arizona. Therefore, occupancy was described according to whether observations were made prior to or after 1985. Then based on the occupancy determinations, we evaluated whether there is a likelihood of exposure to stocked sport fish, as described below and detailed in Table 21. We did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

1. Occupancy—stocking complexes will be considered:

    a. Occupied—if there are positive gartersnake observations within the complex since 1985 (Rosen and Schwalbe 1988, Rosen and Schwalbe 2001, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database) or the USFWS determined that the species is likely extant (USFWS 2008a).

    b. May be occupied—if gartersnake records exists prior to 1985, but since then either surveys have been conducted and no snakes have been found, no systematic surveys have been conducted and habitat condition has diminished (e.g., bullfrogs or crayfish are present), or the USFWS has determined that its status is unknown.

    c. Unoccupied—if a single historical record exists (prior to 1985) but no observations have been made since, the USFWS (2008a) has determined that the species is likely extirpated, or the area lies outside the historical range of the species (Rosen and Schwalbe 1988, Rosen and Schwalbe 2001, Holycross et al. 2006, HDMS).

2. Likelihood of exposure:

    a. Exists—if there is a known population of northern Mexican gartersnakes occupying the complex or snakes are likely to move into the stocking complex because they persist nearby, then there is a likelihood that snakes could encounter stocked sport fish.

    b. Low—if the status of northern Mexican gartersnake populations is unknown in the complex, or the habitat is less suitable because there are other invasive species already present, such as bullfrogs and crayfish, then there is a low likelihood that snakes could encounter stocked sport fish.

    c. Does not exist—if northern Mexican gartersnakes are likely extirpated from a stocking complex or the area lies outside the historical range of the species, then it is unlikely that snakes will encounter stocked sport fish.

Table 8. Criteria for determining whether northern Mexican gartersnakes occupy a site/stocking complex and the likelihood of exposure to stocked sport fish.

Status	Available data/habitat condition	Likelihood of exposure
Occupied	Records >1985; USFWS (2008a) determined status as likely extant.	Exists (positive)—species known to occupy area.
May be occupied	Records exist <1985, but no systematic surveys have been conducted; or, surveys have been conducted but no snakes were observed; or, habitat condition is diminished (e.g., invasive bullfrogs or crayfish present); or, USFWS (2008a) determined status as unknown.	Low—species may occupy area or habitat suitability is low.
Unoccupied	Single historical record exists (<1985), but no observations since then; or, USFWS (2008a) determined status as likely extirpated; or, area lies outside historical range.	Does not exist (negative)—species is unlikely to occur.

Downstream analysis:
There is potential for northern Mexican gartersnakes to occur downstream of stocking sites, stocking stream reaches and outside buffered stocking complexes. Therefore, after carefully examining water connectivity and potential fish movement as described within each stocking complex chapter, we analyzed the likelihood that gartersnakes could be exposed to dispersing sport fish or that gartersnakes will move into the stocking complexes based on the occupancy criteria presented in Table 21, above.

Narrow-headed Gartersnake

Range wide discussion

Narrow-headed gartersnakes are one of the most aquatic gartersnake species, only leaving the water to bask, rest, or gestate (Rosen and Schwalbe 1988; Rossman et al. 1996). The species is confined to primarily large, perennial streams within montane and Great Basin conifer woodlands, chaparral, and upland desert scrub. Important microhabitats include the submerged rock-boulder complexes near riffles and pools, and thick backside vegetation used for basking and escaping from predators (Rosen and Schwalbe 1988, Degenhardt et al. 1996). Narrow-headed gartersnakes also appear to be strongly tied to boulders, rock piles, and other cover structures that lie within the floodplain of creeks (Nowak 2006).

The historical range wide distribution for narrow-headed gartersnakes includes permanent drainages of the Mogollon Rim and White Mountains of Arizona and New Mexico, and the Sierra Madre Occidental in Mexico. They are primarily found at elevations of 1200-1900 m (3937-6234 ft), but have been observed at elevations of 700-2430 m (2297-7972 ft) (Holycross et al. 2006). In Arizona, narrow-headed gartersnakes are found in headwater streams of the Gila River watershed.

Narrow-headed gartersnakes forage for prey along stream banks, in shallow riffles, and between boulders within the stream (Rossman et al. 1996, Pierce 2007). Small soft-rayed fishes make up their primary diet (Nowak and Santana-Bendix 2002), which includes suckers, rainbow trout, red shiner, speckled dace. They have also been reported to prey on larval and adult anurans and larval tiger salamanders (Degenhardt et al. 1996). Narrow-headed gartersnakes will, to a lesser extent, take spiny-rayed fish such as sunfish and catfish (Degenhardt et al. 1996, Pierce 2007). Nonnative spiny-rayed fishes are thought to be unsuitable prey because narrow-headed gartersnakes cannot safely ingest the fish without them becoming lodged in their throats or causing other physical damage to the digestive tract (Nowak and Santana-Bendix 2002).

Narrow-headed gartersnakes have experienced significant population declines throughout their range in Arizona and New Mexico (Holycross et al. 2006, Pierce 2007). Holycross et al. (2006) surveyed for gartersnakes during 2004 and 2005 and only found narrow-headed gartersnakes at 5 of 16 known historical Arizona localities. Based on those surveys, Holycross et al. (2006) concluded that the species was likely extirpated from 5 of the surveyed sites. Furthermore, narrow-headed gartersnakes have experienced significant declines at one of the largest known populations in Arizona in Oak Creek Canyon. As a result of recent (2002, 2004, and 2005) surveys, Nowak and Santana-Bendix (2002) and Nowak (2006) determined that narrow-headed gartersnakes may be extirpated from sites downstream of Oak Creek Canyon. Also, they suggested that while snakes in the upper reaches of the canyon appear to be persisting, there is a declining trend in numbers of snakes detected in the lower reaches of the canyon.

As with other gartersnake species in Arizona, multiple stressors are likely contributing to this species' decline (Nowak 2006). Nonnative predators such as fish, crayfish, and bullfrogs are believed to be the main cause of decline for the species throughout its range, however, other major threats include habitat destruction and degradation associated with aquatic recreation, urbanization, and overgrazing (Rosen and Schwalbe 1988, Rossman et al. 1996, Nowak and Santana-Bendix 2002).

Home Range Size:
All home range information for this species is based on one radio-telemetry study (n = 4 males, 5 females) at Oak Creek Canyon (Nowak 2006). Narrow-headed gartersnakes appear to have intermediate home range sizes compared to published home ranges for other gartersnake species,

with males, on average, having a larger home range than females. Home ranges of males at Oak Creek Canyon were up to 2.2 ha (5.44 acres) in size, while female home range was up to 1.1 ha (2.72 acres) in size. Home ranges, especially those of males, were very linear, as would be expected for a snake that does not venture far from stream habitats during their active season (March through October/November). During their active season, narrow-headed gartersnakes used upland areas up to 100 m (328 ft) from the creek, but were strongly associated with boulders within the floodplain. Hibernacula consisted of rock piles, hillsides with small rocks, boulders, and rock overhangs located 20-200 m (66-656 ft) from the creek. There are no data available describing long distance movements in narrow-headed gartersnakes. However, Harter's watersnake (*Nerodia harteri*) is a snake of similar size, habits and ecological characteristics, has been well studied in rivers in Texas, and provides an ecological analogue with which to predict movements in narrow-headed gartersnakes (Hibbits and Fitzgerald 2005). Harter's watersnakes also typically move relatively short distances during a season, e.g., approximately 150-460 m (493-1509 ft), but over several years, one male moved 19 km (11.8 mi) (Greene 1993, cited in Gibbons and Dorcas 2004, Whiting and Dixon 1997). Therefore, similar long-distance dispersal might be expected in narrow-headed gartersnakes. Although the downstream movement potential during high water events is unknown, narrow-headed gartersnakes are probably unlikely to make large overland movements, since the species is highly dependent on water for foraging.

Criteria Developed:
As described above, narrow-headed gartersnakes are riparian obligates and they forage almost exclusively on fishes. While home range and movement data are limited for narrow-headed gartersnakes, we assumed the frequency at which narrow-headed gartersnakes will make large overland movements is extremely low (i.e., rarely found >200 m [219 ft] from stream edge) and that they will travel linearly along narrow perennial riparian corridors. By examining the inter-connectivity of the perennial waterways and fish movements as described within the stocking complex chapters, we evaluated the potential for exposure of narrow-headed gartersnakes to stocked sport fish for each watershed in which there are positive records for the species. For those watersheds in which gartersnake populations existed historically but are currently believed extirpated or of unknown status (Holycross et al. 2006), we determined that narrow-headed gartersnakes are unlikely to occupy the stocking complex and that there was no likelihood of exposure to stocked sport fish. The likelihood of exposure to stocked sport fish was not evaluated for watersheds that lie outside the known historical range of the species or for which there is a single historical record prior to 1985 and no additional observations.

Throughout the discussion of gartersnakes, AGFD uses the term "less suitable," which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not gartersnakes will or can occur in a particular area. The ability of gartersnakes to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to cover, prey, predators, etc.. While some sites might be capable of supporting large

adult snakes, those same sites might not allow for successful recruitment. Stocking sites or stream reaches would be considered "less suitable" for gartersnakes when local conditions generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for gartersnakes because they exert predatory or competitive pressures on the snakes. However, gartersnakes might continue to persist in "less suitable" sites in the presence of nonnative species if those sites have greater habitat complexity and provide escape cover or feeding sites for neonates or juvenile snakes. An example of this would be Mexican gartersnakes on the middle Verde River, where although we have few data on population status, snakes appear to persist in exceedingly complex riparian habitat in some areas (e.g., Dead Horse Ranch State Park) despite the presence of bullfrogs, crayfish and predatory fishes.

In addition, there are sites within the elevational range of gartersnakes where distributional data suggest gartersnakes do not occur, but other structural habitat features seem to be appropriate. Although lack of data does not necessarily equate with absence, if there are additional habitat characteristics (predators, lack of cover, etc.) that would preclude gartersnakes from occupying those sites or thriving, we also refer to those sites as "less suitable" which contributes to a conclusion that snakes probably do not occur there.

Stocking complex analysis:
We used ArcGIS to map and identify sport fish stocking complexes for which positive observations of narrow-headed gartersnakes exist and that lie within the historical range of the species (Nowak and Santana-Bendix 2002, Nowak 2006, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database). Because narrow-headed gartersnakes are unlikely to make long distance overland movements, we did not analyze the potential for exposure to stocked sport fish at sites in which it would be necessary for gartersnakes to travel >0.25 mile (>0.4 km) overland to reach those sites. For stocking sites with aquatic connectivity, we took a conservative approach and assumed that narrow-headed gartersnakes can move upstream and downstream throughout the stocking complex, similar to fish movements. To analyze the likelihood of exposure to stocked sport fish, we first determined whether narrow-headed gartersnakes occupy the area according to the criteria listed below and described in Table 22, and then examined the degree of aquatic connectivity that would permit gartersnakes to move through the stocking complex. Similar to our analysis for northern Mexican gartersnakes, we did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

As discussed above for northern Mexican gartersnakes, it is difficult to determine whether gartersnakes occupy a site/area because their detectability is low and systematic surveys have generally not been conducted in most areas. Therefore, to make our determination, we built a

case using positive observations reported from HDMS, the Arizona Game and Fish Riparian Herpetofauna Database, and (Heritage) reports to AGFD to determine whether or not narrow-headed gartersnakes are likely to occupy each stocking complex. Rosen and Schwalbe (1988) began the first large-scale surveys for gartersnakes in 1985, which contributed to our understanding of their recent distributions in Arizona. Therefore, occupancy was described according to whether observations were made prior to or after 1985. Then, based on the occupancy determinations, we evaluated whether there is a likelihood of exposure to stocked sport fish, as described further below and detailed in Table 22. We did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

1. Occupancy—stocking complexes will be considered:

    a. Occupied—if there are positive gartersnake observations within the complex since 1985 (Rosen and Schwalbe 1988, Nowak and Santana-Bendix 2002, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database) and suitable habitat exists.

    b. May be occupied—if gartersnake records exist prior to 1985, but since then either surveys have been conducted and no snakes have been found or no systematic surveys have been conducted and habitat condition has diminished (e.g., bullfrogs or crayfish are present).

    c. Unoccupied—if a single historical record exists (prior to 1985) but no observations have been made since, habitat is unsuitable for the species (e.g., closed basin lakes), or the area lies outside the historical range of the species as identified by Holycross et al. (2006).

2. Likelihood of exposure—level of exposure:

    a. Exists—if there is a known population of narrow-headed gartersnakes occupying the complex or snakes are likely to move into the stocking complex because they persist nearby, then there is a likelihood that snakes could encounter stocked sport fish.

    b. Exists but is low—if the status of narrow-headed gartersnakes is unknown in the complex, the habitat is less suitable because there are other invasive species already present, such as bullfrogs and crayfish, or the species would need to make large overland movements in order to reach the stocking complex, then there is a low likelihood that snakes could encounter stocked sport fish.

c. Does not exist—if narrow-headed gartersnakes are unlikely to occupy the area because it is not suitable habitat or the complex lies outside the historical range of the species, then it is unlikely that snakes will encounter stocked sport fish.

Table 9. Criteria for determining whether narrow-headed gartersnakes occupy a site/stocking complex and the likelihood of exposure to stocked sport fish

Status	**Available data/habitat condition**	**Likelihood of exposure**
Occupied	Records >1985 ; and suitable habitat exists.	Exists (positive)—species known to occupy area.
May be occupied	Records exist <1985, but no systematic surveys have been conducted; or, surveys have been conducted but no snakes were observed; or, habitat condition is diminished (e.g., invasive bullfrogs or crayfish present).	Low—species may occupy area; or, habitat suitability is low; or, large overland movement necessary for species to reach stocking complex.
Unoccupied	Single historical record exists (<1985), but no observations since then; or, habitat is unsuitable for the species (e.g., lakes); or, area lies outside historical range .	Does not exist (negative)—species is unlikely to occur.

Downstream analysis:
There is potential for narrow-headed gartersnakes to occur downstream of stocking sites, stocking stream reaches and outside buffered stocking complexes. Therefore, after carefully examining water connectivity and potential fish movement as described within each stocking complex chapter, we analyzed the likelihood that gartersnakes will be exposed to dispersing sport fish or that gartersnakes will move into the stocking complexes based on the occupancy criteria presented in the table below.

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Chapter 3 ANALYSIS METHODS AND CRITERIA

INTRODUCTION TO METHODS

Locations proposed for stocking across the state were identified and arranged by major watershed. The watersheds were then divided into sub watersheds for further evaluation of hydrologic connections associated with the stocking sites and instream and/or downstream species.

STRUCTURE FOR ASSESSMENT

The goal of this assessment document is to review and evaluate potential impacts of proposed stocking activities for ten years on any listed, candidate, proposed species and/or critical habitats not addressed through previous assessment and/or consultation efforts. The document incorporates the required information as outlined in the Federal Aid Section 7 Biological Evaluation Form, guidance from the Federal Aid Toolkit and Section 7 Consultation Handbook. For each species, we provide background information, biology, life history, watershed by watershed distribution, direct and indirect effects of the proposed action and an assessment of other effects for those stocking sites where there may be impacts to the species. Further, we identify regulations and fish stocking procedures undertaken by AGFD designed to ensure responsible stocking practices thereby minimizing, reducing or eliminating disease transmission through stocking of fish and unauthorized transportation and release of stocked fish and associated bait (fish, waterdogs, and crayfish) (regulations were identified in Chapter 1). Interdependent, interrelated actions and/or cumulative effects (non-federal fish stocking or riparian projects) of the proposed stocking actions to listed, candidate, proposed species and/or critical habitat are broadly identified and defined within Chapter 4.

WATERSHED ANALYSIS OF HYDROLOGIC CONNECTIVITY

Information guiding this analysis included the descriptions of the watershed, subwatershed and each stocking site. The stocking sites included specific information as to the waterbody, recreational management of the area, existing conditions, management of the waterbody, proposed action and potential impact analysis. The potential impact analysis was extended to a complex level (grouping of sites where appropriate) depending on hydrologic connection and/or stream connections. Complete descriptions of all stocking sites, their history, connectivity and the local conditions are provided in the watershed chapters (Chapters 5-10).

SPECIES AND CRITICAL HABITAT EVALUATED

Primary sources of listed, candidate, proposed species and/or critical habitats distribution include AGFD's Heritage Data Management System (HDMS), the Nongame and Endangered Wildlife Program's Native Fish Database, AGFD Riparian Herpetofauna database, and Willow Flycatcher

Database. The HDMS is part of a global network including over 80 natural heritage programs and conservation data centers. The information comes from published and unpublished reports, data collected by cooperating agencies, museum and herbarium collections, the scientific and academic communities, Federal Register, and many other sources.

The list of species assessed and reviewed through this assessment process includes all listed or proposed species, proposed or designated critical habitat and candidate species associated with aquatic, wetland and/or riparian habitats where sport fish would be stocked or anglers would access in pursuit of stocked sport fish. Analyses of two additional species that are most likely to become listed in the next ten years were also included.

A spatial approach to the analysis was utilized to identify and map species and/or critical habitats in relation to the proposed stocking locations. The multi-step process to develop this spatial representation (maps) included: proximity of stocking locations to habitats occupied (or historical localities) by species and/or critical habitats. Data from numerous sources were incorporated into ArcGIS for use in spatial analysis and included the best information available to AGFD. The HDMS point data is based on representation of occupied areas of breeding populations with a 1-mile buffer around the point (species) for the protection of the exact location. The state was then broken into watershed units using the US Geological Survey Hydrologic Unit Codes (HUCs) at the HUC 6 level and then further divided into subwatersheds at the HUC 8 level.

Recreational angling impacts are limited to the water's edge or within a reasonable distance from a water source (travel to the water source). This area is referred to as the ***stocking area***. Where there is connectivity between stocking locations and waters supporting listed/proposed/candidate species and/or critical habitat, effects from the stocking location may extend further along those waterway connections. This area is referred to as the ***connected area.*** These areas of potential impact to listed/proposed/candidate species and/or critical habitat by the proposed activities or associated recreational activities are referred to as the ***action area***. A GIS product was developed as the framework for the analysis.

The analysis then proceeded species by species within each watershed. The primary analysis tool for the assessment was based on the working maps developed as described above with review from the AGFD Regional Fisheries and Nongame species leads. The review process included AGFD, WSFR and USFWS Ecological Services personnel.

General preliminary criteria questions were developed for taxonomic groups to establish links between the action and potential listed taxons. The first criteria established the geographic link and included connectivity, probability of movement and suitability of habitat (e.g. potential for stocked fish to survive in the habitat it moved to). The second criteria established the link biologically through interactions between stocked fish and listed, proposed or candidate species

(competition, predation, reproduction, disease, angler access) and impact to critical habitat, where appropriate.

According to USFWS [50 CFR 402.12(g)], it is the responsibility of WSFR to evaluate all potential impacts of funding sport fish stocking activities to all identified listed, candidate, proposed species and/or critical habitat. Species identified by the USFWS as candidates for listing are evaluated based on a standard of "likely or not likely to jeopardize" under provisions for conferences.

Listed, candidate, proposed species and/or their critical habitats are assessed in detail within this document. The review process includes review and assessment with regard to the general analysis criteria as listed above.

SPECIES INTERACTION APPROACH

In order to determine the nature of the exposure between stocked sport fish and listed species of concern, it was necessary to consider the biology of each species stocked and the nature of the response or interaction with each of the listed species. Consideration of this biological interaction resulted in the following descriptions, arranged by general taxonomic groupings for the listed species.

Fish Interactions Background Information

Apache Trout

Methods & Criteria

Impacts to Apache trout require a unique evaluation because the species is currently listed as threatened under the Endangered Species Act with a special (4(d)) rule that provides for angling of the species as long as the angling comports with the laws of the state of Arizona. The proposed action includes stocking Apache trout for the purpose of furthering the conservation of the species through supporting angling opportunity for the species.

Currently conservation and/or recovery of the species in Arizona include several management actions. These include designating and managing recovery populations which are primarily located above constructed or natural barriers. Another management strategy is to promote conservation of Apache trout by actively stocking Apache trout for the purpose of angling with anticipated harvest of the stocked individuals as provided by the ESA 4(d) special rule. In some cases other sport fish species are stocked with Apache trout, and/or stocked Apache trout may impact other listed species. As such, there is a need to evaluate potential impacts to the species given several scenarios. These include:

1. Impacts from sport fish species co-stocked with Apache trout in non-recovery areas for the intent of providing angling opportunity.

2. Impacts from stocked sport fish species to recovery Apache trout that escape from recovery areas above barriers.

3. Impacts from stocked sport fish species to recovery Apache trout if those stocked species move above a failed barrier or into recovery reaches

4. Impacts from Apache trout stocked into recovery Apache trout populations with the intent that the entire population be fishable by the public (this only occurs in 1 case).

5. Impacts from stocked Apache trout on other candidate or listed species and critical habitat.

6. Impacts on stocked Apache trout from wild fish populations present in the receiving waters.

The analysis approach was informed and developed in the following manner:

- Reviewing the down listing packages for Apache and Gila Trout, both of which have been down listed from Endangered to Threatened, are managed as sport fish in the State of Arizona, and have a 4(d) special rule.

- Identifying possible scenarios that could result in impacts to Apache trout.

- Reviewing the applicability of Section 6 of the Endangered Species act, the Apache trout 4(d) special rule and 10(a)(1)(a) permit.

- Developing an impact analysis for each of the scenarios identified above and applying them to applicable stocking reaches or complexes.

In evaluating impacts to Apache trout, two separate proposed actions are considered, first the action of stocking nonnative sport fish (rainbow trout, brook trout, arctic grayling, etc.), and second, the action of stocking native Apache trout into non-recovery streams or waters to provide angling opportunity. The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. The States have specific authority for management of endangered species, in part, manifested through State Section 6 Cooperative Agreements, which authorize management activities for threatened and endangered species. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD. Because stocking of Apache trout is for conservation purposes and consistent with the Act and the Cooperative agreement, take of Apache trout from the proposed stocking of Apache trout is legally permitted. The action of stocking all other nonnative sport fish and potential effects to Apache trout, impacts from

stocked Apache trout on other listed species, and any impacts to critical habitat are analyzed under Section 7 of the Act. Under the ESA, Apache trout hybrids are not protected as a threatened species (FWS Arizona Ecological Service Memo, September 2008) and impacts to hybrid Apache trout are therefore not evaluated.

Bird and Mammal Interaction Methods

Bald Eagle

The bald eagle was delisted during the development of this BA. An analysis of the bald eagle will be included in the Environmental Assessment.

Mexican Spotted Owl

Range wide Discussion:

The Mexican Spotted Owl (MSO) is one of three spotted owl subspecies widespread and occurring in a wide variety of habitats and occupying a broad geographic area but occurs inconsistently throughout its range in Arizona with distinct localities corresponding to pockets of appropriate habitat in mountains and canyons (USFWS 1995). The largest concentrations of MSOs in Arizona occur in the central and east-central forests along the Mogollon Rim, the White Mountains, and volcanic peaks near Flagstaff. The MSO is known from the Colorado Plateau in northern Arizona, areas along the Mogollon Rim, and from "sky island" mountains in the southeastern part of the state. The vegetative communities vary across the range of the owl from pinon juniper, mixed conifer forests to Madrean evergreen and woodland. At lower elevations, the owls are found in steep forested canyons with rocky cliffs. The characteristics of the habitat include high canopy closure, high stand density of multi layered uneven aged stands, numerous snags and downed woody matter in old growth mixed conifer forests. Nesting is more common in the mixed conifer community types, but nesting also occurs in the pine oak riparian and white fir community types. Owls may remain within their respective breeding area throughout the year, but some may migrate outside of the area opportunistically (USFWS 1995). Studies have suggested winter migrants move into the lower, warmer elevations into more open habitats (USFWS 1995).

Recovery units (RUs) were designated based on several factors (physiographic provinces, biotic regimes, perceived threats, administrative boundaries and know patterns of distribution). Arizona contains three of the four physiographic provinces which are identified RUs: Colorado Plateau, Upper Gila Mountains and the Basin and Range West.

Three levels of habitat management were established within the Recovery Plan: protected areas, restricted areas and other forest and woodland types. Protected areas receive the highest level of protection and other forest and woodland types as the lowest. Protected Activity Centers (PAC) protects all MSO sites known from 1989 through the life of the Recovery Plan. The identified activity area is defined as the nest site, a roost grove commonly used during the breeding season

in absence of a verified nest site, or the best roosting/nesting habitat if both nesting and roosting information are lacking. The delineation of an area no less than 600ac around the activity center using the boundaries of known habitat polygons and/or topographic boundaries, such as ridgelines were identified as appropriate. The boundaries of the PAC should enclose the best possible habitat configured as compact as possible with the nest or activity center located near the center to include as much roost/nest habitat as reasonable, supplemented by foraging habitat where appropriate (USFWS 1995). All PACs should be retained for the life of the Recovery Plan, regardless if the owls are not located within them in subsequent years.

The stocking locations identified with overlap for MSO for this consultation are located mostly on Forest Service managed lands. The PACs are incorporated with recommendations from the Recovery Plan in the South Western Region Forest Service Land Resource Management Plans (USFWS 2004) that provides a level of protection for these owls and their habitat. Further, Restricted Areas (defined as other areas of use, unoccupied areas) were additionally incorporated into the planning efforts by the Forest Service in order to maintain and develop potential nesting and roosting habitat now and into the future providing an additional level of protection.

Critical Habitat

Critical habitat for the owl was designated in 2004 (re-designation from 1995 and 2001) based on the recovery needs and guidelines identified in the Recovery Plan. The designation considered currently suitable habitat, large contiguous blocks of habitat, occupied habitat, range wide distribution, need for special management or protection, and adequacy of existing regulatory mechanisms when identifying the critical habitat units and primarily relied on the Recovery Plan and Primary Constituent Elements (PCEs) (USFWS 2004).

The PCEs are identified as those physical and biological features necessary to ensure the conservation and may require special management considerations or protection including those that support nesting, roosting and foraging. General requirements include space for individual and population growth and for normal behavior; food, water or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species (USFWS 2004). Included in the designation are both the protected and restricted habitat areas as defined within the Recovery Plan and areas containing the PCEs.

The majority of owl records are on federal and tribal lands; therefore, state and private lands were not considered essential to the conservation of the species and were not designated as critical habitat (USDI 2005).

Home Range Size:
Home range is defines as the area used by an animal during its normal activities (Burt 1943) and territory is defined as a defended area within an individual's home range (Nice 1941). The territories for MSO are smaller than the home ranges with the relationship not known and consistency to territories being high with most owls remaining on the same territory in subsequent years (USFWS 1995). There is considerable variability among the habitats and/or geographic areas monitored owls displayed (Ganey and Dick 1995). Home ranges sizes vary among areas studied, potentially dependent on cover types (Ganey and Balda 1989b). Estimated home range size comparisons are difficult due to the variability in sampling methods. Results for individuals and pairs varied (USFWS 1995):

- 2,282-3672 acres for individuals on three study areas in the Colorado Plateau RU (Wiley 1993)
- 645-2,601 acres for individuals on five study areas in the Upper Gila Mountains RU (Ganey and Balda 1989a, Ganey and Block, unpublished data, Peter Stacey, Univ. of Nevada, Reno, pers.com)
- 1,116-2,314 acres for individuals on two study areas in the Basin and Range East RU (Zwank et al. 1994, Ganey and Block, unpublished data)
- 941-3831 acres for pairs on five study areas in the Upper Gila Mountains RU (Ganey and Balda 1989a, Ganey and Block, unpublished data, Peter Stacey, Univ. of Nevada, Reno, pers.com)
- 1,415-3,461 acres for pairs on two study areas in the Basin and Range East RU (Zwank et al. 1994, Ganey and Block, unpublished data)

Identified Recreational (Angler) Related Impacts:
The stocking locations identified with overlap for MSO for this consultation are mostly located on Forest Service managed lands. Sport fish stocking sites covered by this consultation may be in proximity to Mexican spotted owl (MSO) habitats, and the presence of anglers drawn by the continued fishing opportunities may result in potential disturbances to MSO and/or their habitats. Sport fish stocking sites, or the stocking reach (which includes those areas where anglers may move up, down or around waterbodies and/or stream reaches) may be in or near MSO PACs or designated critical habitat. Sport fishing activities in general are close to the stocking waterbody or stream reach; though anglers may move throughout fishable areas of the waterbody or stream reach. In addition, recreational angling is part of the larger recreation presence, with developed campgrounds, roads, parking areas, or other amenities present contributing to potential disturbance of MSO.

Recreational activities, including angling, may impact MSOs directly by disturbing owls at nesting, roosting, or foraging sites. The magnitude of the impact is influenced by the location, intensity, frequency, or duration of the disturbance to the particular MSO (USFWS 1995) and/or habitat. Recreational activities in general can also have indirect impacts if habitat is altered by trampling of vegetation, soil compaction, or other physical degradation. Increased fire risk from inappropriate disposal of smoking materials or campfires is also a concern. If a particular recreational activity does not result in habitat alteration, the activity generally is considered to have a relatively low impact potential (USFWS 2004).

Critical habitat

Indirect impacts to habitat within designated critical habitat may include some of those identified above. In addition, indirect impacts to foraging as identified in the PCEs and related to the disturbance or altering of habitat associated with the maintenance of adequate prey species may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation.

The South Western Region of the Forest Service Land Resource Management Plans (LRMPs) associated Biological Opinion, issued by the FWS contains reasonable and prudent measures necessary and appropriate to minimize impacts of incidental take of MSO on FS lands that include the protection of the owl and its habitat and monitoring of occupancy. The terms and conditions further identify the designing of projects within the various programs including but not limited to recreation to minimize or eliminate adverse effects and reduce negative effects with the goal of implementing projects that will have beneficial, insignificant or discountable effects within occupied habitat. The incidental take amount was identified to be in the forms of harm or harass occurring through direct habitat alteration and disturbance to owls from roosting or nesting sites. Both forms would be of limited extent and intensity. Below are the forest programs in Arizona that addressed standards and guidelines in the LRMPs providing a level of protection specific to MSO (note-not all of the forests addressed these Programs specifically).

Apache-Sitgreaves

The Engineering Program seasonally or permanently closes access roads where owls are known to occur, reducing the amount of potential disturbance particularly in the breeding season.

Coconino

The Engineering Program identifies the relocation roads outside of riparian areas and obliterating unnecessary roads in riparian areas to reduce impacts to MSO. The Recreation Program identifies camping areas to be located outside of PACs. Further, specifically identifies increases in day use opportunities emphasizing nature based activities in the area of Oak Creek Canyon with some behavioral disturbance potentially anticipated as a result.

Coronado
Recreation program identifies disturbance from hikers, campers and bird watchers on the various districts and activities such as those not causing habitat alteration and generally a low potential for impacts to MSO.

Kaibab
The engineering program identifies the need to obliterate unneeded system roads in areas that would access owl PACs and reducing the disturbance from human presence.

Criteria
A total of 32 proposed sport fish stocking locations are in proximity to Mexican spotted owl (MSO) habitat. The presence of anglers drawn by the fishing opportunities provided by the stockings may result in two types of potential effects: noise/human presence that may result in disturbance of MSO and physical effects to habitat components that may result from anglers creating or using trails or paths to access the fishing opportunity. All the identified stocking sites have been stocked in the past and do not represent new areas of potential disturbance. To determine where such disturbance and/or habitat effects may occur, maps containing the stocking sites were overlain by maps showing where MSO habitat exists.

For management purposes, MSO habitat is categorized as protected or restricted (USFWS 1995), with designated critical habitat overlain on those categories. Protected habitats include the Protected Activity Areas (PACs) which contain known nesting and roosting habitats and are mapped in GIS layers. The PACs are an area of approximately 600 acres and are where activities during the breeding season are concentrated. All PACs are considered to be occupied by MSO. The PAC is not the home range of an MSO; home ranges are larger and contain additional areas used by MSO outside of the breeding season and, to some extent, during the breeding season.

Other protected habitat areas include steep canyons and reserved lands (e.g., wilderness, Research Natural Areas) that are outside of PACs. Restricted areas, as described in the Recovery Plan (USFWS 1995) are areas outside of PACs where additional guidelines should be implemented to maintain or develop potential nesting and roosting habitat now and into the future. Neither other protected areas nor restricted areas are included on GIS layers available for this analysis. However, most of these identified areas were included within the boundaries of designated critical habitat (CH), which is an available map layer and is used in determining exposure potential. However, the map layer does not provide guidance on whether or not a particular parcel of land within the boundaries actually contains the primary constituent elements (PCEs). In this analysis, we assume those are present unless a site is specifically examined.

For the purposes of this analysis, the CH boundaries are considered to include any other protected or restricted habitats that might be affected by anglers accessing fishing opportunities resulting from stocking. There is use by MSOs of forested areas outside of the PAC boundary

and outside of critical habitat; however, the intent of the PAC and restricted area management guidelines is to protect the most likely areas used by the MSO from significant effects from land management activities. While assuming that CH contains this entire habitat around the stocking site, there may be a small amount of habitat area not in CH that would be excluded from this analysis. The amount of such habitat is likely to be very minimal and not significant to the outcome of this analysis.

Critical Habitat

The critical habitat boundaries designated by the USFWS (2005) was also incorporated into a usable GIS layer for spatially analyzing the stocking locations within the designated areas. If a waterbody or stream reach was located within the boundary impacts were evaluated. Those waterbodies or stream reaches outside of the boundary were not analyzed further.

Based on existing data, limiting potentially disturbing activities to areas greater than 0.25 mile from MSO nest sites during the breeding season (March 1 through August 31) is beneficial to MSO. This corresponds well with the Delaney et al.'s (1999) 0.25 mile threshold for alert responses to helicopter flights. The additional 0.25 mi buffer provides a conservative approach in that it extends the potential use area to account for MSOs use along the edge of the PAC and nearby protected or restricted areas during the breeding season. The potential area for angler disturbance was also extended along the stream above or below the stocking site if fish could move from the site and angler access was available (called herein the fishing opportunity area). This extension was evaluated on a site-by-site basis. If the fishing opportunity area or identified access to it was within the 0.25 mile buffer area or the PAC itself, the potential for disturbance effects during the breeding season was deemed possible. If the fishing opportunity area or identified access to it was outside the 0.25 mi buffer or the PAC itself, disturbance effects during the breeding season were deemed unlikely. If the fishing opportunity area or identified access to it was inside CH or in a PAC or buffer area, habitat effects were deemed possible.

Anglers may access PACs, buffer areas or CH by moving through the area to reach a fishing opportunity area or the fishing opportunity area may be in the PAC, buffer, or CH unit. It must be noted that stocking sites are often in conjunction with other developed recreational sites that include developed campgrounds, roads, parking areas, or other amenities present that may affect MSO use of the area. Anglers are only one component of the recreational use of the PACs, buffers and CH surrounding stocking sites.

The critical habitat designation final rule also identifies actions not likely to destroy or adversely modify critical habitat to include most recreational activities, including hiking, camping, fishing, hunting, cross-country skiing, off-road vehicle use, and various activities associated with nature appreciation as not expecting restrictions to any of those identified activities as a result of the

ruling. In addition, within the 2005 BO for continued implementation of the LRMP for the 11 NF of the SW Region, program standard and guidelines incorporated additional protection for MSO.

New Mexico Meadow Jumping Mouse

Methods and Criteria
Sportfish stocking sites covered by this consultation may be in proximity to New Mexico meadow jumping mouse (MJM) habitats and the activities of anglers drawn by the fishing opportunities may result in impacts to resident MJM. To determine where such impacts may occur, information on location of stocking sites and occupied/potentially occupied MJM habitats was compared to determine areas of potential impact (Table 14).

Table 1. Stocking sites with potential New Mexico meadow jumping mouse exposure for impacts related to sport fish stocking

Stocking site	Season of use for stocked species	Stocking site at or near habitat	Human activities likely during breeding season
Little Colorado River sites			
West Fork/East Fork Little Colorado River at Greer	Summer	On site	Yes
West Fork Little Colorado River at Sheep's Crossing	Summer	On site	Yes
Lee Valley Lake	Summer	Off site	No
Black River sites			
West Fork Black River	Summer	On site	Yes
East Fork Black River	Summer	Off site	No

Southwest Willow Flycatcher
Methodology and Criteria for Evaluating Sport Fish Stocking and Potential Effect this may have on Southwestern Willow Flycatchers

General Information

The southwestern willow flycatcher is a small grayish-green passerine (Family Tyrannidae) measuring approximately 5.75 inches. The song is a sneezy "fitz-bew" or a "fit-a-bew", the call is a repeated "whitt". It is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in dense riparian habitats in the southwestern U.S. (from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado) and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Ridgely and Tudor 1994, Howell and Webb 1995). The historical breeding range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

The primary constituent elements of critical habitat are based on riparian plant species, structure and quality of habitat and insects for prey. A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (USFWS 2005). The primary constituent elements are:

1. Riparian habitat in a dynamic successional riverine environment (for nesting, foraging, migration, dispersal, and shelter) that comprises:

    a. Trees and shrubs that include, but are not limited to, willow species, box elder, tamarisk, Russian olive, cottonwood, stinging nettle, alder, ash, poison hemlock, blackberry, oak, rose, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut;

    b. Dense riparian vegetation with thickets of trees and shrubs ranging in height from 2 to 30 meters (m) (6 to 98 feet (ft.). Lower-stature thickets (2 to 4 meters or 6 to 13 feet tall) are found at higher elevation riparian forests, and tall-stature thickets are found at middle- and lower-elevation riparian forests;

    c. Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub level, or as a low, dense tree canopy;

    d. Sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (*i.e.*, a tree or shrub canopy with densities ranging from 50 percent to 100 percent); or

e. Dense patches of riparian forests that are interspersed with small openings of open water or marsh, or shorter/sparser vegetation that creates a mosaic that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac).

2. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, including: flying ants, wasps, and bees; dragonflies; flies; true bugs; beetles; butterflies/moths and caterpillars; and spittlebugs.

A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (USFWS 2005).

Abundance and distribution in Arizona

In Arizona, southwestern willow flycatchers breed at the lowest elevations along the lower Colorado River to the high elevation White Mountains of central-eastern Arizona. The peak nesting period for southwestern willow flycatchers in Arizona is from approximately 15 May through 31 July, with limited nesting activity occasionally noted before and after these dates. Flycatchers nest very locally along most of the major perennial rivers below 4000 ft (1219 m) elevation such as the Colorado, Big Sandy, Bill Williams, Gila, Santa Maria, Salt, San Pedro and Verde rivers (McCarthy 2005). They also nest locally from 7900 to 8300 ft (2408-2539 m) elevation along the upper Little Colorado and San Francisco rivers. Within Arizona, nesting at mid-elevations between 4000 and 7000 ft (1219-2134 m) has yet to be recorded, and would expected to be infrequent due to the lack of preferred nesting habitat (flat broad floodplains and expansive riparian habitat).

Likely due to a more concerted survey and monitoring effort, the number of known southwestern willow flycatcher territories has significantly increased in Arizona (145 to 459 territories from 1996 to 2007) (English *et al.* 2006, Durst *et al.* 2008), but the overall distribution of flycatchers throughout the state has not changed much over this time frame. Currently, population stability in Arizona is believed to be largely dependent on the presence of two large populations (Roosevelt Lake and San Pedro/Gila River confluence).

Willow flycatchers are also statewide migrants in Arizona. They begin to arrive in late April, with peak migration in May and early June, with north-bound stragglers still regularly passing through the state into mid-June (McCarthey 2005). Like many passerine neotropical migrants, when available these flycatchers often occur in riparian areas during migration. However, in contrast to the more habitat specific requirements for nesting, habitat use and quality during migration is more varied and broad. Willow flycatchers are regularly encountered in all habitats with scattered trees including desert washes and shaded urban parks and residential backyards. Migrant flycatchers are often found in isolated small stands of trees or foraging along edges of

more extensive woodlands. However, they are seldom encountered in heavily forested habitats, particularly higher elevations conifer forests, or those open habitats lacking trees or tall shrubs. Depending on weather and several other factors such as the amount of available food, cover and water, stopover sites are typically utilize by individual passerine migrants for one to three days before moving on (Carlisle et al. 2009). Willow flycatchers are likely to use a similar variety of habitats in Arizona during fall migration which begins in late July and August, peaking in early September with stragglers through mid-October (McCarthey 2005).

Nesting habitat

Historical egg/nest collections and species' descriptions throughout its range describe the southwestern willow flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, San Diego Natural History Museum 1995). Currently, southwestern willow flycatchers primarily use Geyer willow (*Salix geyeriana*), coyote willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), boxelder (*Acer negundo*), live oak (*Quercus agrifolia*) and such widespread exotic species as tamarisk (*Tamarix* sp.) and Russian olive (*Elaeagnus angustifolio*) for nesting. High elevation willow species and nesting habitat is shorter in stature and typically cannot grow as quickly as habitat at lower elevations due to shorter growing seasons and colder winters (USFWS 2002). In Arizona, high elevation thickets used for nesting include Geyer (*Salix geyeriana*) and Bebb (*Salix bebbiana*) willows. Other plant species less commonly used for nesting include: buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.* 1997).

Tamarisk is now an important component of the flycatcher's nesting and foraging habitat in much of Arizona and other parts of the bird's range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in a tamarisk tree (Smith *et al.* 2002). Tamarisk had been believed by some to be a habitat type of lesser quality for the southwestern willow flycatcher, however comparisons of reproductive performance (USFWS 2002), prey populations (Durst 2004) and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference (Sogge *et al.* 2005).

The flycatcher's habitat is dynamic due to it being subjected to river flooding and therefore its quality and location can change rapidly: nesting habitat can grow out of suitability; tamarisk habitat can develop from seeds to suitability within five years; heavy runoff can remove/reduce habitat suitability in a day; or river channels, floodplain width, location, and vegetation density may change over time. The flycatcher's use of habitat in different successional stages may also

be dynamic. For example, over-mature or young habitat not suitable for nest placement can be occupied and used for foraging and shelter by migrating, breeding, dispersing, or non-territorial southwestern willow flycatchers (McLeod *et al.* 2005, Cardinal and Paxton 2005).

Specific habitat used for nest placement is denser, typically more interior with the height of nests primarily in the mid to lower portions of trees. At lower elevation in Arizona (below 4000 ft), willow flycatcher nest heights averages approximately 15 ft (4.6 m) and range from 4.8 to 38.7 ft (1.5-11.8 m), but nests are found lower in the trees 3-10 ft (1-3 m) in the shorter-statured, higher elevation habitat (above 7500 ft) sites (McCarthey 2005).

Occurrence in the action area

In order to determine where suitable flycatcher nesting habitat may be found within the action area, a collection of sources were examined. Information sources used for evaluation included HDMS data (occurrences), FWS designated critical habitat polygons, range wide WIFL database of nesting flycatcher territories and the WIFL Recovery Plan's Table 10 description of important streams, as well professional opinion of the FWS and AGFD where known territories and habitat were found. We then selected segments of streams that can support nesting habitat (instead of patches of habitat), understanding that flycatcher nesting habitat is dynamic and can shift location over time due to floods, drought, fire, and land uses (river diversion, agriculture return flow, etc.).

After placing these information sources together and compared to the proposed stocking locations, suitable southwestern willow flycatcher nesting habitat was determined to occur in two general areas (Verde River and the White Mountains). Along the middle Verde River, flycatcher nesting habitat can be found throughout the Verde Valley (i.e. towns of Clarkdale, Cottonwoood, and Camp Verde). Land ownership throughout this stretch of river is primarily privately owned, however some state (Dead Horse State Park), tribal (Yavapai and Apache) and Forest Service (Prescott NF) land exists. At higher elevation in the White Mountains, nesting flycatcher habitat can be found within the action area along the upper Little Colorado River (and a portion of its forks) downstream to the Town of Greer area (Map x). These areas primarily occur within the Apache Sitgreaves National Forest, although private land parcels are also included.

Consistent breeding areas were identified through HDMS data and analyzed site by site by species experts for evaluation. Documented occurrence sites were only included if they were designated as a territory (singing or paired birds after 15 June) or if nesting activities were actually observed. Southwestern willow flycatchers have been documented nesting at four sites in the Verde Valley between Clarkdale and Camp Verde and three sites in the upper Little Colorado River drainage downstream to Eager.

Because migrant willow flycatchers can occur statewide and are most frequently found along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where willow flycatchers

could not occur. Additionally, the habitat requirements for migrant flycatchers are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance. In fact as noted before migrating passerines typically remain at one location for only one to three days before continuing their journey to breeding or wintering grounds (Carlisle et al. 2009).

Flycatcher nesting habitat can quickly change and vary in suitability, location, use, and occupancy over time (Finch and Stoleson 2000). As a result, it is important to reiterate how this may influence the location of southwestern willow flycatchers with respect to the proposed action. The preferred nesting and migration habitat of southwestern willow flycatchers shifts over time in location and quality which subsequently influences the locations and densities of flycatchers. Flooding, drought, fire, lake levels, etc. can help to accelerate the recycling, growth, and/or shift in location and abundance of riparian vegetation. As a result, past or current nesting flycatcher locations may not be the same exact locations used by flycatchers in the future. Evaluating nesting flycatchers across river segments that can support suitable nesting habitat helps to ensure that future unknown locations are considered in this analysis.

Critical habitat occurrence in the action area

Designated southwestern willow flycatcher critical habitat maps were compared to stocking locations to identify which river stretches of critical habitat are within the action area. Similar to areas where suitable nesting habitat occurs, critical habitat occurs within the action area along the Verde River in the middle Verde Valley and in the White Mountains along the Little Colorado River drainage downstream to the Town of Greer. However, because of specific methodology used to designate critical habitat, it does not mirror all the locations where suitable nesting habitat is found or where all territories have been located. Therefore, critical habitat is a smaller area to evaluate.

Potential effects

Angler activity/behavior along rivers

Riparian areas receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than those farther away from development (Turner 1983). The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations. Impacts can be more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country.

Anglers for stocked trout are a subset of the variety of activities and management actions that may affect riparian areas and flycatcher habitat. For example, those activities include, but are not limited to water management actions (i.e. water diversion, groundwater pumping, etc.), livestock grazing, housing, woodcutting, vehicle use, road development, hiking, camping, shooting, day-

use, horseback riding, etc. (Willard and Marr 1970, Manning 1979, Briggs 1996, Cole and Spildie 1998).

Recreational impacts flycatcher habitat

Riparian habitat impacts from recreation, as described in the Southwest Willow Flycatcher Recovery Plan (USFWS 2002) include: loss of surface soil horizons, soil compaction, altered soil moisture and temperature, altered soil microbiota, habitat fragmentation, reduced dead woody debris, altered plant species composition, altered foliage height diversity, reduced plant diversity/cover, lack of plant regeneration, erosion, increased sedimentation/turbidity of water, altered organic matter content of water, altered water chemistry, altered flow regimes, pollution, increased risk of accidental fire, increased trash, increased human waste and diseases, increased feral domestic animals and pet dogs, increased native predators, displacement of wildlife by facilities, unauthorized roads and trails, human presence and noise disturbance. The potential for the recreational activity to produce negative impacts is highly dependent on the frequency, intensity, location and type of use the area receives. Infrequent but unpredictable recreational actions without patterns can cause more negative impacts per event than those predictable and frequent.

Impacts to streams and stream side habitat have been attributed specifically due to angling. Some of these impacts include: water turbidity, erosion of banks, pollution, over water movement disturbance and reduced stability of habitats (USFWS 2002). Changes in the structure, density and composition of vegetation can occur from recreation induced soil compaction and erosion. Locally, day-use recreation such as angling could reduce or fragment regenerating or growing riparian habitat due to trampling and soil compaction (USFWS 2002). Fragmentation of habitat due to the development of trails can cause habitat to not be suitable for birds requiring dense contiguous vegetation. Where vegetation is sparse, even light use can prevent further development of dense lower strata which are important to flycatchers (USFWS 2002). During spring and summer, cottonwood and willow seedlings often establish on open, unvegetated sand or gravel bars and shorelines which are attractive to anglers as they provide unobstructed locations for casting.

As the number of recreation users increases, so does the probability of an accidental fire (USFWS 2002). Fire within the riparian areas have become more frequent due to the combination of increased drying of riparian areas, increased distribution and growth of flammable exotic plants adapted to these drier conditions, and an increased distribution and abundance of ignition sources (largely man-caused). Fire can devastate southwestern willow flycatcher nesting habitat.

Flycatcher behavior toward human activity/recreation

The types of possible direct recreation impacts to animals, also described in the Flycatcher Recovery Plan (USFWS 2002) include direct/indirect mortality, low productivity, reduced habitat use, and reduced use of preferred habitat and aberrant behavior/stress resulting in reduced reproductive or survival rates (USFWS 2002).

The flycatcher itself does not appear to be overly sensitive to low level human activity occurring outside of the immediate breeding patch (USFWS 2002). Like the majority of nesting passerines, flycatchers will alter their behavior due to human activity when nesting, but will typically resume normal behavior once the presumed danger has passed. Similarly, migrant and foraging flycatchers will fly a reasonably safe distance to adjacent perches if approached too closely by humans.

Human activity that occurs within breeding patches in close proximity to flycatcher nests has the potential to lead to failure or reduced productivity. Spending long durations of time near nests can cause adults to abandon nesting attempts or prevent adults from returning to nests, causing mortality of eggs/nestlings. Frequently walking to and from and/or through nest areas can attract predators or nest parasites to a flycatcher nest. Bushwacking through dense vegetation can cause the failure of precariously placed nests or nests built low to the ground by knocking the nest and/or its contents to the ground.

Fishing line and flycatcher nests

Female flycatchers construct a small cup nest constructed of leave, grass, plant fibers, feathers and animal hair; coarser material is use for the nest base and body with finer material in cup lining (Bent 1963). The use of discarded fishing line for nest construction and subsequent impacts to nestlings has not been documented, even at locations such as Roosevelt Lake where angling activity is extremely high (Pringle 2004).

Western Yellow-Billed Cuckoo

Methods and Criteria

In order to determine where suitable yellow-billed cuckoo (cuckoo) nesting and foraging habitat may be found within the action area, several sources were examined. Information sources used for evaluation included HDMS data (occurrences) and professional opinion of the FWS and AGFD where appropriate habitat is found. We then selected segments of streams or lake shorelines that can support nesting habitat (instead of patches of habitat), understanding that cuckoo nesting habitat is dynamic and can shift location over time due to floods, drought, fire, and land uses (river diversion, agriculture return flow, etc.).

After placing these information sources together and comparing to the proposed stocking locations, suitable yellow-billed cuckoo nesting or foraging habitat was determined to occur at or adjacent to nine stocking sites (Table 15). Consistent breeding areas were identified through

HDMS data and analyzed site by site by species experts for evaluation. Documented occurrence sites were only included if they were designated as a territory (calling or paired birds between 15 June and 31 August) or if nesting activities were actually observed.

Table 2. Stocking sites with potential yellow-billed cuckoo exposure for habitat or disturbance effects.

Stocking Site	**Stocking Season**	**Breeding/Foraging Habitat**	**Effect**
Lower Salt River	Winter/spring	Y	Habitat
Patagonia Lake	All seasons	Y	Disturbance, Habitat
Watson Lake	All seasons	Y	Disturbance, Habitat
Willow Lake	All seasons	Y	Disturbance, Habitat
Middle Verde River	Winter/spring	Y	Habitat
Deadhorse SP	All seasons	Y	Disturbance, Habitat
Oak Creek	Spring through fall	Y	Disturbance, Habitat
West Clear Creek	Spring/fall	Y	Habitat
Wet Beaver Creek	Spring/fall	Y	Habitat

Because migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance. The potential effects of disturbance to cuckoos during migration are discussed separately from disturbance during the breeding season.

Cuckoo nesting habitat can quickly change and vary in suitability, location, use, and occupancy over time. As a result, it is important to reiterate how this may influence the location of cuckoos with respect to the proposed action. The preferred nesting habitat of cuckoo shifts over time in location and quality which subsequently influences the locations and densities of cuckoos. Flooding, drought, fire, lake levels, etc. can help to accelerate the recycling, growth, and/or shift in location and abundance of riparian vegetation. As a result, past or current nesting cuckoo locations may not be the same exact locations used by cuckoos in the future. Evaluating nesting cuckoos across river segments and lake/pond shorelines that can support suitable nesting habitat helps to ensure that future unknown locations are considered in this analysis.

Habitat Impacts

Riparian areas receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than

those farther away from development (Turner 1983). The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations. Impacts can be more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country.

Anglers are a subset of the recreation component of activities and management actions that may impact riparian areas and cuckoo habitat. For example, those activities include, but are not limited to water management actions (i.e. water diversion, groundwater pumping, etc.), livestock grazing, housing, woodcutting, vehicle use, road development, hiking, camping, shooting, day-use, horseback riding, etc. (Willard and Marr 1970, Manning 1979, Briggs 1996, Cole and Spildie 1998).

Riparian habitats impacts from recreation, include: loss of surface soil horizons, soil compaction, altered soil moisture and temperature, altered soil microbiota, habitat fragmentation, reduced dead woody debris, altered plant species composition, altered foliage height diversity, reduced plant diversity/cover, lack of plant regeneration, erosion, increased sedimentation/turbidity of water, altered organic matter content of water, altered water chemistry, altered flow regimes, pollution, increased risk of accidental fire, increased trash, increased human waste and diseases, increased feral domestic animals and pet dogs, increased native predators, displacement of wildlife by facilities, and unauthorized roads and trails (USFWS 2002). The potential for the recreational activity to produce negative impacts is highly dependent on the frequency, intensity, location and type of use the area receives. Infrequent but unpredictable recreational actions without patterns can cause more negative impacts per event than those predictable and frequent.

Impacts to streams and stream side habitat have been attributed specifically due to angling. Some of these impacts include: water turbidity, erosion of banks, pollution, over water movement disturbance and reduced stability of habitats (USFWS 2002). Changes in the structure, density and composition of vegetation can occur from recreation induced soil compaction and erosion. Locally, day-use recreation such as angling could reduce or fragment regenerating or growing riparian habitat due to trampling and soil compaction (USFWS 2002). Fragmentation of habitat due to the development of trails can cause habitat to not be suitable for birds requiring dense contiguous vegetation. Where vegetation is sparse, even light use can prevent further development of dense lower strata which are important to flycatchers and cuckoos (USFWS 2002). During spring and summer, cottonwood and willow seedlings often establish on open, unvegetated sand or gravel bars and shorelines which are attractive to anglers as they provide unobstructed locations for casting. These stocking actions are an ongoing action that has a long history of occurring in these areas. As a result, we anticipate that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, we do not anticipate anglers once they reach

their destination to be fishing in tight areas where vegetation is dense that causes casting to be difficult.

As the number of recreation users increases, so does the probability of an accidental fire (USFWS 2002). Fire within the riparian areas have become more frequent due to the combination of increased drying of riparian areas, increased distribution and growth of flammable exotic plants adapted to these drier conditions, and an increased distribution and abundance of ignition sources (largely man-caused). Fire can devastate cuckoo nesting habitat.

Cuckoo nesting habitat contains dense riparian vegetation in the under- and mid-story levels that make it difficult to create trails and paths through the area. Human traffic can affect tree regeneration in the understory (Corman and Magill 2000, Holmes et al. 2008) and creation of trails can increase potential predator access to the habitat (Corman and Magill 2000). Overuse of riparian areas by livestock, water management actions, vegetation clearing, and woodcutting are more likely to result in fragmented habitats with degraded under- and mid-story conditions that affect nesting habitat quality for the cuckoos than is human traffic. Areas with heavy human traffic may already be impacted by other actions that contributed to the decline of habitat quality that also allows for easier access by humans. In areas without existing trails or paths, the density of cuckoo habitat tends to deter human entrance (Laymon 1998).

As noted earlier, the structural components of cuckoo migration habitat are much broader than for nesting habitat and many riparian areas not suitable for nesting may be used during migration. While the activities described above contribute to degradation of migration habitat, the greater extent of usable migration habitat, that reduction in habitat quality has less impact on cuckoo use of the habitat.

Disturbance Impacts

Human-related disturbance during the migration period (either spring or fall) is likely to have a very limited impacts on cuckoos since individuals are highly mobile, do not remain long in one area, and suitable migration habitat is more available than nesting habitat. This reduces the opportunity for exposure, and avoidance of areas of high human use is more feasible. Information from surveys and observations indicate that migrant and foraging cuckoos will fly a reasonably safe distance to adjacent perches if approached too closely by humans.

The information on the degree to which human presence in cuckoo nesting habitat can impact behavior of the adults and thus the success of the nesting attempt is not entirely consistent. Wiggins (2005) noted that any capture of adult birds for banding should not be done at the nest since the danger of abandonment of the nest is high. Similarly, he cautioned against banding the young birds while they are in the nest for the same reason. Latta et al. (1999) reported that cuckoos will abandon nests if disturbed repeatedly and suggested avoidance of intense and repeated human disturbance in nesting areas between May 20 and September 1. Halterman

(2010) indicated that a steady human presence during nest building or normal, regular human activity in the vicinity the effect to cuckoos is low, but more intensive use could result in nest failure. One report from Texas (Luneau 2002) documented nest abandonment during incubation by cuckoos after less than three minutes observation at a distance of 35 feet from the nest. Cuckoos are not likely to abandon the nest once the first egg hatches and foraging birds are largely oblivious to human presence (Laymon 1998). The cuckoo survey protocol notes that adults do not go to their nest if under observation, and that nest abandonment is a concern particularly during the nest building stage.

The types of possible direct recreation impacts to animals include direct/indirect mortality, low productivity, reduced habitat use, and reduced use of preferred habitat and aberrant behavior/stress resulting in reduced reproductive or survival rates (USFWS 2002).

Although reclusive at times, cuckoos do not appear to be overly sensitive to low level human activity occurring outside of the immediate breeding area. Like most nesting birds, cuckoos will alter their behavior due to human activity when nesting, but will typically resume normal behavior once the presumed danger has passed. Human activity that occurs within breeding patches in close proximity to cuckoo nests has the potential to lead to failure or reduced productivity. Spending long durations of time near nests can cause adults to abandon nesting attempts or prevent adults from returning to nests, causing mortality of eggs/nestlings. Frequently walking to and from and/or through nest areas can attract predators to a cuckoo nest.

Yuma Clapper Rail

Methods and Criteria

Sportfish stocking sites covered by this consultation may be in proximity to Yuma clapper rail (YCR) habitats and the activities of anglers drawn by the fishing opportunities may result in impacts to resident YCR. To determine where such impacts may occur, information on location of stocking sites and occupied/potentially occupied YCR habitats was compared to determine areas of potential impact, including if the habitat was at the site or along an adjacent waterway (Table 16). The potential for impacts at stocking sites vary with the species stocked and if stocking would occur during the breeding season.

Table 3. Stocking sites with potential yellow billed cuckoo exposure for impacts related to sport fish stocking

Stocking site	Season of use for stocked species	Location of habitat relative to stocking site	Human activities possible during breeding season	Potential for effects

Lower Colorado River sites				
La Paz County Park	Seasonal (fishing derbies only)	No habitat at site; habitat on Colorado River is not adjacent to site.	No	No
Hidden Shores Golf Course	Seasonal (fishing derbies only)	No habitat at site; habitat on Colorado River is not adjacent to site.	No	No
Yuma West Wetlands Pond	Seasonal (fishing derbies only)	No habitat at site; habitat on Colorado River is not adjacent to site.	No	No
Lower Gila River sites				
Fortuna Pond	Year round	Minimal cattail at site, adjacent portions of Gila River contain marsh habitat	Yes	Yes
Redondo Lake	Year round	Minimal cattail at site, adjacent portions of Gila River contain marsh habitat	Yes	Yes
Wellton Golf Course Pond	Seasonal (fishing derbies only)	No habitat at site; habitat on Gila River is several miles away	No	No
Salt River sites				
Apache Lake	Year round	No cattail areas on lake	No	No
Canyon Lake	Year round	No cattail areas on lake	No	No
Saguaro Lake	Year round	On site	Yes	Yes

Lower Salt River	Winter/spring	On site	Yes	Yes
Tempe Town Lake	Winter/spring	No cattail areas on lake. Habitat above lake on Salt River	No	No

Riparian Reptiles and Amphibians Methodology

***Batrachochytrium dendrobatidis* and the spread of Amphibian Chytridiomycosis**

The following review and information were prepared to provide an understanding of basic biology, transport mechanisms and impacts to amphibians in Arizona of the amphibian fungal pathogen, *Batrachochytrium dendrobatidis* (sometimes referred to as "chytrid" and hereafter as "*Bd*"), and to use that information to evaluate current hatchery operations and the likelihood of spread of Bd through fish stocking. This is not meant to be an exhaustive review of the global literature on Bd or chytridiomycosis, instead this will concentrate on those aspects of the biology of the organism that are relevant to its survival and distribution in Arizona, and how those might affect the (AGFD) hatchery operations related to the statewide sport fish stocking program.

Introduction and Basic Biology of Bd

Fungi in the primitive group Chytridiomycota are characterized by uniflagellated reproductive cells, and typically occur in water or moist soils, where they are parasites of protists, other fungi, algae, plants, insects and other invertebrates, as well as biodegraders of plant and animal remains containing cellulose, chitin or keratin (Powell 1993). Only one species, *Bd*, is known to infect vertebrates, and prior to 1998 it was unknown to science (Berger *et al.*1998, Longcore et al. 1999). *Bd* causes the serious and sometimes virulent amphibian disease chytridiomycosis (Berger *et al.*1998, Longcore et al. 1999, Stuart *et al.* 2004). In the last decade, the role of infectious diseases has been recognized as a key factor in amphibian declines throughout the world, and chytridiomycosis has been linked to much of that decline (Daszak *et al.* 1999, Carey 2000, Collins and Storfer 2003, Daszak et al. 2003; Skerratt et al 2007). Recent studies support the contention that Bd is an emerging infectious disease, i.e., a novel pathogen (Vredenburg et al. 2010), and not a widespread endemic that has emerged as a result of environmental change (e.g., Pounds et al. 2006).

Although many other chytrid species have been well studied as parasites of economically important plants (Powell 1993), surprisingly few studies have investigated the basic biology or ecology of Bd, although significant advances continue to be made (e.g., Woodhams et al. 2008, Voyles et al. 2009, Briggs et al. 2010, Vredenburg et al. 2010).

Bd has a complex life cycle in which "infective," free-living motile zoospores encounter, and encyst on the keratinized epidermis of amphibians and then develop into reproductive sporangia

(zoosporangia) which produce more zoospores through asexual reproduction. The zoospores are then released back into the water through a discharge tube and the cycle continues; no resting spores have been identified in laboratory studies (Longcore et al. 1999). Amphibians (frogs and salamanders) are the only known hosts for Bd; Bd has not been reported in caecilians (Gower and Wilkinson 2005).

There are few data regarding the ability of Bd to occupy alternative hosts (i.e., other than amphibians). Although Bd had been reported from freshwater shrimp in Australia (Rowley and Alford 2006), subsequent work by the same research group falsified their original findings (Rowley et al. 2007). Collins et al. (2005) used PCR to test for the presence of Bd on a variety of plants and animals collected from sites from which Bd was already known. They reported a Bd positive result from a batch sample of 6 wild caught fathead minnows (*Pimephales promelas*) from Sycamore Creek, Maricopa County, AZ. Whether one or more of those fish was infected with Bd, or simply had zoosporangia or zoospores (or their remains) on the surface of their fins is not known. They also exposed several potential host animals to large quantities of Bd zoospores in a series of experiments. Results suggested that backswimmers (Notonectidae, *Notonecta* sp.), dragonfly naiads (Odonata, including individuals in families Aeshnidae and Libellulidae) and crayfish (*Orconectes virilis*) were capable of carrying Bd for several days. Sample sizes in all cases were small and experimental procedures varied considerably (including different species of odonates). Although the authors used terms like "infected" to describe the results, the results were only Bd positive, suggesting that at a minimum zoospores or zoosporangia persisted on an organisms' surface rather than a host – pathogen relationship. However, the results are suggestive and demonstrate the need for additional rigorous testing.

For the purposes of discussion, unless otherwise defined below, experiments examining basic biological characteristics of Bd use two terms to describe aspects of the life cycle (taken from Johnson and Speare 2003 and Johnson and Speare 2005): 1) "**Viability**" -- in which flagellated zoospores move freely in the medium (water, growth medium, etc.), *or* zoospores move within zoosporangia, *or* growth occurs when aliquots from water with seemingly inactive Bd are subsequently injected into growth media/broth; and 2) "**Growth**" -- in which zoospores attach to a substrate (sometimes termed "encyst") and then develop in zoosporangia, *or* zoosporangia change size and form, *or* zoosporangia release new zoospores into the medium. Work reported by Longcore et al. (1999) and Piotrowski et al. (2004) quantified growth through optical density of zoospores and zoosporangia grown in liquid medium. Finally, it is important to note that Bd zoosporangia might survive in a "state of arrested or nondiscernable development" for extended time periods in less than suitable environments, and then when inoculated into appropriate growth media growth begins again, i.e., the culture remains "viable" (Johnson and Speare 2003). Therefore, lack of observable activity or growth does not indicate a dead or nonviable culture (Johnson and Speare 2003), nor should that be confused with a resting spore stage, which is

unknown for Bd (Longcore et al. 1999). Also, use of the term "**Bd-positive**" only denotes presence of the organism or its DNA, and does not necessarily equate with documented chytridiomycosis or mortalities linked to Bd.

The time and distance that zoospores will swim before encysting on the substrate was measured by Piotrowski et al. (2004). Although exact figures were not reported, the majority of zoospores tested (on 3, 5 cm diameter plastic culture dishes, each of which had about 200,000 zoospores) moved less than 2 cm before they encysted. About 50% had encysted by 18 hours, and 50% remained motile. By 24 hours, only about 5% were still moving; 95% had encysted. These results are consistent with one of the author's (J.E. Longcore) observations that infected amphibian skin cells often occur in clusters, suggesting that many zoospores do not disperse long distances, but rather they infect cells in the immediate vicinity of the zoosporangia from which they were released. This also suggests that Bd might spread among hosts during close contact, e.g., anuran amplexus, combat, aggregating tadpoles, etc. (Piotrowski et al. 2004).

Experiments by Johnson and Speare (2003) examined the ability of Bd to survive and grow in tap water, deionized water and sterilized "lake" water. Although in all cases, zoospores developed into zoosporangia which attached to the plastic flask in which they were housed, only the lake water treatment subsequently released zoospores, and did so for up to seven weeks. The tap and deionized treatments did not grow, but remained viable for three to four weeks (i.e., when reinoculated in broth). Presumably, unquantified nutrients and organics in the sterilized lake water allowed Bd to survive longer. It is important to note that no experiments have tested the lake water result under "field" conditions, i.e., with living lake, pond, stream water, etc.. Presumably, under those conditions Bd zoospores would be subject to predation by a variety of free-living protists, fungi, zooplankton, etc.

Although Bd is generally considered to be obligately aquatic, it has been reported to survive for at least 12 weeks (= 17 – 21 generations) in sterilized, damp (33% moisture content) sand (Johnson and Speare, 2005). At least one strain grew in sand with moisture contents as low as 10%, but those results were not quantified and need to be repeated (Johnson and Speare, 2005). However, earlier experiments demonstrated that mortality occurred when zoospores were dried (i.e., "complete dessication") for at least 3 hours (Johnson et al. 2003).

Interestingly, there is a recent report of Bd in the direct-developing plethodontid salamander, *Batrachoseps attenuatus*, a salamander with no aquatic habits nor an aquatic stage in its life cycle (Weinstein 2009), suggesting Bd is spread by direct contact, or that Bd can, in fact, survive and probably disperse in moist soils. Nonetheless, mechanisms by which Bd can infect largely terrestrial amphibians (or disperse through seemingly unfavorable habitats) are not known, and Johnson and Speare (2005) suggest that risk of infection in terrestrial habitats will vary among soil types, moisture content and pH.

Bd appears to tolerate a wide range of pH. Experiments have demonstrated survival and growth from pH 5 through pH 10 (none survived at pH 3 or 4), although the best zoosporangia growth and zoospore activity occurred between pH 6 and pH 7.5 (Piotrowski et al. 2004, Johnson and Speare 2005). At pH 5, 5.5 and 8 growth was slower than between pH 6 and 7.5. At pH 9 and 10 there was early growth, but activity ceased by day 7 and 3, respectively. However, cultures that were grown at pH 9 and 10 for 1 - 2 weeks (during which they were not growing or active) and then inoculated into cultures at pH 6.7 then became active and grew (Johnson and Speare 2005). These results suggest that although Bd does best at near normal pH, moderate extremes do not necessarily kill the fungus, thus Bd can probably survive in a wide variety of aquatic habitats. Further, it is also likely that Bd occurring inside an amphibian host might be buffered from external pH (Piotrowski et al. 2004), including the more basic waters that are common in Arizona.

The biology of Bd is greatly influenced by ambient temperature. In culture, Bd grew at temperatures as low as 4°C (Piotrowski et al. 2004), optimum growth occurred at 23°C but slowed at 28°C, and there was (reversible) cessation of growth at 29°C (Longcore et al.1999). Later experiments indicated that optimal growth occurred at 17° - 25° C (Piotrowski et al. 2004). Bd is sensitive to heat, and in culture isolates maintained at 28° C failed to grow and contained no live zoospores after 2 days (Piotrowski et al. 2004); mortality occurred at 30° C (Piotrowski et al. 2004; time of exposure not reported) and at 37°C when exposed for 4 hours (Johnson et al., 2003). Bd is pathogenic over a broad range of temperatures (12° - 27° C) but is most virulent from 12° - 23° C. Both pathogenicity and virulence decrease as temperature increases beyond 27° C (Skerratt et al. 2007 and references therein). In culture, short-term growth was maximal at 17°-25° C, and zoospores encysted and developed faster into zoosporangia (Woodhams et al. 2008). However, at cooler temperatures (7° - 10° C) although zoosporangia grew more slowly, they produced greater numbers of zoospores and they remained infectious longer. Piotrowski et al. (2004) noted that the ability to grow, albeit slowly, at 4° C would permit Bd to survive overwintering in aquatic habitats, and as temperature rose Bd could reproduce rapidly. Also in culture, zoospores can be induced to release by a sudden decrease in temperature (Woodhams et al. 2008). Finally, Woodhams et al. (2008, p.1627) summarized their work by saying, "The effect of temperature on amphibian mortality will depend on the interaction between fungal growth and host immune function and will be modified by host ecology, behavior, and life history. These results demonstrate that *B. dendrobatidis* populations can grow at high rates across a broad range of environmental temperatures and help to explain why it is so successful in cold montane environments."

Piotrowski et al. (2004) also demonstrated that Bd responds dramatically to different sources of nitrogen, although how those experimental nitrogen sources translate to environmental sources of

nitrogen is not clear. Experiments testing the effects of phosphorus are underway at Arizona State University (O. Hyman pers. comm.).

The precise mechanism by which Bd kills amphibians is not yet known, but recent work provides important information. The fungus may release toxins that are absorbed through the skin, but since amphibians absorb water and often respire cutaneously, Bd has been thought to affect water uptake, ionic balance or respiration. Voyles et al. (2007) reported that severe chytridiomycosis in Australian green tree frogs (*Litoria caerulea*) causes decreases in blood pH, plasma osmolality and plasma sodium, potassium, magnesium and chloride concentrations, and that this imbalance in osmotic homeostasis is caused by a disruption of normal cutaneous function. Their more recent work has shown that pathophysiological changes associated with electrolyte transport across the epidermis resulted in mortality. These researchers were the first to demonstrate experimentally that disruption of cutaneous function is a likely mechanism by which Bd kills amphibians. They noted that in "diseased individuals, electrolyte transport across the epidermis was inhibited by >50%, plasma sodium and potassium concentrations were respectively reduced by ~20% and ~50%, and asystolic cardiac arrest resulted in death" (Voyles et al 2009, p. 582).

The degree to which Bd affects amphibians at the population level varies considerably, and the factors that influence individual and population responses are incompletely understood (Briggs et al., 2010). Some amphibians appear to tolerate Bd with few negative effects (Davidson et al. 2003, Daszak et al., 2004; Weldon et al., 2004), while its presence has been correlated with high levels of mortality in many species (Stuart et al., 2004, Lips et al. 2006,) and has also been implicated in amphibian extinctions (La Marca et al., 2005). This range of variability is also apparent in populations of Arizona anurans (see below).

In Arizona, Bd has been implicated in mortalities in Bufo punctatus, Hyla arenicolor, H. wrightorum, Pseudacris triseriata, Rana berlandieri, R. blairi, R. chiricahuensis, R. pipiens, R. tarahumarae and R. yavapaiensis, and has been identified in Ambystoma tigrinum stebbinsi and Rana catesbeiana (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data, O. Hyman pers. comm.). Among these species, Bd has been implicated in severe population declines of Rana yavapaiensis (Sredl 2000) and the extirpation of Rana tarahumarae from Arizona (T. Jones, P.J. Fernandez unpublished; see also Hale et al. 2005), yet populations of other species seem to have survived despite occasional losses of individuals to Bd. For example, Bd was confirmed in Sycamore Canyon from a 1972 Rana yavapaiensis specimen (S. Cashins, E. Davidson, M.J. Sredl unpublished) and from dead and dying R. yavapaiensis and R. tarahumarae collected in 1974 (T. Jones, P.J. Fernandez unpublished). It is clear that Chiricahua leopard frog populations can coexist with the disease for extended periods, and in this case they have coexisted with Bd in

Sycamore Canyon at least since 1972 (U.S. Fish and Wildlife Service 2007), despite periodic mortalities.

Some amphibian species or populations are known to harbor Bd without evidence of lethal effects (e.g., Longcore et al. 2007). In Arizona, this includes native tiger salamanders (*A. t. stebbinsi*) and exotic bullfrogs (Davidson et al. 2003, Mazzoni et al. 2003). Consequently, through dispersal both species would be capable of moving or maintaining Bd in the environment (Collins *et al.* 2003, Daszak et al. 2004). Other native and nonnative frogs that are susceptible to the disease also serve as disease vectors or reservoirs of infection (e.g., Bradley *et al.* 2002).

Vectors

The mechanism by which Bd is spread across the landscape is incompletely understood, but we know that Bd can be transmitted in at least two ways: 1) through the movement of infected amphibians, or 2) through movement of water (or mud) that contains zoospores or zoosporangia from infected amphibians.

As mentioned above, the most likely avenue for Bd dispersal is through movement of infected amphibians (either naturally or for management purposes) that then spread the pathogen to previously uninfected amphibians. Through this process the largest numbers of viable zoospores would ultimately be transferred, i.e., living, infected amphibians would continue to shed zoospores into the environment thus increasing densities of free living zoospores, and increasing the likelihood that the zoospores would contact local amphibians; a typical density dependent pattern of pathogen transmission in which an increase in density of the pathogen increases the probability of transmission.

Recent work on mountain yellow-legged frogs (*Rana mucosa* and *R. sierrae*) strongly supports the hypothesis that the frogs themselves were probably the most important agents of dispersal at the local scale (i.e., within metapopulations), although other unknown vectors contributed to movement of Bd across the larger landscape. At one site the data indicated that Bd spread through the metapopulation, mediated by dispersing frogs, in a distinct wave at a rate of approximately 688 m/year (Briggs et al. 2010, Vredenburg et al. 2010).

In Arizona, dispersal of infected native amphibians across the landscape is limited to some extent by unfavorable (usually arid) habitats that separate many amphibian populations during much of the year, and is limited to some extent by low densities of some native amphibians (e.g., native leopard frogs). Nonetheless, there are some environments (e.g., higher elevation sites, like the Kaibab Plateau, parts of the Mogollon Rim, White Mountains) where there are large contiguous tracts of favorable habitat that might remain sufficiently mesic for periods of time long enough to facilitate dispersal e.g., following snow melt or during the monsoon season. Under those

conditions, infected amphibians, particularly those that harbor sub-lethal Bd infections (e.g., tiger salamanders) can probably move among aquatic habitats, thus dispersing the pathogen.

Invasive exotic bullfrogs are extremely effective dispersers and might also be responsible for the spread of Bd. Studies done by biologists at the University of Arizona suggest that an individual bullfrog might move as much as seven miles over relatively flat terrain during the summer monsoon season (Suhre, et al. 2006. Unpublished abstract. Joint Meeting Of Ichthyologists & Herpetologists, New Orleans, Louisiana). Although bullfrogs can succumb to chytridiomycosis (Pearl and Green 2005), to a large degree they appear to be able to support sub-lethal infections and are therefore probably effective Bd vectors (Daszak et al. 2004). In addition, international trade in bullfrogs for food is likely spreading Bd worldwide (Schloegel et al. 2009).

The AGFD has compiled data for the presence of Bd in bullfrogs from several sites including, San Bernardino NWR, San Pedro River, Mammoth Hot Springs, Cienega Creek watershed, San Rafael Valley, Scotia Canyon (Huachuca Mtns), Sycamore Canyon and Salty Tank (Atascosa/Pajarito Mtns), Tonto Basin, and Bubbling Ponds Fish Hatchery (BPFH) (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data; P. Rosen pers. comm.). Bullfrogs at all of these sites that might disperse to nearby sites that support native amphibians.

The biology of Bd also suggests strongly that Bd might be spread by people or terrestrial animals that move among sites, one or more of which must support infected amphibians and therefore motile zoospores. Viable zoospores in water or mud could potentially be spread by wet or muddy boots or clothing, vehicles, cattle and other animals moving among aquatic sites, during scientific sampling of fish, amphibians, or other aquatic organisms, or through the direct movement of water (e.g., Johnson and Speare 2003, 2005).

The only experiments of which we are aware that test the hypothesis that terrestrial animals other than amphibians might contribute to Bd dispersal are by Johnson and Speare (2005). They demonstrated that Bd zoospores could quickly (1 minute) associate with bird feathers (chicken and duck down), and those zoospores were viable after the feathers had been removed from media for up to an hour. If given sufficient exposure to feathers (up to 4 days in media), zoospores formed attached zoosporangia. Zoosporangia on duck down survived drying up to 3 hours (note: drying was only defined as removal from media, after which the feathers were placed in a laminar flow hood), thus suggesting the disease could be spread by waterfowl or other water birds moving among wetlands. These results also support the contention that wet clothing or sampling equipment could be effective vectors for zoospores or zoosporangia. In addition, experiments mentioned above by Johnson and Speare (2005) strongly support the hypothesis that viable zoosporangia could survive transport in wet mud or sand, although the

degree to which other microorganisms would affect their survivorship is unknown. Nonetheless, it is still not known how the fungus survives in the absence of amphibian populations.

Carey et al. (2006) tested the effects of Bd zoospore dosage (i.e., numbers of zoospores to which an animal is exposed) and length of exposure on survival time of boreal toads (*Bufo boreas*). In this experiment, juvenile toads were placed in 236 ml (~ 1 cup) containers, into which a 20 ml solution containing zoospores was added; 20 ml was sufficient volume to immerse the toads ventral side. They found that dosage and exposure strongly influenced survival. Unsurprisingly, at high dosages (i.e., 10^3 and 10^6 zoospores) there was 100% mortality, irrespective of exposure time. At low dosages results varied according to exposure time, however, even the lowest doses (1 zoospore/20 ml) often resulted in infection. Significantly, at the lowest doses (1, 20, 40, 60, 100 zoospores) and exposure for 1 day, percentage of toads that survived for 42 days (the duration of the experiment) ranged from 30% (100 zoospores) to 93% (1 zoospore). It is important to note that regardless of zoospore dosage, the toads were sitting in only 20 ml of solution for ≥ 1 day, and therefore could not escape contact with the zoospore(s). That volume of solution in a 236 ml cup would place the toad well within the swimming distance reported by Piotrowski et al. (2004). Nonetheless, there was significant survival at low doses, suggesting that higher doses of zoospores are necessary to cause lethal infections.

In a study that focused primarily on ranavirus screening, Picco and Collins (2008) tested whether the bait trade in larval tiger salamanders (waterdogs) in Arizona facilitated the dispersal of Bd. They used real-time PCR to screen water samples and to test salamander tissue samples from 9 bait shops that sold waterdogs. They reported positive results for Bd from water samples from 3 of the 9 shops, and Bd positive tissue from one of those 3 shops. Importantly, they discovered that many anglers surveyed (67%, n = 27) released tiger salamanders bought as bait into the waters where they fished, and one out of 24 shops (4%) sampled in the entire study released unsold tiger salamanders into the wild after they had been kept in shops with Bd or ranavirus infected animals.

Bd and fish stocking

Depending on whether the fish being stocked originated at an AGFD hatchery or from an external vendor, operations vary, but there are three routine stocking operations by which Bd might be transferred from the point of origin to a stocking site. However, in each case the stocking operation process limits the probability of transmission of Bd (see below).

The first operation includes fish raised in open (natural) ponds that are available habitat for amphibians. These activities are limited to “incentive” fish that are raised in “show ponds” on hatchery grounds (e.g., Tonto Creek and Canyon Creek fish hatcheries). Incentive fish are generally larger fish that, when stocked into waters along with “typical” stocked fish, provide an extra incentive for anglers. Stocking incentive fish occurs infrequently, and often those fish are

not stocked, but are provided to commercial entities for display (e.g., Bass Pro Shops, Cabela's, etc.). Earthen raceways at Silver Creek hatchery are similar to open ponds, although they are flow-through systems and do not provide suitable amphibian habitats.

The second operation includes raceway raised fish (which may also include incentive fish, e.g., at Tonto Creek), in which fish are raised in artificial structures that generally are inhospitable for amphibians (i.e., they might be raised structures, concrete, rubber lined, etc.).

Finally, some fish are purchased from external vendors. These include cold water fish that are only stocked in urban fishing lakes, and warm water fish that are generally stocked in urban lakes but have been stocked in various lakes statewide. In all cases, stocking trucks are filled with clean well or spring water before fish are loaded and transferred. Table 1 outlines the procedures followed during stocking operations initiated by AGFD hatcheries and how those procedures influence the persistence of Bd in that operation.

At most AGFD hatcheries, the fish are raised entirely in raised tanks or in raceways that are not available to amphibians that might or might not be infected with Bd. Therefore, fish raised under those conditions do not present a credible threat with respect to transferring Bd through stocking activities.

In the rare event that incentive fish are used for stocking purposes, they are typically netted from "show ponds" or from raceways, and placed directly into stocking trucks with clean water. Show fish numbers are usually in the hundreds, and they are not mixed in trucks with regular stock (truck loads of which typically number in the thousands).

Fish are also purchased from external vendors (primarily from the southeastern U.S.). Those fish are removed from the rearing ponds and placed into truck tanks filled with well water. After loading, the tanks are flushed with well water before transit. Finally, in Texas, all tanks are again flushed with well water. Importantly, vendors are contractually obligated to provide fish that are free of disease or other pathogens as prescribed by AGFD (details depend upon species being purchased), and the loads must be free of non-target organisms (plants or animals). Loads are off-loaded in nets at the receiving point, at which time they are visually inspected for overall health and non-target organisms. Loads that fail to pass this inspection may be rejected.

The AGFD has Bd-positive records for amphibians occurring in the following river systems: Agua Fria (Lake Pleasant), San Francisco, Gila (tributary to mainstem), Hassayampa, Río de la Concepción, Salt, San Pedro, Santa Cruz, Verde and Río Yaqui (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data).

Bd has been documented in bullfrogs in open hatchery ponds only at BPFH. To date, we have very few data on Bd on amphibians at any other AGFD hatchery, including nearby Page Springs Hatchery, but reports of amphibians in other facilities have been rare. Because bullfrogs can apparently harbor Bd for long periods of time without apparent ill effects (Daszak et al. 2004), the presence of bullfrogs at a hatchery presents a risk for spread of Bd either through spread of infected bullfrogs or tadpoles, or through spread of zoospores shed by infected bullfrogs into water that is then moved from one site to another. Note that fish stocked from AGFD hatcheries, approximately 98% of them are trout from the 5 hatcheries other than BPFH. Those fish from BPFH are primarily warm water native fish and are not stocked for sport fish purposes.

The pathways by which there is transfer of Bd from one environment to another depends on success of a series of events in the life cycle of the fungus: 1) a motile zoospore with a single flagellum disperses by swimming, 2) the zoospore encysts on a suitable host, 3) the resulting zoosporangium produces new zoospores, and 4) new zoospores are released into the water, where the process repeats. Under ideal conditions, the zoospore encysts on amphibian skin.

Thus, the questions that must be addressed are: 1) is there a measureable risk of transporting amphibians that harbor Bd, and 2) is there a measureable risk of transporting viable zoospores or zoosporangia to habitats that support native amphibians, including Chiricahua leopard frogs?

1) Is there a measureable risk of transporting amphibians that harbor Bd?

This pathway of infectivity, transport of infected amphibians (e.g., bullfrogs) along with stocked fish, is the most effective way to transmit Bd. This pathway has serious consequences and if it takes place is very likely to spread the disease from one place to another. Existing AGFD HAACP plans and best management practices incorporated into hatchery operations make this highly unlikely, thus the risk of transporting infected bullfrogs or other amphibians is not significantly different than zero.

2) Is there a measureable risk of transporting viable zoospores or zoosporangia?

Although Bd zoospores can encyst and grow on non-living surfaces and survive for considerable periods of time under controlled conditions in vitro (Longcore et al.1999, Johnson and Speare 2003, 2005, Piotrowski et al. 2004, Woodhams et al. 2008), we are unaware of any studies that have experimented with the ability or likelihood of zoospores to encyst and grow successfully on non-target surfaces under natural conditions (i.e., in the presence of competitive and predatory organisms). We are also aware of no data to indicate that Bd can encyst on fish skin, where epidermal mucous, bacterial flora, etc. of non-host organisms would probably inhibit attachment. Therefore we think it is highly unlikely that Bd would be carried by an alternate fish host, but acknowledge that the question remains to be tested.

Based on their experimental laboratory studies (again, in a monoculture under controlled conditions), Johnson and Speare (2003) made the following conservative recommendations regarding the movement of water that has come into contact with Bd infected amphibians: 1) water should be regarded as contaminated for at least 7 weeks following last contact with infected amphibians; 2) water storage alone should not be used as a means of disinfecting water; 3) all contaminated water should be disinfected with appropriate chemical disinfectants before being discharged into the natural environment.

However, Piotrowski et al. (2004) suggested that the limited dispersal characteristics of zoospores indicate Bd is most likely spread by close amphibian contact. Although they acknowledge that zoospores could be carried longer distances by water currents, they also point out that passive dispersal like that "would decrease the chances of a zoospore contacting a host, because the spores would be diluted to low concentrations" (Piotrowski et al. 2004, p. 13). Serial dilutions of water that take place in standard hatchery operations would simulate the conditions noted by Piotrowski et al. (2004), i.e., zoospores would be reduced to exceedingly low concentrations. And, infection rates at those lower concentrations might be quite low (e.g., Carey et al. 2006).

Fish purchased from vendors undergo at least 2 dilutions; they are initially netted into a truck with clean water and that water is changed approximately midway during the trip to Arizona. Over the past three years of stocking, approximately 17% of the fish stocked in Arizona were provided by contract vendors. Of those contract vendor fish about 90% were stocked in Urban Fish Program (UFP) lakes that have few or no aquatic connections to sensitive native amphibian sites, and none to Chiricahua leopard frog habitats. During the 10 year period covered in this consultation, risk of transporting viable zoospores or zoosporangia via contract vendor pathway is expected to remain low because: 1) the number of fish purchased is expected to remain similar to current stocking numbers with the exception that there may be some additional locations stocked, including primarily the Fishing in the Neighborhood (FIN) waters that are located in primarily urban areas with limited hydrologic connectivity to sensitive native amphibian sites, and 2) because warm water stockings that would likely require fish purchase in response to a partial or complete loss of a fishery due to catastrophic events could occur during the 10 year period; however these stockings are not anticipated to occur only rarely.

Finally, considering the stocking protocol outlined above, there is a very small chance that some Bd zoospores would be released into waters stocked with fish. Those zoospores would again be diluted by the large volume of water at the stocking site. In order to complete their life cycle, the zoospores would have to encounter an amphibian and encyst on that host. The likelihood of a few zoospores in an exceedingly large volume of water coming in contact with a streamside/lakeside amphibian is, again, extremely low. In addition, depending on the stocking locations, the community of Arizona amphibians that would inhabit those waters would be

limited to a few species. Most native ranids, i.e., those species that would be most likely to become infected with Bd, no longer occur in many of those habitats.

Conclusions

Chytridiomycosis is an extremely serious amphibian disease, and there is no doubt that it has caused significant losses among Arizona's native fauna. Many aspects of the natural history and ecology of Bd remain to be answered, and mechanisms of dispersal beyond the actual movement of infected amphibians (e.g., Vredenburg et al. 2010) are woefully understudied. Thus, it is important to approach questions of potential spread of Bd with caution, and to take steps to prevent that spread. AGFD staff working with aquatic organisms (including mollusks, fishes, amphibians and reptiles) practice strict disinfectant protocols (as outlined in the Chiricahua leopard frog recovery plan [USFWS 2007]) to prevent the spread of Bd (and other pathogens) among populations of aquatic wildlife.

However, there are specific concerns that the AGFD hatchery stocking program might spread *Bd*. This risk has been assessed and found to be very low considering the life cycle of Bd (Berger et al. 2005), behavior of the zoospores (Piotrowski et al. 2004), the procedures followed in normal hatchery operations, and the precautions taken in the AGFD HACCP plan and best management practices within the hatcheries. The particular case of spreading Bd is one that relies on a long series of unlikely events taking place that would lead to amphibians being infected by Bd in areas where the disease does not already exist. Specifically: 1) a hatchery would have to be infected with Bd; 2) water from an infected hatchery would need to have enough Bd zoospores so that some individual spores would survive treatments during fish transfer and those called for in the HAACP plan; 3) zoospores would have to survive freshwater dilution in raceway raising, sorting or tagging procedures; 4) remaining zoospores would have to survive the trip in the hatchery truck to the stocking site; 5) zoospores would have to survive in the stocking area long enough to encounter an amphibian host; and 6) the amphibian host would have to develop chytridiomycosis then spread the disease to others.

Finally, **Error! Reference source not found.** outlines the steps in stocking hatchery fish and how these steps relate to the prevention of the spread of chytridiomycosis.

Table 4. Operations and procedures followed by AGFD hatcheries to collect, sort, transport, and stock native and nonnative fish.

Step	**Notes on hatchery procedures**	**Notes relevant to the persistence of Bd**
1. fill sanitized stocking truck with spring or well water (proceed to step 2a		if truck had been previously exposed to Bd zoospores, they will be killed during sanitization

Step	Notes on hatchery procedures	Notes relevant to the persistence of Bd
or 2b)		truck is filled with water that has low or no likelihood of having exposure to fish, bullfrogs, or Bd
2a. if fish are collected from raceways, they are usually individually netted or in some cases harvested using automated equipment (contained, drained, and moved) and placed in transport truck (proceed to step 5)	raceways are inspected during feeding [daily] and cleaning [1-3 times per week] for non-target organisms	this step should get rid of Bd infected amphibians Bd zoospores will be in the residual water on the skin of fish and collecting gear or runoff from the collecting process Bd zoosporangia in shed amphibian skin could hatch and become free swimming Bd zoospores could remain free-swimming or encyst on the skin of a fish or on the inside of the transport truck at any step
2b. if fish are collected from ponds: fish and possibly frogs and tadpoles are netted or seined and moved to transport truck (proceed to step 3)	these are generally native fish, but also include incentive fish, e.g. trout fish from raceways and ponds have residual water during collection and movement	this step should get rid of Bd-infected amphibians Bd zoosporangia in shed amphibian skin could be discharged and become free swimming Bd zoospores will be in the residual water on the skin of fish and collecting gear or runoff from the collecting process
3.fish are placed in raceways fed by spring or well water and sorted, then placed in the stocking truck (proceed to step 4)	non target organisms (frogs and tadpoles) are removed during sorting	in raceways, Bd zoospores might remain on the skin of fish, but will not grow, or be placed back in “solution” and diluted or “swept away” by the flowing water of the raceway
4. refill unsanitized truck with spring or well water and put fish in stocking	truck has been drained, but not disinfected after the	truck is filled with water that has low or no likelihood of having exposure to fish, bullfrogs, or Bd

Step	Notes on hatchery procedures	Notes relevant to the persistence of Bd
truck (proceed to step 5)	previous step. It may be left "empty" for some duration	Bd zoospores have been diluted by the volume of water in the transport truck
5. one to three hour drive to stocking site (proceed to step 6)		
6. acclimate water in truck to local water quality parameters (proceed to step 7)		
7. release fish by dumping entire load or individually netting fish		once at the stocking site, free-swimming zoospores would have to find a suitable amphibian host, encyst, and form many zoosporangia and reinfect host

Chiricahua and Northern Leopard Frog

Introduction

The Arizona Game and Fish Riparian Herpetofauna Database contains observational data for native ranid frogs that were collected from 1884 to present. Historical ranid frog distributions were determined from museum registers, published and gray literature reports and observations of credible individuals (for a complete list of citations, see Sredl 1997). In addition to these sources, this dataset includes data from AGFD surveys targeting native ranid frogs: *Rana blairi*, *Rana chiricahuensis*, *Rana pipiens*, *Rana subaquavocalis*, *Rana tarahumarae*, and *Rana yavapaiensis* and includes positive and negative site visits for these taxa. For complete survey methodology, see Sredl (1997).

Historical and recent frog observations

To evaluate the status of frog populations at a stocking site or in the vicinity of that site, we considered the best available positive and negative frog survey data, habitat suitability, and survey effort (Table 18), using data from the following sources: AGFD Riparian Herpetofauna Database, HDMS, and RAPI_from_MacVean, Tonto National Forest (Tonto NF 1979-2008), Apache-Sitgreaves National Forest (Black Mesa (Negative) 2003-2007), and Coconino National Forest (Coconino NF 2005-2008). Positive frog observations from these sources were divided in four categories:

Observations made prior to 1980: By 1980, all currently recognized species of Arizona leopard frogs had been described or recognized (note: although the lowland leopard frog was not

described until after 1980 (Platz 1984), the term "lowland form" to reference this taxon was commonly used in the literature prior to 1980). This timeframe captures what has often been used by researchers to establish baselines for status and distribution studies (e.g. Clarkson and Rorabaugh 1989, Sredl et al. 1997).

Observations made between 1980 and 1999: This timeframe includes the period when the modern taxonomy for Arizona leopard frogs became widely used in inventory, status and distribution studies. This period includes survey work by Clarkson and Rorabaugh (1989), which was the seminal paper that brought declines of Arizona ranid frogs to the attention of the research and conservation communities, and the work of Sredl et al. (1997), who conducted the first comprehensive analysis of inventory, status and distribution of Arizona ranid frogs. The work of Sredl et al. (1997) and subsequent surveys are cited as Arizona Game and Fish Riparian Herpetofauna Database in our analyses.

Observations made between 2000 and 2005: After 1999, field surveys targeting Arizona ranids began to transition from wide-ranging inventories and status and distribution studies to monitoring extant populations, evaluating sites for recovery opportunities or reconnaissance of new leopard frog populations. In addition to many records included in Arizona Game and Fish Riparian Herpetofauna Database, other datasets used in our analyses that primarily fall within this timeframe are: MacVean (RAPI_from_MacVean), Tonto National Forest (Tonto NF 1979-2008), Apache-Sitgreaves National Forest (Black Mesa (Negative) 2003-2007), and Coconino National Forest (Coconino NF 2005-2008).

Observations between 2005 and the present: In many cases, observations made after 2005 represent our best assessment of leopard frog populations that are extant, and are located in all data sets used in our analyses.

Habitat suitability

Throughout the discussion of leopard frog habitat and dispersal corridors, we use the term "less suitable," which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not leopard frogs will or can occur in a particular area. The ability of leopard frogs to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to water availability, cover, prey, predators, etc.. Stocking sites or stream reaches would be considered "less suitable" for leopard frogs when there are known reasons in conditions that generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for leopard frogs because they exert predatory or competitive pressures on the frogs.

Frog occupancy

It is difficult to determine if frogs are absent from a site or area. In order to make that determination, we used a "preponderance of evidence approach" to build a case that frogs are present or absent. We acknowledge that these criteria are imperfect, but they utilize the best available data in a consistent manner.

1. Frog sites / stocking complexes will be considered occupied if they contain
    a. extant populations of frogs, defined as sites that have positive observations for Chiricahua or northern leopard frogs made from 2006 to the present, or
    b. locations where frogs were observed one or more times from 2000 through 2005 and habitat is in good condition and therefore could contribute to "recovery" (e.g. those sites in a Chiricahua Leopard Frog Management Area (MA))
2. Frog sites / stocking complexes may be occupied
    a. if they are located in the historical range (i.e. within the approximate boundaries of a Chiricahua Leopard Frog Recovery Unit [RU]) and contain positive observations from 1980 through 1999 but there have been no subsequent surveys or
    b. if they are located in the historical range and contain leopard frog records that were made prior to 1980 and the area has been poorly surveyed
3. Frog sites / stocking complexes will be considered unoccupied if they are
    a. outside the historical range (i.e. RUs) or
    b. within the historical range and contain no positive observation made through 1999 and
        i. areas that have been well-surveyed and all survey results are negative at both historical and non-historical localities or
        ii. there has been a no post-1999 positive reports from areas that are frequently visited by knowledgeable biologists or
        iii. presence of degraded habitats (e.g. those that are dewatered or contain many nonnatives) and all surveys subsequent to 1999 are negative

Table 5. Criteria used and data considered to characterize the likelihood that Chiricahua or northern leopard frogs occupy a site or area.

Status	Occurrence data	Habitat suitability	Survey effort
Occupied	extant frog population (= positive observations from 2006 to present) or	NA	NA
	frogs observed from 2000 through 2005	…and habitat is in a condition such that it could contribute to "recovery" (i.e. area is in CLF MA)	NA
May be occupied	frogs observed from 1980 through 1999 or	…and in historical range (~RU)	but there have been no subsequent surveys
	frogs observed prior to 1980	…and in historical range (~RU)	and area has been poorly surveyed
Unoccupied	frogs observed through 1999	…and in historical range (~RU)	and well-surveyed area and results include only negative surveys at both historical and non-historical localities or lack of positive reports from areas that are frequently visited by knowledgeable biologists
	frogs observed through 1999	…and in historical range (~RU) and the prevalence of degraded habitats (dewatered, many nonnatives…)	and all surveys subsequent to 1999 are negative

Developing Buffered Stocking Complexes

Local Analysis

To evaluate both the likelihood that a site or local area is occupied by Chiricahua and northern leopard frogs, and the level of exposure of stocked fish to these leopard frogs, we developed a buffered stocking complex approach by creating a minimum convex polygon (MCP) around all stocking sites within a stocking complex, and buffering this MCP by 5 miles.

In most cases we used the buffered MCP approach to circumscribe the entire stocking complex, but in three stocking situations we had to depart from this approach and create sub-complexes. These situations arose when stocking sites in complexes consisted of: 1) fewer than 3 sites, 2) sites that were isolated and distant from other stocking sites, or 3) only stream reaches. In these cases, a 5 mile buffer was made around individual stocking sites or around the entire stocking reach. A buffered MCP or a 5 mile buffer was applied only to those sites or complexes that lie within the known historical range of Chiricahua and northern leopard frogs. Some stocking complexes were so large or heterogeneous (e.g. Middle Verde River stocking complex), we divided the complex into smaller, more manageable sub-complexes comprising one of more of the three situations outlined above.

We analyzed potential impacts of stocking at two levels, the local and broad scales. For the local analyses, we used each buffered stocking complex to limit our query of historical and visual encounter survey data. We then used these data to consider at the local level the likelihood of occupancy and exposure to stocked fish. Water distribution and connectivity within each stocking complex was reviewed thoroughly to fully understand the ability and likelihood of fish and frog movement within the buffered stocking complexes, reaches or sites.

Broad Scale Analysis

The likelihood of occupancy of Chiricahua and northern leopard frogs and exposure to stocked fish were evaluated on a broader scale by assessing potential movement of fish and frogs upstream and downstream beyond the buffered stocking complex, reach, or individual site. The water distribution and connectivity portion of each stocking complex was reviewed thoroughly to fully understand the ability and likelihood of fish and frog movement outside of the buffered stocking complexes, reaches or sites.

Determining exposure: Dispersal of fish and frogs

To evaluate the likelihood that dispersing Chiricahua or northern leopard frogs could be exposed to stocked fish, we used data on flow, distance, and other attributes of corridor suitability for fish and frogs to make this determination (see Table 19 for criteria examined). By circumscribing a distance of 5 miles around all stocking sites within a stocking complex, we considered all possible distances that Chiricahua and northern leopard frogs are reasonably likely to disperse (1 mile overland, 3 miles along intermittent drainages, and 5 miles along permanent drainages, see

USDA Forest Service Southwestern Region 2004, Chiricahua Leopard Frog Recovery Plan 2007 and references therein). For details on buffering stocking complexes, see section below.

Table 6. Criteria used to characterize the likelihood of exposure of dispersing Chiricahua or northern leopard frogs to stocked fish.

Flow was categorized by the predominant flow type (perennial or intermittent, or none), while considering additional information on water distribution and potential for frogs and fish to disperse through that corridor. Distance between occupied frog sites and stocking sites was measured in ArcGIS. Known reasons that alter the "suitability of dispersal corridor" include natural and manmade barriers to dispersal of stocked fish and presence of nonnative aquatic species (crayfish, fish, and bullfrogs).

Likelihood of Exposure	**Flow**	**Distance (miles)**	**Suitability of dispersal corridor**
High	Perennial	< 5	NA
	Intermittent	< 3	NA
Moderate	Perennial	> 5	There are known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish
	Intermittent	> 3	There are known reasons that decrease the likelihood of dispering frogs being exposed to stocked fish
Low	Perennial	>> 5	There are many known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish
	Intermittent	>> 3	There are many known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish

In order to evaluate the likelihood that Chiricahua or northern leopard frogs could be exposed to dispersing stocked fish, we used data on flow and other attributes of corridor suitability found in the watershed chapters to make this determination (see Table 20 for criteria examined).

Table 7. Criteria used to characterize the likelihood of exposure of Chiricahua or northern leopard frogs to dispersing stocked fish. Flow and known reasons that alter the "suitability of dispersal corridor" determined as in Table 19.

Likelihood of Exposure	**Flow**	**Suitability of dispersal corridor**
High	Perennial	NA
Moderate	Perennial	There are known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish
	Intermittent (may contain substantial pools)	There are known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish
Low	Perennial	There are many known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish
	Intermittent	There are many known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish

<u>Northern Mexican Gartersnake</u>

Range wide discussion

Northern Mexican gartersnakes are closely associated with riparian areas and typically inhabit cienegas, perennial streams, rivers, earthen stock tanks, and ponds with thick bank vegetation (Holycross et al. 2006; Rosen and Schwalbe 1988). Their historical range wide distribution extends from central Arizona and west-central New Mexico south along the Sierra Madre Occidental to west-central Veracruz and also includes isolated populations in central Oaxaca and central Nuevo Leon, Mexico (Holycross et al 2006). In Arizona, northern Mexican gartersnakes were historically found between 500-2050 m (1640-6725 ft) elevation and have been previously documented from Tonto Creek, upper Verde River, Agua Fria River, Salt/Black River, Little Colorado River, San Bernardino Ranch, San Pedro River, Altar Wash, and Santa Cruz River watersheds (Holycross et al. 2006). While they were once considered common, northern Mexican gartersnakes are believed to have declined substantially throughout their range and are now candidates for Federal listing under the Endangered Species Act.

Using the best available data, the USFWS determined in their 12-month finding (USFWS 2008a) that northern Mexican gartersnakes are likely extant at the following locations: Santa Cruz River/Lower San Rafael Valley, Verde River from the confluence with Fossil Creek upstream to

Clarkdale, Oak Creek at Page Springs, Tonto Creek from the mouth of Houston Creek downstream to Roosevelt Lake, Cienega Creek from the headwaters downstream to the "Narrows" just downstream of Apache Canyon, Pantano Wash (Cienega Creek) from Pantano downstream to Vail, Appleton-Whittell Research Ranch and vicinity near Elgin, and Red Rock Canyon east of Patagonia. They determined that it is unknown whether the species is still extant at the following locations: downstream portion of the Black River drainage from the Paddy Creek confluence, downstream portion of the White River drainage from the confluence of East and North forks, Big Bonito Creek, Lake O'Woods near Lakeside, Spring Creek above the confluence with Oak Creek, Bog Hole Wildlife Area, Upper 13 Reservoir, Patagonia Mountain bajada, Babocomari River, Upper Scotia Canyon in the Huachuca Mountains, Arivaca Cienega, Gila River at Highway 180. The species is considered likely extirpated from the following locations: the Gila River, Lower Colorado River from Davis Dam to the International Border, the San Pedro River, Santa Cruz River downstream from the International Border at Nogales, Salt River, Rio San Bernardino from International Border to headwaters at Astin Spring (San Bernardino National Wildlife Refuge), Agua Fria River, Verde River upstream of Clarkdale, Verde River from the confluence with Fossil Creek downstream to its confluence with the Salt River, Tanque Verde Creek in Tucson, Rillito Creek in Tucson, Agua Caliente Spring in Tucson, Potrero Canyon/Springs, Babocomari Cienega, Barchas Ranch, Huachuca Mountain bajada, Parker Canyon Lake and tributaries in the Canelo Hills, and Oak Creek at Midgley Bridge (USFWS 2008a).

Home range

Home range information is lacking for northern Mexican gartersnakes, however, a study in British Columbia found that for adult terrestrial gartersnakes (*Thamnophis elegans*), a species similar to northern Mexican gartersnakes, home-range varied from 10 to 100,000 m^2 (108 to 1,076,391 ft^2) and that they often migrated nearly 3 km (1.86 mi) in a season (Graves and Fuvall 1990, Farr 1988, cited in Rossman et al. 1996). Additionally, common gartersnakes, *T. sirtalis*, from Manitoba made long distance movements between hibernation sites and feeding areas which ranged from 4.3 to 17.7 km (2.67 to 11 mi) (Gregory and Steward 1975, cited in Rossman et al. 1996). In a Kansas study, the mean activity area for *T. sirtalis* ranged from 92,000 m^2 (990,280 ft^2) for females to 142,000 m^2 (1,528,475 ft^2) for males (Fitch 1965, cited in Rossman et al. 1996), and in Michigan, their range was recorded at 8000 m^2 (86,111 ft^2) (Carpenter 1952, cited in Rossman et al. 1996). In yet another study, researchers found that recaptured gartersnakes were rarely found more than 160 m (525 ft) from their original capture locations (Freedman and Catlin 1979, cited in Rossman et al. 1996).

While northern Mexican gartersnakes are likely capable of large-scale overland movements similar to those described above for other gartersnake species, the frequency at which they occur is unclear. Though they are rarely found more than 15 m (52 ft) from permanent water, observations of this species from the San Rafael Valley, Arizona, indicate that northern Mexican

gartersnakes can wander overland and be found several kilometers from riparian areas (e.g., cienegas and rivers) (Rosen and Schwalbe 1988). For example, northern Mexican gartersnakes have been found at overland distances of 3 km (1.86 mi) (FS799 tank) and 6.2 km (3.85 mi) (Upper 13 Reservoir) from the Santa Cruz River despite a lack of aquatic connectivity (T. Jones pers. comm.). While it is unclear whether the observations were of dispersing individuals or resident snakes, these data support the suggestion that this species, similar to other gartersnakes, is capable of moving across the landscape and can persist at sites beyond riparian corridors. The large-scale movements described for similar species listed above likely reflect their need to move between limited suitable hibernation locations and feeding areas during the active season. The average distance northern Mexican gartersnakes travel between hibernation sites and active season feeding areas is currently unknown.

Snakes are cryptic by nature and their detectability is generally low, even among common species. Currently, no standard survey protocol exists for detecting northern Mexican gartersnakes, however, researchers employ similar field techniques which include trapping with mesh minnow traps, visual searching, dip-netting, and turning cover objects (boards, rocks, logs, etc.). The area covered and duration of trapping and visual searching periods often vary by site and over time. It is difficult to quantify the degree to which populations of northern Mexican gartersnakes have declined over time because long-term demographic data are generally lacking. There are few comparisons of relative abundance between/among sites and those are typically quantified through catch per unit effort (e.g., person-search hours and trap-hours), however, this measure does not account for habitat variables or other covariates that might influence detectability. Often, and as is the case for gartersnakes, these indices of relative abundance constitute the best available information from which management decisions must be made for a species. While the assumption is often made that snakes will be detected if present at a site, it is necessary to use caution when interpreting relative abundance or presence/absence data and extrapolating across sites.

To demonstrate how detectability varies with survey design and effort, we offer two examples from a similar area along the Santa Cruz River in the San Rafael Valley, Arizona. In 2000, Rosen et al. (2001) reported results from trapping and surveying efforts along the main-stem of the Santa Cruz River (~11 hrs dip-netting and general searching; 1 trapping array for 24 hr), Heron Spring (10 min general searching; 1 gartersnake fyke trap for 48 hr), and Sharp Spring (45 min general searching; 1 trapping array for 48 hr). Across six survey days, only five northern Mexican gartersnakes were observed and none trapped. The number of traps deployed within each array was not reported, thus it is not possible to quantify trap effort accurately. Based on their results, Rosen et al. (2001) concluded that the population was persisting and may not be declining rapidly, though there were no means of comparison from previous years. Conversely, AGFD staff implemented two intensive 8-day trapping sessions (~100 traps spaced 25 m [82 ft]

apart during each session) along a 2.7 mile (4.5 km) stretch of the Santa Cruz River extending north from the U.S./Mexico border within the San Rafael State Natural Area. During 15.4 days (1553.6 trap days), 52 northern Mexican gartersnakes were captured and individually marked. An additional three gartersnakes were observed but not captured. It might appear that this population increased in size based on raw numbers of captures in 2008 vs. those including the same area in 2000; however, the difference in capture numbers likely results from differences in survey design and trapping efforts. All but two of the snakes captured in 2008 were large adults, which suggests low recruitment rates within the population (M. Ingraldi, R. Mixan pers. comm.). Both studies indicate that northern Mexican gartersnakes persist along the upper Santa Cruz River in the San Rafael Valley, but it is not possible to evaluate the viability of the population without further study. As these two examples demonstrate, detectability varies with survey design and effort, thus it is necessary to use caution when interpreting relative abundance or presence/absence data and extrapolating across sites.

Criteria Developed:
We evaluate the potential for exposure of northern Mexican gartersnakes to stocked sport fish for each watershed in which the USFWS determined that populations are extant or of unknown status (USFWS 2008a). For those watersheds in which gartersnake populations existed historically but are currently believed extirpated, we determined that northern Mexican gartersnakes are unlikely to occupy the stocking complex and that there was no likelihood of exposure to stocked sport fish. The likelihood of exposure to stocked sport fish was not evaluated for watersheds that lie outside the known historical range of the species. As described above, similar gartersnake species are capable of long-distance movements exceeding several kilometers during their active seasons. While home range and movement data are lacking for northern Mexican gartersnakes, we assume they too are capable of such large movements both overland and along drainages. The frequency at which these movements occur is unclear but likely correlates with prey availability in a system, reproductive activity, postpartum dispersal, etc.

Throughout the discussion of gartersnakes, AGFD uses the term “less suitable,” which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not gartersnakes will or can occur in a particular area. The ability of gartersnakes to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to cover, prey, predators, etc.. While some sites might be capable of supporting large adult snakes, those same sites might not allow for successful recruitment. Stocking sites or stream reaches would be considered “less suitable” for gartersnakes when local conditions generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for gartersnakes because they exert predatory or competitive pressures on the snakes. However, gartersnakes might continue to persist in “less suitable” sites in the presence of nonnative species if those sites have greater habitat complexity and provide escape cover or feeding sites for

neonates or juvenile snakes. An example of this would be Mexican gartersnakes on the middle Verde River, where although we have few data on population status, snakes appear to persist in exceedingly complex riparian habitat in some areas (e.g., Dead Horse Ranch State Park) despite the presence of bullfrogs, crayfish and predatory fishes.

In addition, there are sites within the elevational range of gartersnakes where distributional data suggest gartersnakes do not occur, but other structural habitat features seem to be appropriate. Although lack of data does not necessarily equate with absence, if there are additional habitat characteristics (predators, lack of cover, etc.) that would preclude gartersnakes from occupying those sites or thriving, we also refer to those sites as "less suitable" which contributes to a conclusion that snakes probably do not occur there.

Stocking complex analysis:
Following methods similar to those described for Chiricahua and northern leopard frogs, we used ArcGIS to map and identify sport fish stocking complexes from which positive observations of northern Mexican gartersnakes exist and that lie within the historical range of the species (Rosen and Schwalbe 1988, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database). We then developed a similar buffered stocking complex approach by creating a minimum convex polygon (MCP) around all stocking sites within a stocking complex, and then buffering the MCP by 20 km (12.43 mi). This buffer was developed after evaluating the best available home range and movement data for similar gartersnake species and northern Mexican gartersnake observations described above, and it represents a conservative estimate of distances that northern Mexican gartersnakes might make along ephemeral or perennial drainages. Overland movements will likely be <20 km, however, over ecological time, gartersnakes within a population could move long distances in search of food or suitable habitat. Within some stocking complexes, stocking sites were widely separated from one another and were therefore considered separately, in which case a circular buffer with a 20 km (12.43 mi) radius was created around each stocking site (e.g., Santa Cruz stocking complex). Within each of these buffered stocking complexes, we evaluated the potential for northern Mexican gartersnakes to be exposed to stocked sport fish by considering the criteria described below and detailed in Table 21.

It is difficult to determine whether gartersnakes occupy a site/area because their detectability is low and recent systematic surveys have generally not been conducted in most areas.

Therefore, to make our determination, we built a case using positive observations reported from HDMS, the Arizona Game and Fish Riparian Herpetofauna Database, and the USFWS (2008a) 12-month finding to determine whether or not northern Mexican gartersnakes are likely to occupy each buffered stocking complex. Rosen and Schwalbe (1988) began the first large-scale surveys for gartersnakes in 1985, which contributed to our understanding of their recent

distributions in Arizona. Therefore, occupancy was described according to whether observations were made prior to or after 1985. Then based on the occupancy determinations, we evaluated whether there is a likelihood of exposure to stocked sport fish, as described below and detailed in Table 21. We did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

1. Occupancy—stocking complexes will be considered:

    a. Occupied—if there are positive gartersnake observations within the complex since 1985 (Rosen and Schwalbe 1988, Rosen and Schwalbe 2001, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database) or the USFWS determined that the species is likely extant (USFWS 2008a).

    b. May be occupied—if gartersnake records exists prior to 1985, but since then either surveys have been conducted and no snakes have been found, no systematic surveys have been conducted and habitat condition has diminished (e.g., bullfrogs or crayfish are present), or the USFWS has determined that its status is unknown.

    c. Unoccupied—if a single historical record exists (prior to 1985) but no observations have been made since, the USFWS (2008a) has determined that the species is likely extirpated, or the area lies outside the historical range of the species (Rosen and Schwalbe 1988, Rosen and Schwalbe 2001, Holycross et al. 2006, HDMS).

2. Likelihood of exposure:

    a. Exists—if there is a known population of northern Mexican gartersnakes occupying the complex or snakes are likely to move into the stocking complex because they persist nearby, then there is a likelihood that snakes could encounter stocked sport fish.

    b. Low—if the status of northern Mexican gartersnake populations is unknown in the complex, or the habitat is less suitable because there are other invasive species already present, such as bullfrogs and crayfish, then there is a low likelihood that snakes could encounter stocked sport fish.

    c. Does not exist—if northern Mexican gartersnakes are likely extirpated from a stocking complex or the area lies outside the historical range of the species, then it is unlikely that snakes will encounter stocked sport fish.

Table 8. Criteria for determining whether northern Mexican gartersnakes occupy a site/stocking complex and the likelihood of exposure to stocked sport fish.

Status	Available data/habitat condition	Likelihood of exposure
Occupied	Records >1985; USFWS (2008a) determined status as likely extant.	Exists (positive)—species known to occupy area.
May be occupied	Records exist <1985, but no systematic surveys have been conducted; or, surveys have been conducted but no snakes were observed; or, habitat condition is diminished (e.g., invasive bullfrogs or crayfish present); or, USFWS (2008a) determined status as unknown.	Low—species may occupy area or habitat suitability is low.
Unoccupied	Single historical record exists (<1985), but no observations since then; or, USFWS (2008a) determined status as likely extirpated; or, area lies outside historical range.	Does not exist (negative)—species is unlikely to occur.

Downstream analysis:
There is potential for northern Mexican gartersnakes to occur downstream of stocking sites, stocking stream reaches and outside buffered stocking complexes. Therefore, after carefully examining water connectivity and potential fish movement as described within each stocking complex chapter, we analyzed the likelihood that gartersnakes could be exposed to dispersing sport fish or that gartersnakes will move into the stocking complexes based on the occupancy criteria presented in Table 21, above.

Narrow-headed Gartersnake

Range wide discussion

Narrow-headed gartersnakes are one of the most aquatic gartersnake species, only leaving the water to bask, rest, or gestate (Rosen and Schwalbe 1988; Rossman et al. 1996). The species is confined to primarily large, perennial streams within montane and Great Basin conifer woodlands, chaparral, and upland desert scrub. Important microhabitats include the submerged rock-boulder complexes near riffles and pools, and thick backside vegetation used for basking and escaping from predators (Rosen and Schwalbe 1988, Degenhardt et al. 1996). Narrow-headed gartersnakes also appear to be strongly tied to boulders, rock piles, and other cover structures that lie within the floodplain of creeks (Nowak 2006).

The historical range wide distribution for narrow-headed gartersnakes includes permanent drainages of the Mogollon Rim and White Mountains of Arizona and New Mexico, and the Sierra Madre Occidental in Mexico. They are primarily found at elevations of 1200-1900 m (3937-6234 ft), but have been observed at elevations of 700-2430 m (2297-7972 ft) (Holycross et al. 2006). In Arizona, narrow-headed gartersnakes are found in headwater streams of the Gila River watershed.

Narrow-headed gartersnakes forage for prey along stream banks, in shallow riffles, and between boulders within the stream (Rossman et al. 1996, Pierce 2007). Small soft-rayed fishes make up their primary diet (Nowak and Santana-Bendix 2002), which includes suckers, rainbow trout, red shiner, speckled dace. They have also been reported to prey on larval and adult anurans and larval tiger salamanders (Degenhardt et al. 1996). Narrow-headed gartersnakes will, to a lesser extent, take spiny-rayed fish such as sunfish and catfish (Degenhardt et al. 1996, Pierce 2007). Nonnative spiny-rayed fishes are thought to be unsuitable prey because narrow-headed gartersnakes cannot safely ingest the fish without them becoming lodged in their throats or causing other physical damage to the digestive tract (Nowak and Santana-Bendix 2002).

Narrow-headed gartersnakes have experienced significant population declines throughout their range in Arizona and New Mexico (Holycross et al. 2006, Pierce 2007). Holycross et al. (2006) surveyed for gartersnakes during 2004 and 2005 and only found narrow-headed gartersnakes at 5 of 16 known historical Arizona localities. Based on those surveys, Holycross et al. (2006) concluded that the species was likely extirpated from 5 of the surveyed sites. Furthermore, narrow-headed gartersnakes have experienced significant declines at one of the largest known populations in Arizona in Oak Creek Canyon. As a result of recent (2002, 2004, and 2005) surveys, Nowak and Santana-Bendix (2002) and Nowak (2006) determined that narrow-headed gartersnakes may be extirpated from sites downstream of Oak Creek Canyon. Also, they suggested that while snakes in the upper reaches of the canyon appear to be persisting, there is a declining trend in numbers of snakes detected in the lower reaches of the canyon.

As with other gartersnake species in Arizona, multiple stressors are likely contributing to this species' decline (Nowak 2006). Nonnative predators such as fish, crayfish, and bullfrogs are believed to be the main cause of decline for the species throughout its range, however, other major threats include habitat destruction and degradation associated with aquatic recreation, urbanization, and overgrazing (Rosen and Schwalbe 1988, Rossman et al. 1996, Nowak and Santana-Bendix 2002).

Home Range Size:
All home range information for this species is based on one radio-telemetry study (n = 4 males, 5 females) at Oak Creek Canyon (Nowak 2006). Narrow-headed gartersnakes appear to have intermediate home range sizes compared to published home ranges for other gartersnake species,

with males, on average, having a larger home range than females. Home ranges of males at Oak Creek Canyon were up to 2.2 ha (5.44 acres) in size, while female home range was up to 1.1 ha (2.72 acres) in size. Home ranges, especially those of males, were very linear, as would be expected for a snake that does not venture far from stream habitats during their active season (March through October/November). During their active season, narrow-headed gartersnakes used upland areas up to 100 m (328 ft) from the creek, but were strongly associated with boulders within the floodplain. Hibernacula consisted of rock piles, hillsides with small rocks, boulders, and rock overhangs located 20-200 m (66-656 ft) from the creek. There are no data available describing long distance movements in narrow-headed gartersnakes. However, Harter's watersnake (*Nerodia harteri*) is a snake of similar size, habits and ecological characteristics, has been well studied in rivers in Texas, and provides an ecological analogue with which to predict movements in narrow-headed gartersnakes (Hibbits and Fitzgerald 2005). Harter's watersnakes also typically move relatively short distances during a season, e.g., approximately 150-460 m (493-1509 ft), but over several years, one male moved 19 km (11.8 mi) (Greene 1993, cited in Gibbons and Dorcas 2004, Whiting and Dixon 1997). Therefore, similar long-distance dispersal might be expected in narrow-headed gartersnakes. Although the downstream movement potential during high water events is unknown, narrow-headed gartersnakes are probably unlikely to make large overland movements, since the species is highly dependent on water for foraging.

Criteria Developed:
As described above, narrow-headed gartersnakes are riparian obligates and they forage almost exclusively on fishes. While home range and movement data are limited for narrow-headed gartersnakes, we assumed the frequency at which narrow-headed gartersnakes will make large overland movements is extremely low (i.e., rarely found >200 m [219 ft] from stream edge) and that they will travel linearly along narrow perennial riparian corridors. By examining the inter-connectivity of the perennial waterways and fish movements as described within the stocking complex chapters, we evaluated the potential for exposure of narrow-headed gartersnakes to stocked sport fish for each watershed in which there are positive records for the species. For those watersheds in which gartersnake populations existed historically but are currently believed extirpated or of unknown status (Holycross et al. 2006), we determined that narrow-headed gartersnakes are unlikely to occupy the stocking complex and that there was no likelihood of exposure to stocked sport fish. The likelihood of exposure to stocked sport fish was not evaluated for watersheds that lie outside the known historical range of the species or for which there is a single historical record prior to 1985 and no additional observations.

Throughout the discussion of gartersnakes, AGFD uses the term "less suitable," which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not gartersnakes will or can occur in a particular area. The ability of gartersnakes to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to cover, prey, predators, etc.. While some sites might be capable of supporting large

adult snakes, those same sites might not allow for successful recruitment. Stocking sites or stream reaches would be considered "less suitable" for gartersnakes when local conditions generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for gartersnakes because they exert predatory or competitive pressures on the snakes. However, gartersnakes might continue to persist in "less suitable" sites in the presence of nonnative species if those sites have greater habitat complexity and provide escape cover or feeding sites for neonates or juvenile snakes. An example of this would be Mexican gartersnakes on the middle Verde River, where although we have few data on population status, snakes appear to persist in exceedingly complex riparian habitat in some areas (e.g., Dead Horse Ranch State Park) despite the presence of bullfrogs, crayfish and predatory fishes.

In addition, there are sites within the elevational range of gartersnakes where distributional data suggest gartersnakes do not occur, but other structural habitat features seem to be appropriate. Although lack of data does not necessarily equate with absence, if there are additional habitat characteristics (predators, lack of cover, etc.) that would preclude gartersnakes from occupying those sites or thriving, we also refer to those sites as "less suitable" which contributes to a conclusion that snakes probably do not occur there.

Stocking complex analysis:
We used ArcGIS to map and identify sport fish stocking complexes for which positive observations of narrow-headed gartersnakes exist and that lie within the historical range of the species (Nowak and Santana-Bendix 2002, Nowak 2006, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database). Because narrow-headed gartersnakes are unlikely to make long distance overland movements, we did not analyze the potential for exposure to stocked sport fish at sites in which it would be necessary for gartersnakes to travel >0.25 mile (>0.4 km) overland to reach those sites. For stocking sites with aquatic connectivity, we took a conservative approach and assumed that narrow-headed gartersnakes can move upstream and downstream throughout the stocking complex, similar to fish movements. To analyze the likelihood of exposure to stocked sport fish, we first determined whether narrow-headed gartersnakes occupy the area according to the criteria listed below and described in Table 22, and then examined the degree of aquatic connectivity that would permit gartersnakes to move through the stocking complex. Similar to our analysis for northern Mexican gartersnakes, we did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

As discussed above for northern Mexican gartersnakes, it is difficult to determine whether gartersnakes occupy a site/area because their detectability is low and systematic surveys have generally not been conducted in most areas. Therefore, to make our determination, we built a

case using positive observations reported from HDMS, the Arizona Game and Fish Riparian Herpetofauna Database, and (Heritage) reports to AGFD to determine whether or not narrow-headed gartersnakes are likely to occupy each stocking complex. Rosen and Schwalbe (1988) began the first large-scale surveys for gartersnakes in 1985, which contributed to our understanding of their recent distributions in Arizona. Therefore, occupancy was described according to whether observations were made prior to or after 1985. Then, based on the occupancy determinations, we evaluated whether there is a likelihood of exposure to stocked sport fish, as described further below and detailed in Table 22. We did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

1. Occupancy—stocking complexes will be considered:

    a. Occupied—if there are positive gartersnake observations within the complex since 1985 (Rosen and Schwalbe 1988, Nowak and Santana-Bendix 2002, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database) and suitable habitat exists.

    b. May be occupied—if gartersnake records exist prior to 1985, but since then either surveys have been conducted and no snakes have been found or no systematic surveys have been conducted and habitat condition has diminished (e.g., bullfrogs or crayfish are present).

    c. Unoccupied—if a single historical record exists (prior to 1985) but no observations have been made since, habitat is unsuitable for the species (e.g., closed basin lakes), or the area lies outside the historical range of the species as identified by Holycross et al. (2006).

2. Likelihood of exposure—level of exposure:

    a. Exists—if there is a known population of narrow-headed gartersnakes occupying the complex or snakes are likely to move into the stocking complex because they persist nearby, then there is a likelihood that snakes could encounter stocked sport fish.

    b. Exists but is low—if the status of narrow-headed gartersnakes is unknown in the complex, the habitat is less suitable because there are other invasive species already present, such as bullfrogs and crayfish, or the species would need to make large overland movements in order to reach the stocking complex, then there is a low likelihood that snakes could encounter stocked sport fish.

c. Does not exist—if narrow-headed gartersnakes are unlikely to occupy the area because it is not suitable habitat or the complex lies outside the historical range of the species, then it is unlikely that snakes will encounter stocked sport fish.

Table 9. Criteria for determining whether narrow-headed gartersnakes occupy a site/stocking complex and the likelihood of exposure to stocked sport fish

Status	**Available data/habitat condition**	**Likelihood of exposure**
Occupied	Records >1985 ; and suitable habitat exists.	Exists (positive)—species known to occupy area.
May be occupied	Records exist <1985, but no systematic surveys have been conducted; or, surveys have been conducted but no snakes were observed; or, habitat condition is diminished (e.g., invasive bullfrogs or crayfish present).	Low—species may occupy area; or, habitat suitability is low; or, large overland movement necessary for species to reach stocking complex.
Unoccupied	Single historical record exists (<1985), but no observations since then; or, habitat is unsuitable for the species (e.g., lakes); or, area lies outside historical range .	Does not exist (negative)—species is unlikely to occur.

Downstream analysis:
There is potential for narrow-headed gartersnakes to occur downstream of stocking sites, stocking stream reaches and outside buffered stocking complexes. Therefore, after carefully examining water connectivity and potential fish movement as described within each stocking complex chapter, we analyzed the likelihood that gartersnakes will be exposed to dispersing sport fish or that gartersnakes will move into the stocking complexes based on the occupancy criteria presented in the table below.

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Chapter 4 SPECIES ANALYSES

SPECIES INTERACTIONS AND EFFECTS ANALYSIS

INTERACTIONS BETWEEN STOCKED FISH AND NATIVE FISH SPECIES

Introduction

The decline of native aquatic species is primarily attributed to numerous human-induced disturbances including dam construction, irrigation development, and community development which produced impacts such as habitat loss, habitat change, and variations in water temperatures and flow characteristics. The introduction of nonnative aquatic species, particularly fish, is also implicated in the decline of native aquatic species. The introduction of nonnative aquatic species into areas outside of their historical range or where they were previously absent has occurred worldwide and is the subject of literature in many countries including the United States (see references to follow), Canada (Van Zyll de Jong et al 2004), Europe (Cowx and Gerdoux 2004), New Zealand (McDowall 2003), and South America (Macchi et al 1999).

Today, it is widely accepted that the introduction of nonnative fishes can influence native fishes by predation, competition, hybridization and the introduction of diseases or parasites (see for example Robinson et al 1997; Zimmerman 1999; Adams et al. 2001). In addition to these potential interactions, Moyle (2002) described interactions as well as the potential for habitat interference (changes to physical or biological qualities of the habitat due to the actions of the nonnative species). The result of these potential interactions can be the elimination or reduction of native species, reduced growth and survival of native species, changes in the community structure, or no effect or no measurable effect (Moyle et al. 1986). Prior to the 1960s, the implications of these introductions on native aquatic fauna were unknown or not typically considered. However, for many decades now, the impacts of nonnative fish on native aquatic communities is considered and incorporated into management plans.

Interaction opportunities

The interaction opportunities that may result from the introduction of nonnative fishes including predation, competition, and the introduction of disease and parasites are discussed in this section. Hybridization is discussed in the Background section specific to trout. While it is recognized that habitat interference due to the addition of nonnative fish is a potential impact to native aquatic communities, the dynamics associated with these impacts have focused largely on changes in the food web dynamics in lakes or coastal and estuarine systems after the introduction or removal of top predator nonnative fish species or nonnative molluscs (see for example Elser et al 1995; Holmlund and Hammer 2004 and references within; Ruesink et al 2005). In general, it is recognized that fish play a part in regulating food web dynamics and what they consume as well as what they are consumed by also impact the trophic structure and biodiversity of waters. It is

important to note that even between species that evolved together, the dynamics of current interactions may not be the same as before habitat alterations occurred. The assumptions of how the native species will interact under current conditions take this into account, while acknowledging the historical context.

Competition.—In order to evaluate the impacts of intra- or inter-specific competition between native aquatic species and stocked nonnative fish, the basic ecology of each species involved must be understood. In general, competition occurs when multiple organisms use common and limited resources. For competitive interactions between salmonids and between species with similar dietary preferences, competition is for habitat space for foraging rather than direct competition for individual foods (Pacificorps 2004). Presumably intraspecific competition between salmonids for limited spawning, foraging, and overwintering habitat may be influential to the growth and survival of individuals because habitat preferences and requirements are the same.

The effects of interspecific competition are difficult to quantify, particularly when species introductions produce a species assemblage which were not naturally sympatric. Baltz and Moyle (1984) found that populations of Sacramento suckers (Catostomus occidentalis) and rainbow trout exhibited high resource overlap yet partitioned themselves vertically in the stream, thus minimizing similar microhabitat use. Based on studies conducted in California streams, Baltz and Moyle (1993) postulated that native species assemblages are highly structured and provide resistance to invasions of introduced fishes by their adaptability to fluctuating environmental conditions and the presence of occasionally predacious native fishes that may prey on juvenile introduced fishes. Similar results were found in North Carolina, where the species assemblage and microhabitat use were determined primarily by flow variability rather than interspecific competition for limited resources and predation (Grossman et al 1998). At a broader scale, species assemblages can also be determined by human induced changes in habitat. For example, Moyle and Nichols (1974) surveyed streams in the Sierra Nevada foothills of California and found that introduced species occurred primarily in disturbed habitats due to dam construction and development, and the range of native fishes moved upstream out of these areas.

To determine the quantifiable impacts of inter- and intra-specific competition, the experimental design of the study must include comparisons between the impacts of adding and/or removing interspecific competing species versus the impact of adding and/or removing intraspecific competitors (Lemly 1985; Fausch 1988). Additional considerations include, but are not limited to, the plasticity of native and nonnative aquatic species in habitat preferences, timing of overlap, carrying capacity of habitats, available habitat niches, water velocity and temperature variations and adaptations (Baltz and Moyle 1984; Fausch 1988; Baltz and Moyle 1993; Pacificorps 2004).

The evidence of competition is rarely quantified and is largely inferential (Moyle 1986). More often, environmental conditions such as drought and flow variations impact the species assemblage by causing mortality and low recruitment (Baltz and Moyle 1993; Grossman et al 1998; see Introduction). However, it is recognized that competition for limited resources may occur and may be highly variable based on many factors discussed in this section. Although the capacity of habitats to support a particular biomass of fish varies, and other factors influence the actual biomass present (Clarkson and Wilson 1995), the addition of individuals to resident fish populations may result in resource limitation and subsequent competitive interactions.

Predation.— The degree of piscivory in the proposed species for stocking varies substantially. Studies have documented the following ranges of piscivory (in percent of diet), some of which will be discussed in more detail in the Background section: brook trout (0-60%), brown trout (10-60%), cutthroat trout (0-22.5%), rainbow trout (0-8%), channel catfish (0-55%), largemouth bass (15-100%), smallmouth bass (10-100%), and sunfish (10-65%) (Griffith 1974; Cunjak et al 1987; Mittelbach and Persson 1998; Railsback and Rose 1999; Simpkins and Hubert 2000; L'Abée-Lund et al 2002; Mistak et al 2003; Olson and Young 2003; Wheeler and Allen 2003; Fritts and Pearsons 2004; Hilderbrand and Kershner 2004; Naughton et al 2004; Nowak et al 2004; Haddix and Budy 2005; Kawaguchi et al. 2007; Tabor et al 2007). The effects of nonnative fish predation on native fish may impact the population structure of native fish and this largely depends on the degree of piscivory in nonnative fish, as well as several other factors, including: species assemblage and prey base, and competition among top predators (Lemly 1985).

Nonnative aquatic species vary in the type and degree of potential interactions they have with native aquatic species. Some nonnative aquatic species are more piscivorous than others; some are more aggressive and are better competitors for space. Individuals of the two species must, at some time, be in the same place (occupy or use the same water or specific habitats within that water), be in competition for resources (food or habitat), or, for direct predatory interactions, also be available at the right size for the predation attempt. There may be seasonal dynamics that determine when an interaction may occur based on when the nonnative aquatic species is present and the life stage and vulnerability of available prey.

Diseases and Parasites

Potential to spread pathogens by the AGFD fish stocking program

The potential risk of spreading pathogens through the AGFD hatchery stocking program has been rigorously evaluated by the AGFD in conjunction with the USFWS and it is greatly reduced through recurrent fish heath inspections and strict Hazard Analysis and Critical Control Point planning (HACCP). Based on current knowledge, all pathogens that have been found in Arizona hatcheries have also been found in wild populations in Arizona waters (Table 23; AGFD 2010), making it less likely that novel pathogens will be introduced into Arizona waters. Also, evidence

indicates that a greater number of pathogens have been found in wild fish than in fish within Arizona hatcheries, even though disease testing occurs more frequently at hatcheries (Table 23). Amos and Thomas (2002) found a greater risk of disease transmission from wild fish to hatchery fish, than from hatchery fish to wild fish. This is perhaps due to the conditions created by the intensive culture of hatchery fish, making them more prone to infections. In wild fish populations, lower fish densities confer some safeguards regarding transmission. Also, wild fish are less stressed and may have stronger and more natural immune systems compared to hatchery-raised fish.

To prevent the spread of pathogens, the AGFD follows the same protocols for fish health inspection as the USFWS National Fish Hatcheries and the USFWS Fish Health Centers: the American Fisheries Society Fish Heath Section Blue Book co-authored by the USFWS (Thoesen 2007). This handbook reflects the combined efforts and expertise of the USFWS Fish Health Centers and the American Fisheries Society Fish Health Section. It has been assembled by a vast array of individuals with academic and field expertise. It is a compilation of methodologies determined to be most appropriate for detecting the presence of specific pathogens during an aquatic animal health inspection. The methodologies are based on numerous sources, including the USFWS National Wild Fish Health Survey Manual, the American Fisheries Society Blue Book, 5th edition of the Office International des Epizooties (OIE) Manual of Diagnostic Tests for Aquatic Animals, Alaska Department of Fish and Game, Fish Pathology Section Laboratory Manual, and peer reviewed literature.

The AGFD HACCP plan complies with international standard (ASTM E2590 - 09) for reducing or eliminating the spread of unwanted species. The HACCP was developed as an effective planning tool for creating best management practices to prevent the spread of non-target species. The USFWS, AGFD and State of Wyoming Game and Fish Department worked together to develop the HACCP Planning for Natural Resource Pathways manual keyed to the operations and activities associated with natural resource management and aquatic resource propagation (USFWS 2004). This tool provides a comprehensive method to identify risks and focus procedures to prevent the spread of species through natural resource pathways.

There are specific concerns that the AGFD hatchery stocking program may spread the amphibian disease *Bd*. This risk has been assessed and found to be very low due to the life cycle of Bd (Berger et al. 2005) and the precautions taken in the AGFD HACCP plan. The life cycle of Bd is a progression from a zoospore to the growing organism called a thallus. The thallus contains a zoosporangium which functions as a container for zoospores. The zoosprorangium cleaves into multiple zoospores that exit the zoosporangium through papillae. The motile zoospores attach to the keratinised outer layers of its amphibian host. Zoospores mature into zoosporangia that then release zoospores into the external environment. The cycle is initiated again once a suitable substrate (in the same or a different host) is found. This particular case of spreading Bd is one

that relies on the following series of events to occur that would lead to amphibians being infected by Bd in areas where the disease does not already exist. Specifically: 1) a hatchery would have to be infected with Bd; 2) zoospores contained in water from an infected hatchery would have to survive control points and treatments called for in the HAACP plan (See Chapter 1); 3) zoospores would then have to survive the trip in the hatchery truck to the stocking site; 4) zoospores would have to survive in stocking area long enough to encounter an amphibian host; and 5) the amphibian host would have to become infected and then spread the infection to other amphibians.

Table 1. Pathogens that are found in wild fish in Arizona waters. Also noted is their occurrence in Arizona hatcheries.

Pathogen	**Type**	**Found in Arizona Hatcheries (Y/N)**
Saprolegnia sp.	Fungal	Y
Lernaea cyprinacea	Parasitic	Y
Cestodes	Parasitic	Y
Ichthyophthirius multifilis	Parasitic	Y
Ichthyobodo necator	Parasitic	Y
Ambiphrya sp.	Parasitic	Y
Trichodina sp.	Parasitic	Y
Gyrodactylus sp.	Parasitic	Y
Dactylogyrus sp.	Parasitic	Y
Hexamita	Parasitic	Y
Clinostomum sp.	Parasitic	N
Posthodiplostomum sp.	Parasitic	N
Urilifer sp.	Parasitic	N
Leaches	Parasitic	N
Nematodes	Parasitic	N
Myxobolus cerebralis	Parasitic	N
Flavobacterium psychrophilus	Bacterial	Y
Flavobacterium sp.	Bacterial	Y
Flavobacterium columnare	Bacterial	Y
Yersinia ruckeri	Bacterial	Y
Aeromonas salmonicida	Bacterial	Y
Renibacterium salmoninarum	Bacterial	N
Aeromonas hydrophilla	Bacterial	N
Cyprinid herpesvirus-3	Viral	N
Unspecified reovirus	Viral	N
Infectious Pancreatic Necrosis Virus	Viral	Y

The only known occurrence and tests for Bd in the AGFD hatchery system is in bullfrogs found in the ponds at the Bubbling Ponds Hatchery. Trout are not raised in these ponds; trout are raised near Bubbling Ponds at the Page Springs Hatchery. Page Springs Hatchery has separate water sources (Pond Spring and Cave Spring). Another consideration is that trout are raised in raceways and do not come in contact with frogs and therefore are unlikely to come into contact with Bd.

Fish Species Proposed for Stocking

This section addresses currently proposed sport fish stockings in Arizona, by species (Table 24), and discusses potential interactions and impacts stocked fish may have on Federally listed, candidate or proposed native fish and other native aquatic species. A thorough background on proposed stocking species that exhibit varying degrees of piscivory is presented as well as survivability of stocked species, if sufficient background information was available. The following will be addressed for native fish:

- Impacts related to documented competition and/or predation between stocked and native fish (predation is discussed for stocked species with documented piscivory only);
- Impacts of hybridization between stocked and native salmonids.

*Table 2. Fish species proposed for stocking into Arizona waters. A * indicates a native fish species. The nonnative fish species proposed for stocking under this program are all currently found in Arizona.*

Group	Species
Salmonids	Rainbow trout, brown trout, brook trout, cutthroat trout, Arctic grayling, Apache trout*
Bass	Largemouth bass, smallmouth bass
Sunfish	Bluegill, redear sunfish, black crappie, white crappie
Catfish	Channel catfish
Carp	Triploid Grass carp (white amur)
Other	Walleye, yellow perch, threadfin shad

<u>Proposed stocking species: black basses (largemouth bass and smallmouth bass)</u>

History of stocked black basses

Stockings of other nonnative fishes occurred throughout the United States to diversify angling experiences in warmer waters. Centrarchids, native to North America east of the Rocky Mountains, have been widely introduced throughout the eastern and western United States. In Arizona, black basses were introduced in the late 1800s (Sublette et al 1990).

Survivability of stocked black basses

It is difficult to estimate the post-stocking survivability of stocked basses, primarily because they are predominately stocked into large lakes and reservoirs (Buynak et al 1999). The annual mortality of adult largemouth bass in the Lucchetti Reservoir in Puerto Rico may be greater than 50% and mortality from angling approximately 28% (Neal and Noble 2002). A meta-analysis of largemouth bass and smallmouth bass populations in North America revealed average annual natural mortality rates at 35% and annual angler harvest rates for the average population were over 30% (Beamesderfer and North 1995). Poor survival of subadult largemouth bass stocked into Carr Creek Lake, Kentucky, was observed and determined to result primarily from illegal harvest and stress from catch-and-release angling (Buynak et al 1999). Low long-term survival was documented for various sizes of largemouth bass fingerlings stocked into Illinois reservoirs and was greatly influenced by predation by resident piscivores, predominately adult largemouth bass (Diana and Wahl 2009). Considering the high natural mortality rates of stocked bass, fish are typically stocked in high numbers to establish sport fisheries.

Competition between black basses and native fish

Where largemouth bass persist, they are likely to be top predators. They prefer warmer streams and lakes with lower turbidity and beds of aquatic vegetation (Sublette et al. 1990; Moyle 1976; Bryan et al. 2000). Pacey and Marsh (1998) reported no data to support largemouth bass occupying higher velocity stream habitats in Arizona (e.g., riffles, runs, glides, eddies). In streams in the Sierra Nevada foothills of California, largemouth bass were found primarily in habitats disturbed by humans (e.g., dams, silt, irrigation diversions) and preferred warm, turbid pools (Moyle and Nichols 1973). Species diversity was high in areas where largemouth bass occurred, with an assemblage including mosquitofish, sunfish, bluegill, shiners, catfish, and carp. Largemouth bass, among other introduced fish, were less common in areas dominated by native fish. Native fishes were located in areas upstream, most likely displaced by a combination of habitat disturbance, water quality, and the presence of introduced fishes.

Little information exists regarding competition between black bass and native fishes; most information focuses on the impacts of predation of black bass on native fishes. However, competition and predation among top predators such as black bass, walleye, and northern pike in lake systems have been evaluated (see for example, Fayram et al 2005). For example, some studies in lacustrine habitats have found that predation on walleye by largemouth bass was the primary limiting factor for walleye production and survival (Fayram et al 2005). Thus, competition is possible between black bass and other top predator native fish in areas where they co-exist and resources are limited. Given the aggressive nature of black basses, displacement and/or competition between bass and native fish is possible if there is any overlap in diet or habitat.

Piscivory in black basses

Both largemouth and smallmouth basses are highly piscivorous at juvenile and adult ages. Largemouth bass larvae feed on zooplankton and switch to macrobenthos, and become piscivorous at 38-100 mm (Sublette et al. 1990; Mittelbach and Persson 1998). Adults may feed on a variety of organisms including insects, crayfish, frogs, snails, small mammals, reptiles, young waterfowl and other fishes (Sublette et al. 1990, Pacey and Marsh 1998). Bonar et al. (2004) considered largemouth bass to be the most significant piscivore in the Verde River with almost 17% (n = 1109) of the diet consisting of fish (8.3% native fish, 6.2% nonnative fish, 2% unknown fish). Other studies have documented piscivory rates in largemouth bass to range between 15-100%, varying by size and location (Mittelbach and Persson 1998; Olson and Young 2003; Wheeler and Allen 2003; Tabor et al 2007).

Young smallmouth bass feed on plankton, immature aquatic insects, and fish while adults take in crayfish, fish, and aquatic and terrestrial insects in lakes and streams. In streams, smallmouth bass can be very aggressive when hellgrammites and terrestrial insects are available. Once the bass reaches 200 mm in length, the diet may become nearly exclusively piscivorous when sufficient prey are present (Moyle 1976; Sublette et al 1990) and crayfish have been found to dominate the diets of adults when abundant as well (41-79% fish, 13-58% crayfish; Fayram and Sibley 2000). Piscivory rates for smallmouth bass have been documented to range between 3.4-100%, with rates varying by size, season, and location (Mittelbach and Persson 1998; Olson and Young 2003; Bonar et al 2004; Fritts and Pearsons 2004; Naughton et al 2004). Bonar et al. (2004) documented piscivory rates in smallmouth bass in the Verde River to be less than 4% (n = 1441) and most fish consumed were nonnative fish (2.8% nonnative, 0.7% native, 0.7% unknown). In the Columbia River, smallmouth bass diets were dominated by fish (70-83%) or crayfish (52%) during spring and summer, varying by location (Zimmerman 1999). Smallmouth bass consumed both native and introduced fish, but preferred native sculpins, suckers, and salmonids.

<u>Proposed stocking species: Channel catfish</u>

History of stocked channel catfish

Channel catfish, native to central North America and southern Canada, were introduced into warm water habitats in Arizona beginning in 1878.

Piscivory in channel catfish

There was insufficient information available in the literature on the survivability of channel catfish and competitive interactions with native fish. However, competition, including displacement, can occur with native fish where resources are limited and species co-occur. Channel catfish feed primarily on macroinvertebrates as well as plants, crayfish, and fish. In Missouri, the use of foods other than macroinvertebrates tended to increase when catfish reached larger sizes (Michaletz 2006). The channel catfish diet was dominated by macroinvertebrates

until fish size was greater than 550 mm or 650 mm, depending on the lake. Consumption of fish and crayfish increased with size and the highest piscivory rates were in channel catfish over 550 mm (10-35% of diet). Crayfish consumption was most substantial in fish greater than 650 mm (range 20-40% of diet). Piscivory in smaller channel catfish was much lower, ranging from 0-5% in fish 250-349 mm, about 3-10% in fish 350-449 mm, and about 10-15% in fish 450-549 mm. Chironomids were the most commonly consumed macroinvertebrate (52% of diet) with mayflies and caddisflies contributing to 12% of the diets. This study also found that plant materials and fish increased in the diet as the size of the catfish increased (>400 mm).

In Arizona, channel catfish and flathead catfish were documented to prey upon newly stocked juvenile razorback suckers, with 55% and 90% of diets consisting of suckers post-stocking, respectively (Marsh and Brooks 1989). Prior to stocking, flathead catfish fed primarily on red shiner and channel catfish, and channel catfish observed an omnivorous diet with both fish and insect prey consumed.

Proposed stocking species: sunfish (bluegill, redear sunfish, black crappie, white crappie)

History of stocked sunfishes
To diversify angling experiences in warmer waters, eventually stockings of other nonnative fishes occurred throughout the United States. Centrarchids, native to North America east of the Rocky Mountains, have been widely introduced throughout the eastern and western United States. In Arizona, bluegill were first stocked in 1932, crappie in 1905, and redear sunfish in 1946 (Sublette et al 1990).

Survivability of stocked sunfishes
There is little information available in the published literature on the post-stocking survival of sunfish reared in hatcheries; most literature on survival documents natural populations, primarily in lacustrine habitats. In general, sunfishes are considered short-lived, fast-growing fish with low natural survival rates (Sammons and Maceina 2008). In Georgia rivers bluegill lived for up to 7 years and annual mortality ranged between 66-79%. Redear sunfish reached a maximum of 10 years and annual mortality ranged between 40-42%. In Lake Panasoffkee, Florida, annual mortality rates for bluegill and redear sunfish were 64% and 68%, respectively, 50-55% of which were from natural mortality and the remainder from angler exploitation (Crawford and Allen 2006). Black crappie survival in Georgia reservoirs ranged between 8-18% and angler exploitation rates ranged between 40-68% (Larson et al 1991).

Survival of bluegill may depend on whether or not they co-exist with piscivores. Bluegill are known to have high survival rates in the absence of piscivores, but are an important prey fish in waters containing piscivores such as largemouth bass, which would impact bluegill survival and recruitment (Gabelhouse 1987; Santucci and Wahl 2003). For example, predation by largemouth

bass on larval bluegill produced a 13% mortality rate, while predation on juvenile bluegill produced a mortality rate between 58-93%; natural mortality was estimated at 87-97% for larval bluegill and less than 10% for juvenile bluegill (Santucci and Wahl 2003).

Establishment of reproducing populations for sport fishing in Arizona is only done in lakes and ponds, not streams or rivers. Optimal riverine habitat for bluegills is characterized by the following conditions, assuming water quality is adequate: large, low gradient streams (<0.5 m/km); warm water temperatures (> 20° C); sluggish current velocities (<5cm/sec); clear water (<50 ppm suspended solids); and an abundance of bottom cover within pool areas (Stuber et al. 1982a). Bluegill are not abundant or widespread in most small or medium stream systems because of the limited habitat suitability.

Competition between sunfish and native fish

There is limited information published on the dynamics of competition between introduced sunfish and native fish. One study documented native fish (e.g., sunfish, darters, perch, pickerel, eel) abundances with small ranges in the New Jersey Pinelands were significantly higher in impoundments absent of introduced centrarchids (black crappie, bluegill, and largemouth bass; Bunnell and Zampella 2008). The impoundments supporting introduced centrarchids were generally considered degraded habitats, which may have been less suitable for native fish, resulting in fewer fish. Predation and competition among native fish and introduced centrarchids likely occurred, yet impacts to native fish by largemouth bass were likely more severe than impacts from black crappie and bluegill (Bonar et al 2004).

Piscivory in sunfish

Bluegill.—Eagles-Smith et al (2008b) observed bluegill in Clear Lake, California, less than 45 mm to consume both pelagic and benthic insect prey, and fish greater than 45 mm fed primarily on benthos; bluegill were not observed to feed on fish. Crayfish, fish, zooplankton, and aquatic vegetation may also be consumed by bluegill in particular habitats (Seaburg and Moyle 1964; Sigler and Sigler 1987; Sublette 1990). For example, bluegill diets in two Minnesota lakes varied between lakes; bluegill consumed primarily insects (60%) and plants (21%) and were not piscivorous in Maple Lake, while bluegill in Grove Lake consumed fish (6%), insects (40%), and crustaceans (19%; Seaburg and Moyle 1964). Bluegill in two Washington lakes consumed primarily invertebrates and less that 1% of diets consisted of fish (Bonar et al 2005). Similarly, bluegill in two Missouri lakes consumed primarily macroinvertebrates and did not exhibit piscivory (Michaletz 2006). Bonar et al. (2004) considered bluegill to be primarily insectivorous in the Verde River; fish accounted for a small portion of bluegill diets (less than 4%) and bluegill were not considered to have a significant predatory impact on native fish populations. Minckley (1973) observed bluegill diets to consist of primarily zooplankton and aquatic insects, and occasionally very small fishes (threadfin shad and other sunfishes). In coastal Mississippi waters, bluegill consumed primarily insect larvae, copepods, and amphipods, and consumed larger

insects at larger sizes. Fish were not found in the diets of either bluegill or redear sunfish. Similar results were documented for redear and bluegill in Lake Pontchartrain, Louisiana (Desselle et al 1978).

Redear sunfish.—These sunfish primarily feed on benthic organisms (insect larvae, insects, snails, amphipods) and have evolved specialized muscles and molars for crushing mollusc shells (Lauder 1983; Etnier and Starnes 1993). The diets of redear sunfish from Lake Roosevelt consisted primarily of planktonic crustaceans, insect larvae, and small clams (Minckley 1973); redear sunfish consumed insect larvae, larger insects, amphipods and molluscs (Peterson et al 2006). Fish were not found in the diets of either bluegill or redear sunfish. Similar results were documented for redear and bluegill in Lake Pontchartrain, Louisiana (Desselle et al 1978).

Black and white crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey more on fishes as they mature (Etnier and Starnes 1993). In two Minnesota lakes, the dominating prey in black crappie diets varied between lakes (Seaburg and Moyle 1964). Black crappie fed primarily on fish (60%) and insects (36%) at Maple Lake and fed primarily on insects (49%), fish (23%), and crustaceans (12%) in Grove Lake. In Washington lakes, black crappie fed primarily on invertebrates (70-89%) and fish (8-27%; Bonar et al 2005). Sublette et al. (1990) described adult black crappies as mid-water carnivores, feeding on insects, crustaceans, other invertebrates, and small fish. They may prefer fish, insects, and crustaceans as adults, and planktonic crustaceans and larval insects as juveniles (Minckley 1973; Moyle 2002). Minckley (1973) stated that in Arizona, when they achieve 100 mm in length they feed almost entirely to threadfin shad where the species co-occur. White crappie are similar to black crappie, and are often difficult to distinguish, particularly at small sizes (Minckley 1973). In Kansas reservoirs, white crappie consumed primarily diptera larvae; however, 53% of crappie also consumed juvenile walleye (Quist et al 2003).

Proposed stocking species: trout and grayling

History of stocked trout

In the western United States from the late 1800s up to the mid 1960s, millions of trout were stocked into lakes and streams to enhance sport fishing opportunities (Pister 2001). The stockings of primarily salmonids were made by miners, cattlemen, sportsman groups, private individuals, and eventually government agencies. Rainbow trout and brook trout, both native to North America, were stocked in streams and lakes outside of their native ranges. Early rainbow trout stockings were most likely with fish from numerous California hatcheries (California Department of Fish and Game [CDFG] 2009) and brook trout were transported from the eastern United States. Brown trout were first brought to North America in the late 1800s and subsequently stocked into lakes and rivers across the country. Eventually states began raising nonnative salmonids in state-run hatcheries and produced fish were stocked into waters within each state. In western states in the late 1950s and early 1960s, it was not uncommon for fisheries

management activities to include chemically treating waters to reduce nongame fish abundance to favor game fish abundance (see for example, Moyle et al 1983). In Arizona, rainbow, brook, brown, and cutthroat trouts, arctic grayling, and coho salmon have been stocked historically.

Survivability of stocked trout

Most hatchery rainbow trout stocked into put-and-take fisheries in streams are caught within a few weeks (Butler and Borgeson 1965; Fay and Pardue 1986; Moyle et al 2002; Barnes et al 2009; CDFG 2009). This subject has been widely investigated for rainbow, brown, and brook trouts since the 1940s when fishery managers sought to increase survivability of stocked trout to meet angler demands (see for example: Chamberlain 1943; Miller 1954; Reimers 1963). For example, 50% of hatchery-raised brown trout stocked into Norway streams were caught within 15 days, and 90% within 67 days (Skurdal et al. 1989). In the Pigeon River, Michigan, survival of stocked hatchery rainbow, brown, and brook trouts was 22%, 26%, and 4%, respectively, 40 days post-stocking (Cooper 1953). Fewer than 10% of stocked rainbow and brown trout and less than 3% of stocked brook trout survived to overwinter. Survival of stocked hatchery-reared cutthroat trout and transplanted wild cutthroat trout, both stocked during the summer, were compared in Gorge Creek, Alberta (Miller 1954). Hatchery trout survival from summer to one winter ranged between 3 – 15% and wild transplanted trout survival was 62%. The majority of rainbow trout stocked into Convict Creek, California, were caught within the first few weeks post stocking and a small number of fish survived to overwinter (Reimers 1963). However, the majority of surviving fish died during the winter due to low condition factors at the end of the summer. These results are typical based on the results of other studies and indicate that stocked trout are generally either angled or experience natural mortality soon after stocking (Bachman 1984; Skurdal et al. 1989). Overwinter mortality may also be higher for stocked trout that survive the summer creel compared with resident trout (Meyer 1995; Simpkins and Hubert 2000).

One study in Arizona estimated post-stocking survival of catchable-size hatchery-reared native Apache trout and found that 34% of stocked trout survived three months post-stocking, however only 3% survived nine months post-stocking (Meyer 1995). Hatchery-reared brook trout stocked in Wisconsin streams during the fall, a domestic strain for 30 years, had survival rates at 6-months post-stocking between 33 – 49% and less than 1.5% survived for one year post-stocking (Mason et al 1967). In lakes, survivability of stocked trout is typically higher depending on the sport fishery (e.g., put-and-take, put-grow-take) and can range from 3-5 years (Haddix and Budy 2005; CDFG 2009). Studies conducted in 2006 in an Idaho River show that stocked triploid trout do not persist long in the stream, some of the mortality is likely due to angler harvest, however much is likely due to poor survival of stocked trout in stream environments (High, B. and K.A. Meyer, 2009). In this same study post stocking dispersal (30 days) was generally downstream of the stocking point with median movement values of maximum known downstream and upstream dispersal distance being 5.0 and 1.2km from the stocking point respectively.

In general, the high natural mortality rate observed in stocked trout is suggested to result from a combination of the following: stocked trout are poorly adapted to stream environments, competition with resident trout populations, high stocking densities, warming water temperatures, foraging techniques and natural feed, appropriate energy expenditures, and seasonal dominance hierarchies associated with drift feeding and territory establishment (Bachman 1984; Runge et al. 2008). For example, domestication and naivety may influence trout survival in streams by constant feed and/or overfeeding, lack of exercise, constant temperatures, absence of predators, and transport stress (Schuck 1948; CDFG 2009). In addition, habitat suitability also plays a strong part in the survivability of stocked trout (Montgomery and Bernstein 2008). Stand alone or combined, these adaptations may result in malnutrition and subsequent mortality. In a study examining the interactions between stocked greenback cutthroat trout (*Oncorhynchus clarki stomias*) and wild brown trout, cutthroat trout were typically displaced by brown trout and were at a competitive disadvantage for food and space (Wang and White 1994). In a separate study, cutthroat trout *in situ* in a linear foraging hierarchy set up with the dominant fish at the front and intermediate and subordinate fish behind. The dominant trout will have a foraging advantage because it can catch the most optimal invertebrates in the drift first (Lewynsky and Bjornn 1986). Foraging dominance hierarchies have also been documented for other salmonids including rainbow trout, brown trout, brook trout, and coho salmon (*O. kisutch*) (Jenkins 1969; Fausch 1984). It is postulated that trout stocked into a stream with previously established resident trout would not be able to establish a superior foraging position and would also be at an aggressive disadvantage (Jenkins 1969).

Based on information presented in the studies cited above, the survivability of hatchery-reared stocked trout in streams is low, regardless of the species, and a number of factors involved in hatchery methods may play a part. For put-and-take fisheries, most trout are harvested immediately to within a few weeks after stocking, so streams may be stocked multiple times throughout a season in a concentrated area to maintain acceptable catch rates. The frequency of stocking is dependent on many factors including the anticipated angling demand, recreational use potential of certain locations, existing fish populations, availability of trout, and the physical, chemical, and biological characteristics of the location receiving fish. Stocking frequency ranges from weekly to monthly, and the duration of the season largely depends on the temperature regime for individual streams and angler accessibility or use. Because survival of stocked trout is usually limited by summer water temperatures and overwintering success, harvest of trout in these waters is generally encouraged. Regulations typically permit the harvest of six trout per day with no size restrictions.

When trout are stocked at high densities multiple times a year, there may be a pulse effect where stocked trout are abundant for a short time before the majority of fish are harvested or die. The duration of the pulse events is highly variable depending on the number of fish stocked, angling

pressure, fishing mortality (harvest and catch related), natural mortality, stocking season duration, and the number of stockings that occur. A thorough review of the literature did not find publications that addressed the potential impacts of multiple trout stockings on native fish populations in the stocking locations. Thus, the competitive and predatory interactions discussed below are assumed to apply to these stocking strategies for put-and-take fisheries. It is acknowledged that there may be multiple stressors impacting any given fish population and that the additive impacts of put and take rainbow trout stocking may or may not have a significant impact on the persistence of native fish populations. The presence of wild and self-sustaining nonnative trout populations in Arizona is evidence that some stocked fish may survive, evade harvest and establish populations. Many of these existing trout populations were stocked earlier in Arizona's history and may have come from many different sources such as from hatcheries as adults, from hatcheries as juveniles, from wild trout transported directly from the natal stream to the Arizona stream as larvae, juveniles or adults or other vectors. Many of these populations may have first been established in remote first and second order streams that experience limiting fishing pressure; however, once established there, they spread into other suitable habitats With regard to rainbow trout, the transition of the stocking program to raising triploid, non-reproducing fish greatly reduces the opportunity for their stocking to result in establishment of new populations or augmentation of existing populations.

Competition between stocked trout and native fish

Competition for space between stocked trout and native or nonnative salmonids has been documented in several studies and may depend on a multitude of factors including prey availability, diet niches, territorial behavior, naivety, growth, and habitat conditions and preferences (Fausch 1988; DeWald and Wilzbach 1992; Wang and White 1994; Shemai et al 2007; Öhlund et al 2008). For example, one study determined there was significant overlap between the insectivorous diets of native Bonneville cutthroat trout (*O. c. Utah)* and nonnative brook trout in Idaho, but did not document any indication of competition that may result in different length/weight relationships (Hilderbrand and Kershner 2004). However, they noted that if food was a limiting resource there may be competition between the species. In contrast, a study examining competition between hatchery Rio Grande cutthroat trout (*O. c. virginalis*) and resident brown trout in New Mexico found that cutthroat trout lost weight and fed less in the presence of brown trout (Shemai et al 2007). Another study examining the success of stocked hatchery brook trout on resident brown trout found that brook trout exhibited poor survival as evidenced by lack of feeding success or inefficient feeding ability (Ersbak and Haase 1983). At the time of stocking, the condition factors of brook trout were significantly higher than for resident brown trout. The condition factor in brook trout declined significantly within two weeks of stocking; brown trout consumed significantly more prey and greater volumes of prey. After 2 weeks the condition factors between brown and brook trout were similar, however, brown trout continued to consume more prey and the condition factor of brook trout continued to decrease.

Displacement of native salmonids due to the presence of nonnative salmonids has been widely documented and is highly variable (see for example, Larson et al 1995; McHugh and Budy 2006). For example, some studies indicate that native stream-dwelling salmonids occupy headwater reaches more frequently than nonnative salmonids (Larson et al 1995; Dunham et al 1999; Paul and Post 2001). Paul and Post 2001 suggested the elevation gradient of trout occurrence to be a result of interspecific competition, angling harvest, and/or original stocking location. Native salmonids may be competitively superior at higher elevations and nonnative salmonids superior at lower elevation reaches. A study of potential displacement of native greenback cutthroat trout by nonnative brook trout determined that brook trout competitively influenced the recruitment of age-0 cutthroat trout; however, brook trout did not displace cutthroat trout at any other life stage when living in sympatry (McGrath and Lewis 2007). Strange and Habera (1998) determined that the range of native brook trout was not impacted by sympatric populations of rainbow trout and that the fluctuations in the numbers of both species over time was due to interactions of biotic and abiotic factors.

Interspecific competition has been documented for the relationship between native and nonnative salmonids (see references above), however, there is less information available on the competitive impacts of stocked trout on non-salmonid native fish. The impacts of resident nonnative trout on native galaxiids in New Zealand have been documented and include predation and exploitative competition for prey (McDowall 2003). Changes in habitat use have been documented in some studies examining the impact of nonnative salmonids on native small-bodied fishes. For example, Blinn et al (1993) found that Little Colorado spinedace used undercut banks more frequently when rainbow trout were absent, and spinedace were less abundant in habitats shared with resident rainbow trout populations (Blinn and Runck 1990). Due to temperature tolerances of trout, competitive interactions between stocked trout and other native fishes may be weakened in warm waters (Montgomery and Bernstein 2008).

Propst et al (1998) studied the interactions between nonnative stocked rainbow trout and native cyprinids (e.g., loach minnow, spikedace) and native suckers in the Gila River, New Mexico. At three study sites where rainbow trout were regularly stocked, a small number of hatchery rainbow trout were captured and native fishes were the most abundant. At two out of the three study sites, evidence of piscivory by hatchery rainbow trout on native fish was low (1/13 [8%] site 1; 1/11 [9%] site 2). Rainbow trout were found occupying different habitat than loach minnow and spikedace; trout were found most commonly in pools compared with the more common presence of native cyprinids in riffles. The authors concluded that the persistence of hatchery trout was low and predation on native fish was low, which likely reduced any negative impacts on native fish populations. A long-term study in the Gila River determined that the decline of native fishes was influenced by many factors (Propst et al 2008). In one study reach, the decrease in native fishes was due to the increase in nonnative predacious fish including

largemouth bass and yellow bullhead, and modified flow regimes. In another study reach where trout were consistently stocked until 1996, the decline in native fishes was not attributed to predation by stocked trout, but from impacts of drought and wildfire. Stocked trout in one study reach were implicated as a reason for decline of native fishes in that reach, and stocking was ceased in 1996. Thus, results were highly variable and dependent upon many factors.

Piscivory in Apache trout, rainbow trout, cutthroat trout, and Arctic grayling
Wild rainbow and cutthroat trout, not including steelhead or coastal populations of either species, are opportunistic feeders that primarily consume aquatic and terrestrial insects (diets consisted of invertebrates only: see for example, Railsback and Rose 1999; Simpkins and Hubert 2000; Hilderbrand and Kershner 2004; Kawaguchi et al. 2007). However, evidence of piscivory in rainbow and cutthroat trout has been documented at varying levels and piscivory is demonstrated more frequently in lacustrine habitats compared with fluvial habitats. For example, Hubert et al (1994) found evidence of piscivory in 1.5% of stocked rainbow trout from Lake DeSmet, Wyoming. Stocked rainbow trout in Flaming Gorge Reservoir, Utah, primarily consumed macroinvertebrates and only switched to limited piscivory at large sizes that accounted for 2.5 - 8% of trout diets (Haddix and Budy 2005). Elser et al (1995) documented piscivory in 1% of rainbow trout (n = 4/400) in Castle Lake, California. In contrast, evidence of piscivory in native populations of cutthroat trout in Lake Washington, Washington, was found in 22.5% of trout less than 200 mm and in 95% of trout greater than 400 mm (Nowak et al 2004).

In stream systems, stocked and resident cutthroat trout are less likely to consume significant amounts of fish compared with trout in lacustrine habitats (Young et al 1997; McGrath and Lewis 2007). For example, an investigation into the predation and competition between native greenback cutthroat trout and nonnative brook trout in Colorado streams revealed that 0.3% (n = 1/323) of brook trout contained fish in stomach contents and 2.9% (n = 3/136) of greenback cutthroat trout contained fish in stomach contents (McGrath and Lewis 2007). The majority of prey fish in the stomach contents of both species were cutthroat trout. The dominant stomach contents for both species were aquatic and terrestrial invertebrates. Native Colorado River cutthroat trout (*O. c. pleuriticus*) in the North Fork Little Snake River, Wyoming, exhibited no piscivory in their diets (Young et al 1997). In four Idaho streams, resident populations of nonnative brook and native cutthroat trout fed predominantly on aquatic or terrestrial insects and piscivory was rare (0.009% in cutthroat trout, 0.010% in brook trout; Griffith 1974). Similarly, cutthroat trout in the Logan River, Utah, were predominately insectivorous and fish were rarely consumed (0.006%; Fleener 1952).

Rainbow trout in stream systems may also exhibit rare piscivory. For example, rainbow trout in the Green River, Utah, were primarily insectivorous and piscivory was rarely documented (0.004%; n = 2/478; Filbert and Hawkins 1995). Documentation of piscivory in rainbow trout in Arizona and New Mexico streams has ranged between 4-9%, with diets primarily consisting of

invertebrates (Propst et al 1998; Robinson et al 2000; Bonar et al 2004). Sweetser et al. (2002) found this species was least piscivorous of the three trout species (brown, brook, rainbow) they examined in the Little Colorado River in Arizona. Blinn et al (1993) documented high rates of piscivory by resident rainbow trout feeding on Little Colorado spinedace (*Lepidomeda vittata*), a threatened native cyprinid, when trout and spinedace were monitored in 2 m x 3 m sections of Nutrioso Creek isolated with nets. The high piscivory rate exhibited may mimic the response of rainbow trout feeding behavior during periods of isolation due to drought, with a high number of smaller bodied fishes in the same isolated habitat.

Piscivory in Apache trout *in situ* has not been documented in stream systems.

Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Jones et al 2003; Sheuerell et al 2007). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996).

Piscivory in brown trout and brook trout

Piscivory in brook trout is typically documented at higher rates than rainbow trout and cutthroat trout; however, this is highly variable. For example, two populations of native brook trout in West Virginia exhibited no piscivory, and fed on aquatic and terrestrial invertebrates (Sweka and Hartman 2008). Two studies cited above (Griffith 1974; McGrath and Lewis 2007) found piscivory to be rare in nonnative brook trout. Similarly, the diets of rainbow, brown, and brook trout in the Pine River, Michigan, were predominately insectivorous and combined piscivory was less than 3% for all three species (Mistak et al 2003). A study of the winter diet of brook trout in three Ontario streams found fish to represent less than 10% of the diet composition in brook trout from only one of the three streams (Cunjak et al 1987). In contrast, fish constituted a large part of the brook trout diet in seven lakes in Ontario (Fraser 1981). As stated above, brook trout feed primarily on macroinvertebrates, but may also exhibit piscivory of varying degrees.

A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Brown trout are known to be generalists, and their diets may fluctuate between invertebrates and fish depending on prey availability and size of brown trout (Jonsson et al 1999; Jensen et al 2008). Their piscivorous behavior, as well as its plasticity, is well documented (e.g., Tabor and Wurtsbaugh 1991; L'Abée-Lund et al 2002). For example, a long-term study of brown trout in the Tunhovdfjord reservoir in Norway documented piscivory in trout to fluctuate between 10% and 60%, depending on the fluctuating populations of two prey species (L'Abée-Lund et al 2002). One study in eastern Arizona documented piscivory in rainbow trout (6%, n = 3/54), brook trout (25%, n = 1/4), and brown trout (33%, n = 7/24); one brown trout captured had consumed one Little Colorado spinedace (Sweetser et al 2002). Conversely, resident brown trout

in the Arkansas River, Colorado, exhibited no piscivory and consumed primarily macroinvertebrates (Clements and Rees 1997).

Similar to brook trout, studies have found the diets of brown trout to vary significantly (Mittelbach and Persson 1998) and piscivorous behavior is apparently more common in lacustrine habitats and for larger trout (e.g., Macchi et al 1999; Belica 2007). In Arizona, brown trout are proposed for stocking mostly in isolated waters, and interactions between stocked brown trout and native fish would likely depend on survivability and fish size.

Hybridization between stocked trout and native trout
Hatchery-reared rainbow trout and cutthroat trout will not be stocked into Apache trout or Gila trout recovery streams, which are located above natural or artificial barriers that prevent upstream movement of fish into protected recovery areas. It is possible that hybridization between nonnative trout (*Oncorhynchus* spp) and native trout could occur based on the following scenarios: 1) recovery populations of native trouts above barriers may move out of the recovery areas downstream of barriers and potentially hybridize with nonnative trout; and 2) barrier failure may result in the ability of nonnative congeneric trout to reach recovery areas and hybridize with native trout.

Proposed stocking species: walleye
History of stocked walleye
Walleye, native to the Midwestern United States and most of Canada, were introduced into Arizona in 1957.

Survival of stocked walleye
The survival of age-1 walleye stocked into Oneida Lake, New York, was estimated at 40% during the first 1.5 months post-stocking, and only 0.2-3.2% survived to age 4 (VanDeValk et al 2007). Survival of stocked walleye fry for the first 24 hours post-stocking ranged between 0-34% (Pitman and Gutreuter 1993).

Piscivory in walleye
The diets of walleye in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al 1984). Walleye older than 1 year were predominately piscivorous, consuming shiners, clupeids, and spiny-rayed fishes depending on seasonal availability. Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad where the species co-occur (Minckley 1973).

Proposed stocking species: yellow perch
History of stocked yellow perch
Yellow perch, native in central and eastern Canada and the United States, were introduced into Arizona in 1919.

Piscivory in yellow perch
There was insufficient information available in the literature on the survivability of yellow perch and competitive interactions with native fish. However, competition, including displacement, can occur with native fish where resources are limited and species co-occur. The diets of yellow perch in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al 1984). Most yellow perch consumed similar amounts of invertebrates and fish (e.g., 80-100% of diets were insects from April to August). Yellow perch switched to gizzard shad and shiners in the late summer early fall, then switched back to invertebrates as the numbers of forage fish declined. Out of the highly piscivorous ecotype, fish accounted for 5-25% of diets in the spring, 5-60% of diets in the summer, and 40-60% of diets. Yellow perch exhibited ecotypes that may consume fish exclusively (16%), invertebrates exclusively (35-59%), or a combination of both (25-48%; Paradis et al 2006). Bonar et al (2005) documented piscivory in yellow perch at approximately 7%, with invertebrates as the dominant prey type.

Interactions Between Native Fish and Stocked Fish
Apache trout
Interaction species: Apache trout, Arctic grayling, brook trout, cutthroat trout, rainbow trout

Habitat preferences and diet of Apache trout
Information concerning specific stream habitat requirements for all life stages of Apache trout is limited, but habitat preferences are similar to those of rainbow trout and cutthroat trout. Recovery populations of Apache trout currently exist mainly in headwater areas upstream from natural and artificial barriers. This environment is subject to extreme variations in both temperature and flow. Instream cover and bank cuts are important variables defining Apache trout habitat. In general, Apache trout select areas with the greatest depths and cover in the absence of nonnative trout. The temperature tolerances of Apache trout are similar to other species of trout, with critical limits above 25°C (Alcorn 1976; Lee and Rinne 1980).

Apache trout spawning in the White Mountains occurs from March through mid-June, and varies with stream elevation. Apache trout begin redd construction and associated spawning during receding flows in the spring, at approximately 8°C (Harper 1978). Redds are constructed primarily at downstream ends of pools in wide varieties of substrates (0.87 mm to 32 mm size), most frequently in water depths from 19-27 cm in areas that receive day-long illumination, with water velocities ranging between 50-110 cfs (Harper 1976). Spawning maturation is estimated to begin at 3 years of age, with eggs hatching in approximately 30 days, and emergence occurring about 60 days after deposition (Harper 1978).

The Apache trout is largely an opportunistic feeder that eats a variety of aquatic and terrestrial organisms, the utilization of which can vary with the season and fish size. Studies have shown Apache trout to be diurnal feeders, with mayflies and caddisflies dominating their diets in stream

environments (Robinson and Tash 1979). In lake habitats, Apache trout have been observed to feed on aquatic and terrestrial insects, zooplankton, crustaceans, snails, leeches, nematods, and fish (Clarkson and Dreyer 1996). Piscivory in Apache trout *in situ* has not been documented in stream systems.

Interaction: competition

Apache trout, cutthroat trout, and rainbow trout.—Competition for food or habitat, where limiting, among *Oncorhynchus* spp of trout may occur if the species interact due to overlaps in diet and habitat preferences. When trout are stocked or co-stocked with recreationally stocked Apache trout multiple times in a concentrated area, competition among stocked and resident trout for food or habitat would likely occur for a few weeks, which is when most stocked trout would be caught in the creel.

Apache trout stocked for recreation in an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River. Once stocked, Apache trout will be considered part of the recovery population. All other recreational stockings of Apache trout will occur in non-recovery areas for Apache trout.

Arctic grayling.— Natural reproduction of Arctic grayling in Arizona has not been documented and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. Because diets and habitat preferences overlap between Arctic grayling and Apache trout, there may be competition for food or habitat if the species co-occur.

Brook trout.—Competition between Apache trout and nonnative brook and brown trout has been implicated in the decline of the species mainly due to intraspecific competition for habitat (Apache Trout Recovery Plan 2009). There are some diet and habitat similarities between brook trout and Apache trout, thus, competition for food or habitat is possible if the species co-occur.

Interaction: hybridization

Hybridization between Apache trout and congeneric rainbow trout and cutthroat trout has been implicated in the primary cause of the decline of the species (Apache Trout Recovery Plan 2009). Hybridization between rainbow or cutthroat trout and recovery Apache trout would be possible considering the following scenarios: 1) recovery populations of native trout above barriers may move out of the recovery areas downstream of barriers and potentially hybridize with nonnative trout and 2) barrier failure may result in the ability of nonnative congeneric trout to reach recovery areas and hybridize with native trout. If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. If recreationally stocked Apache

trout survive the creel, it is possible that they may hybridize with stocked or resident nonnative trout that also survived the creel or are resident populations.

Interaction: predation

Apache trout.—Apache trout were downlisted from endangered to threatened in 1975 with an accompanying Endangered Species Act (ESA) 4(d) rule allowing Arizona and the White Mountain Apache Tribe to regulate take of the species and to establish sport fishing opportunities. As such, Apache trout are raised in AGFD hatcheries to catchable size and stocked into streams and lakes for recreational put-and-take fisheries. Because most stocked trout will be caught by anglers within the first few weeks post-stocking, and because many stocking locations do not provide suitable habitat and stream temperatures, they are not expected to establish viable populations.

Thus, the impact of stocking recreational Apache trout is the loss of individuals from a seasonally-temporary sport fish population and does not detract from the overall recovery of Apache trout. The co-stocked rainbow trout may compete for food and foraging habitat with the stocked Apache trout. The recreational stocking of Apache trout provides a conservation benefit by increasing public acceptance and appreciation for native and endangered species, and reduction of the risk of invasion and hybridization downstream of Apache trout recovery barriers.

The majority of trout stocked on a weekly basis through the summer months are caught within the first few days following stocking. Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and resident Apache trout would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al 2007; Jones et al 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and Apache trout would be rare.

Brook trout.—Brook trout are more predacious than rainbow and cutthroat trouts. Piscivory has been documented to range between 3-60% (Fraser 1981; Cunjak et al 1987; L'Abée-Lund et al 2002; Mistak et al 2003; Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al 2002).

Stocked brook trout may prey upon eggs, larvae, and juvenile Apache trout if recreationally stocked Apache trout become established and if the species co-occur. Because stocked brook trout and stocked Apache trout are similarly sized, predatory interactions between the species adults are not likely.

Rainbow trout and cutthroat trout.—Hatchery-reared rainbow and cutthroat trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Recreation Apache trout that survive the creel would likely become hybridized with resident rainbow trout that occur close to Apache trout stocking locations. If recreationally stocked Apache trout become established, predation by stocked rainbow trout on the eggs, larvae, and juvenile Apache trout is possible if the species co-occur. Because stocked rainbow trout and stocked Apache trout (for recreation) are similarly sized, predatory interactions between the species adults are not likely.

Apache Trout Interactions- Additional analysis

Conservation of the Apache Trout & Description of the Special 4(d) Rule

Reclassifying the species from endangered to threatened has had no effect on the regulations designed to protect and recover Apache trout. The only change was to allow take related to recreational fishing as provided in the special 4(d) rule, which accompanied the downlisting.

In general, establishment of recreational opportunities can be developed in recovery waters that have stable or increasing numbers of individuals and where habitat conditions are of sufficient quality to support viable populations of Apache trout under managed angling. In addition, recreational opportunities may be developed in non-recovery waters. The principal effect of the special rule is to allow take in accordance with fishing regulations enacted by AGFD, which were developed using the best available science.

A special rule for a threatened species may be issued by the Fish and Wildlife Service when it is deemed necessary and advisable to provide for the ‘conservation’’ of the species. The term conservation, as defined in section 3(3) of the Endangered Species Act, means to use and the use of all methods and procedures necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. The authority to take endangered or threatened species to relieve population pressures is applicable to our recovery efforts for Apache trout. Apache trout stocked for the purpose of providing angling opportunity are surplus to recovery needs.

Specifically, this special 4(d) rule contributes to the conservation of the Apache trout by: (1) Providing eligibility for Federal sport fishing funds, (2) enhancing the ability to monitor populations, and (3) creating goodwill and support in the local community. Despite these benefits, it is probable that some Apache hybrids would be produced given that other trout including rainbow trout, cutthroat trout, brook trout and brown trout may be co-stocked or

existing as wild reproducing populations are present in most reaches and connecting waters proposed for stocking. Apache trout might also be lost to predation or competition with other species co-stocked with Apache trout or nonnative wild species already established in the system; however, the benefits far outweigh any potential negative aspects of this action.

Finally, if Apache trout were stocked in additional waters, the angling public would be exposed to, and become more familiar with, Apache trout's natural beauty and value as a sport fish, thereby increasing public support for the program. There are several lakes and stream segments in Arizona that are not currently identified in long-term recovery strategies and that could provide quality angling opportunities for Apache trout.

Standard Effects Analysis: Nonnative Sport Fish Stocking

1. Stocked Apache trout co-stocked with other species: Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

   Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts was provided immediately preceding.

2. Apache trout escapement from recovery areas and exposure to stocked sport fish: If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas (see #1 above).

3. Stocked sport fishes moving above failed barriers or moving into recovery reaches: Impacts to recovery Apache trout are not expected to occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and AGFD would attempt to repair the barrier and if necessary renovate the reach to remove nonnative fish. During this period

of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

There are three stocking sites that are not separated by a barrier from a recovery Apache trout reach; they are:

- Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River whereby Apache trout stocked into Lee Valley Lake, upstream of the recovery reach, could escape and move into the recovery population. Apache trout are also stocked directly into the recovery population at Sheeps Crossing (see #4 below)
- a recovery population in the South Fork of the Little Colorado River. This recovery reach is located above a barrier; however, Mexican Hay Lake is located upstream of both the barrier and recovery reach. Apache trout stocked into Mexican Hay Lake may escape and reach the recovery population downstream, and
- Ackre Lake, located in the headwaters of Fish Creek Fish Creek is a recovery stream, and Apache trout or Arctic grayling may escape Ackre lake and enter the recovery population downstream in Fish Creek.

Standard Effects Analysis: Apache Trout Stocking

A detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.) between Apache trout and other listed species was provided above. Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed in the watershed analyses (Chapters 5- 11 as appropriate). Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described later in this chapter.

4. Stocked Apache trout into recovery Apache trout: The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

   Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River. All other recreational stockings of

Apache trout will occur in non-recovery areas for Apache trout. This recovery population is designated open to angling under the special 4(d) rule. Once stocked, Apache trout will be considered part of the recovery population. AGFD would stock hatchery reared apache trout into the recovery population at densities expected to maintain angler satisfaction while minimizing impacts to the population as a whole. Some density dependent competition may occur in the stocking reach however not throughout the entire recovery reach since stocking only occurs at the lower end of the reach where angler access is possible.

5. Impacts from stocked Apache trout on other candidate or listed species and critical habitat: Impacts from stocked Apache trout on listed species may include predation, and/or competition for resources. AGFD's intent is to manage for a native Apache trout fishery (rather than a nonnative fishery) by maintaining an Apache trout stocking program that provides angling opportunities to not only promote a native fish community, but also to further conservation for not only Apache trout, but additional listed aquatic species found within the areas proposed for stocking of Apache trout. This strategy is an attempt to balance native and sport fish management in the state by taking advantage of opportunities to utilize native fishes to provide both sport opportunity and conservation. While Apache trout may prey on, or compete with, other candidate or listed species, the AGFD's intent in these stocking areas is to recreate what happened in nature historically (i.e., a native predator eating a native prey species).

6. Impacts from wild populations on stocked Apache trout: The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

   Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Site specific analyses

The six possible stocking situations that would impact Apache trout (AT) were described above. The stocking locations that may result in each of the six situations are presented in Table 25 and are:

1. Stocked AT co-stocked with other species;

2. Recovery AT escaped and into stocked fish;

3. Stocked fish moving above barriers or moving into AT recovery areas;
4. Stocked AT stocked into recovery AT;
5. Stocked AT impacting other candidate or listed species and/or critical habitat; and
6. Stocked AT into established nonnative populations.

Table 3. Stocking situations (1-6) that apply to the proposed Apache trout stocking sites.

ATr = recovery Apache trout ATs = stocked Apache trout

Complex	Stocking Site	Situation	Notes
LCR above Lyman	Becker Lake	1, 6	Stocking RT, AP and grayling.
West Fork LCR	White Mountain Reservoir	2, 3	RT stocked, could move downstream, if barriers on south failed stocked RT could move upstream into the recovery reach.
	Mexican Hay Lake	3, 6	Only AT stocked. If there is an irrigation release, ATs could possibly reach the South Fork LCR and a population of ATr. If ATs make it downstream as far as the LCR (very unlikely they will get out of Mexican Hay Lake because since the outlet is non functional) they could come into contact with wild brown and rainbow trout.
	Lee Valley Lake	1, 3, 4, 6	Stocking AT and grayling. ATs and grayling may move downstream into the West fork (recovery population); emigration is expected to be low and ATs would assimilate into recovery populations. ATs or grayling would not be able to reach east fork except for in the event of a valve check every 10 yrs. Stocked APs could even move further downstream into River Reservoir or LCR where wild rainbow trout and brown trout are present
	Bunch Reservoir	1, 3, 6	Stocking RT and AT. For Bunch, Tunnel and River there is a possibility of either RT or ATs reaching ATr if the barriers fail on the West Fork or South Fork.
	Tunnel Reservoir	1,3, 6	Stocking RT and AT. See Bunch
	River Reservoir	1,3, 6	Stocking RT and AT. See Bunch
	LCR Greer	1, 2, 3, 6	Stocking RT and AT. If barriers at West Fork and East Fork LCR; or movement of ATr over the barriers into the LCR Greer.
	LCR at Sheep's Crossing	2, 4, 6	Stocking AT into a ATr reach. In this reach stocked APs = ATr, and they could move downstream into LCR Greer, River Reservoir and the LCR below that.
Upper LCR	Little Ortega Lake	2, 3	ATr in Mineral creek upstream from Little Ortega above a barrier. CC stocked in Little Ortega.

Complex	Stocking Site	Situation	Notes
White Mountain (LCR)	Silver Creek	1, 6	Stocking RT and AT.
Schoen's Complex (LCR)	Show Low Lake	1, 6	Stocking RT, BT, CT, AT, CC and bluegill.
	Show Low Creek	1, 6	AT stocked in Show Low Lake could move downstream into Show Low Creek. Possible impacts from trout stocked in the creek and resident RT non native fishes.
	Fool's Hollow	1, 6	Stocking RT, BT, CT, AT, CC and bluegill.
Black River Complex (Salt)	Ackre Lake	1, 3, 6	Stocking AT and grayling. ATs could go over spillway into ATr in Fish Creek. ATs could move into Black River and up into ATs on the East Fork or ATr if barrier fails on the West Fork.
	Big Lake	1, 3, 6	Stocking RT, CT, BT, and AT. If ATs reached the West Fork and the barriers failed.
	East Fork	1, 2, 3, 6	Stocking RT and AT. . If ATs reached the West Fork and the barriers failed. Escapement of ATr into stocked ATs and RT at East Fork.
	West Fork	2, 3, 6	Stocking AT only. If barriers fail.

Bonytail chub

Interaction species: bluegill, channel catfish, largemouth bass, rainbow trout, redear sunfish

Habitat preferences and diet of bonytail chub

The primary threats to bonytail chub include streamflow regulation, habitat changes, impacts of nonnative fish, pesticides, and pollution (USFWS 2002). Because wild bonytail are rare, and reproduction is rarely documented, impacts by stocked nonnative fish are primarily to hatchery fish stocked to establish self-sustaining populations. Bonytail chub utilize mainstream portions of mid-sized to large rivers (both strong current and pools), usually over mud or rocks at elevations from 235 – 1,960 feet. During spring flooding they utilize inundated terrestrial habitats. In reservoirs, bonytail chub occupy a variety of habitat types, but seem to appear to prefer the open water areas. Certain characteristics of bonytail chub, such as smaller, reduced or embedded scales and relatively small eyes may be adaptations to the high silt loads which characterized the remarkable erosive, turbid Colorado River systems prior to the constraint of dams (Minckley 1973).

In Lake Mohave, spawning has been observed during the month of May, while in the upper Green River, spawning occurs in June and July at water temperatures of about 18° C (64°F)

(Minckley 1973). Eggs are scattered over the bottom; no parental care occurs. Cold water released below dams precludes successful hatching of eggs (Bagley 1989).

In rivers, bonytail chub adults eat primarily terrestrial insects, plant debris, and algae, while juveniles eat aquatic insects. In lakes they apparently feed on algae and plankton. Low levels of piscivory in bonytail chub have been documented (8% of diet; Minckley and Marsh 2009, pp 129-130).

Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are differences in general habitat preferences between species, backwater habitats can provide habitat for either species. Bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. There may be overlap in habitat between species, particularly for juvenile catfish whose diet is predominately macroinvertebrates. Adult channel catfish also feed primarily on macroinvertebrates, but exhibit piscivory varying with fish size. Although there are differences in general habitat preferences between the species, competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Largemouth bass.—Largemouth bass are considered generalists and can live in a variety of habitats, prefer sluggish waters of lakes and reservoirs, but are able to colonize larger streams that have low gradients and velocity (Etnier and Starnes 1993; Pacey and Marsh 1998). There is little to no data supporting largemouth bass occupying higher velocity stream habitats (e.g., riffles, runs, glides, eddies). Adult bonytail chub in rivers prefer fast-moving waters in mainstem portions, but can inhabit backwater areas also. Although there are differences in habitat preference between the species, overlap may occur when preferred habitat is not available. Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are the primary food source for bonytail chub. This could lead to competition for food or habitat, where limiting, between the species if they co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in bonytail chub habitat because of high water

temperatures and turbidity. Rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Redear sunfish.—Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Etnier and Starnes 1993, AGFD 2003). In rivers and streams, they prefer deep, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks) and are not reported in riffle, run, or glides, and avoid turbidity. Although there are differences in habitat preference between the species, overlap may occur when preferred habitat is not available. Redear sunfish feed primarily on invertebrates, thus competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Interaction: predation

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on bonytail chub is possible if the species co-occur. There are currently no wild populations of bonytail chub and interactions would most likely be with stocked bonytail chub. Although reproduction in the wild has not been documented recently, if reproduction occurs, stocked bluegill may prey upon eggs, larvae, and juvenile bonytail chub if interactions occur. Because stocked bluegill and stocked bonytail chub are similarly sized, predatory interactions between the species adultsare not likely.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Flathead catfish, channel catfish, and largemouth bass predation on razorback sucker has been documented (Marsh and Brooks 1989; USFWS 2002b). In the upper Colorado River basin, channel catfish were widespread and common in bonytail chub habitat, even when chub populations were common (Bestgen et al 2008).

Although reproduction in the wild has not been documented recently, if reproduction occurs, predation by channel catfish on recently stocked bonytail chub is possible, particularly by catfish greater than 550 mm. However, macroinvertebrates are the dominant component in channel catfish diets, regardless of fish size, but particularly for juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates and are smaller than stocked bonytail chub, predation on stocked bonytail chub would be rare.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass, however, they can be highly piscivorous; thus, there may be predation by stocked largemouth bass on stocked bonytail chub if interactions exist. Although reproduction in the wild has not been documented recently, if reproduction occurs, largemouth bass may predate on bonytail chub eggs, larvae, and juveniles if the species co-occur. The differences in general habitat preferences

between these two species may reduce the opportunity for predatory interactions. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Rainbow trout stocked into bonytail chub habitat that may enter the river would not be expected to survive more than a few months due to predation by larger resident top predators, high water temperatures in the summer, and high turbidity. Because stocked rainbow trout and stocked bonytail chub are similarly sized, predatory interactions between the species adults are not likely. Although reproduction in the wild has not been documented recently, if reproduction occurs, predation by stocked rainbow trout on the eggs, larvae, and juvenile bonytail chub is possible if the species co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation on bonytail chub eggs, larvae, and juveniles is possible if they co-occur and bonytail chub reproduction occurs. Because adult redear sunfish and stocked bonytail chub are similarly sized, the potential predation on stocked bonytail chub would be rare.

Colorado pikeminnow

Interaction species: bluegill, channel catfish, largemouth bass, rainbow trout

Habitat preferences and diet of Colorado pikeminnow

Colorado pikeminnow prefer rivers with high silt content, warm water, turbulence, and variable flow by season less than 1,219 m (4000 ft) in elevation. Adults inhabit pools and eddies just outside the main current, while young are found in backwater areas. During winter, Colorado pikeminnow use backwaters, runs, pools, and shallow shoreline areas. In spring and early summer, Colorado pikeminnow use shorelines and lowlands inundated during typical spring flooding (USFWS 1994). The USFWS established “nonessential” experimental population areas for the pikeminnow in Arizona on July 24, 1985 (50 FR30188-30195). Two areas were designated; the Salt River from Roosevelt Dam to the U.S. Highway 60 Bridge, and the Verde River from Horseshoe Dam to Perkinsville. No pikeminnow are likely present in the upper Verde River at this time.

Spawning Colorado pikeminnow in the Green and Yampa Rivers occurs most frequently in summer months with average water temperatures between 22- 25 ^{o}C, but Pacey and Marsh report that reproduction can occur across a wide range of temperatures (14 – 28 C^{o}). Data from the Green River indicate that upon emergence from spawning substrates, Colorado pikeminnow fry enter the stream drift and are transported downstream for approximately 6 days, traveling an average distance of 160 km (100 mi) to reach nursery areas in low gradient reaches (Tyus and Haines 1991).

The Colorado pikeminnow is the largest American minnow, and can grow up to 1.8 m (6 ft) long and reach a weight of 36 kg (80) lbs. Juvenile Colorado pikeminnow feed primarily on zooplankton and insect larvae (USFWS 1990a). Adult Colorado pikeminnow are primarily piscivorous, the only highly predatory native fish species in Arizona. The juvenile and adult life-stages of the species and other members of the genus are documented to eat small mammals and birds in addition to a variety of fishes (Tyus 1991; Pacey and Marsh 1998). The last wild adult Colorado pikeminnow record in Arizona was collected from Lake Mohave on the Colorado River in 1967 (Minckley and Deacon 1968). Natural populations are restricted to the upper basin states in the Green, Yampa, White, and Colorado Rivers (USFWS 1990a and citations therein). Since 1995, the AGFD and cooperators have stocked 14,816 Colorado pikeminnow into the Verde River at 2 locations near Camp Verde and Childs (D. Weedman pers. comm.). The minimum size of pikeminnow stocked is 300 mm.

Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with juvenile Colorado pikeminnow is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. There may be overlap in habitat between species, particularly between juvenile catfish and pikeminnow whose diets include zooplankton and insects. Adult channel catfish are more piscivorous and adult pikeminnow are predominately piscivorous, thus competition for food or habitat, where limiting, is possible if they co-occur.

Largemouth bass.—Largemouth bass are considered generalists and can live in a variety of habitats, prefer sluggish waters of lakes and reservoirs, but are able to colonize larger streams that have low gradients and velocity (Etnier and Starnes 1993; Pacey and Marsh 1998). There is little to no data supporting largemouth bass occupying higher velocity stream habitats (e.g., riffles, runs, glides, eddies). Largemouth bass may be highly piscivorous, particularly at larger sizes. Due to similarities in diet and habitat preferences between largemouth bass and pikeminnow, competition for food or habitat, where limiting, is possible if they co-occur. This could lead to competition for food or habitat, where limiting, between the species if they co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in pikeminnow habitat because of high summer water temperatures and turbidity. Although there are differences in general habitat preferences between the species, rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, with Colorado pikeminnow juveniles is possible if they co-occur.

Interaction: predation
Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on Colorado pikeminnow is possible if the species co-occur. If predation occurs, it would be limited to the eggs, larvae, and juvenile Colorado pikeminnow because adult pikeminnow are substantially larger than adult bluegill.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on Colorado pikeminnow larvae and juveniles would be rare. Larger channel catfish can be more piscivorous, but because adult pikeminnow may be significantly larger than adult catfish, predation on pikeminnow by adult catfish may be limited to eggs, larvae, and juvenile pikeminnow if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, there may be predation by stocked largemouth bass on larval and juvenile Colorado pikeminnow if interactions occur. Due to the large sizes of adult largemouth bass and pikeminnow, predatory interactions between species adults are unlikely.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Rainbow trout stocked into pikeminnow habitat would not be expected to survive more than a few months due to predation by larger resident top predators, high water temperatures in the summer, and high turbidity. Because adult pikeminnow are significantly larger than stocked rainbow trout, predation on pikeminnow by rainbow trout may be limited to eggs, larvae, and juvenile pikeminnow if the species co-occur.

Desert pupfish
Interaction species: bluegill

Habitat preferences and diet of desert pupfish
Desert pupfish are found in shallow water of desert springs, small streams, and marshes below 1,515 m (5,000 ft) elevation. Most habitats include clear water and soft substrates. The species

can tolerate high salinities (concentrations twice that of seawater, 68g/l), high water temperatures (to 45°C), and low dissolved oxygen (0.1-0.4 mg/l) (USFWS 1993).

Larval desert pupfish feed on invertebrates and as they grow become omnivorous. Adults feed on ostracods, copepods, and other crustaceans and insects, pile worms, molluscs, aquatic macrophytes, detritus, and algae.

Interaction: competition
Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with desert pupfish is possible if the species co-occur.

Interaction: predation
Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on desert pupfish is possible if the species co-occur.

Gila chub
Interaction species: bluegill, brook trout, brown trout, channel catfish, cutthroat trout, largemouth bass, rainbow trout, redear sunfish, threadfin shad, white crappie.

Habitat preferences and diet of Gila chub
Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in artificial impoundments. Generally, Gila chub are associated with cover including: terrestrial vegetation, boulders, fallen logs (Rinne and Minckley 1991) and undercut banks created by over hanging terrestrial vegetation (Nelson 1993). Habitat selection is life stage specific with adults commonly found in deep pools and eddies below areas with swift currents (Minckley 1973). Young-of-the-year inhabit shallow water among plants or eddies, and older juveniles use higher-velocity stream areas such as riffles (Minckley 1973). Dudley (1995) observed temporal variation in habitat selection in Sabino Canyon whereby Gila chub occupied dark interstitial spaces during winter and sub-adults were observed farther from cover and frequently in shallow areas or higher current areas during summer as water temperatures warmed.

Gila chub probably mature in their second to third year. Reproduction occurs primarily from late spring into summer in streams, but can extend into late winter in constant temperature springs. Generally breeding is initiated with warmer water temperatures of 20 – 26.5 ºC (68 – 79.7 ºF). Gila chub prefers to spawn over submerged aquatic vegetation or root wads.

Griffith and Tiersch (1989) describe Gila chub as omnivorous. Rinne and Minckley (1991) identify that Gila chub feed on large and small aquatic and terrestrial invertebrates, and small fishes. Smaller individuals feed on organic debris, aquatic plants (especially filamentous algae), and diatoms (unicellular or colonial algae). Griffith and Tiersch (1989) found that Gila chub in Redfield Canyon consumed speckled dace, dobsonfly nymphs (order Megaloptera), terrestrial insects (e.g., ants, caterpillars, and beetles). A high presence of algae (diatoms) and small gravel (indicating bottom feeding) were also found to be present in their diet.

Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Aquatic insects are a major food source for both bluegill and Gila chub. Although there are minor differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with Gila chub is possible if they co-occur.

Brook trout and brown trout.—Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Macroinvertebrates are a major food source for channel catfish, especially for juveniles. Since macroinvertebrates are a major food source for Gila chub, competition for food or habitat, where limiting, is possible if the two species co-occur.

Cutthroat trout and rainbow trout.—Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are a major food source for Gila chub. This could lead to competition for food or habitat, where limiting, between the species if they co-occur. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Since redear sunfish diets contain aquatic insects, competition for food or habitat, where limiting, is possible if the species co-occur. However, redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Etnier and Starnes

1993, AGFD 2003). Pacey and Marsh (1998) also include rivers and streams as potential habitat, with microhabitat preferences of deeper, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks). The differences in general habitat preferences between these two species may reduce the opportunity for predatory interactions. However, habitat use may overlap when preferred habitat is not available.

Threadfin shad.—In Arizona, threadfin shad are a small prey fish found primarily in reservoirs. Differences in habitat preferences between the two species may reduce the opportunity for competition. Because of some similarities in diet, competition for food or habitat, where limiting, is possible if they co-occur.

White crappie— The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since white crappie diets contain aquatic insects, competition with Gila chub for food or habitat, where limiting, is possible if they co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for competition.

Interaction: predation

Bluegill—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on Gila chub is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile Gila chub due to size similarities between adult bluegill and adult Gila chub.

Brook trout.—Brook trout are more predacious than rainbow trout and cutthroat trout and piscivory has been documented to range between 3-60% and was documented at 25% in Arizona. Because adult brook trout and Gila chub are similarly sized, predation on adult Gila chub is not likely. Predation could occur, however, on eggs, larvae, and juvenile Gila chub if the species co-occur.

Brown trout.—A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Their piscivorous behavior, as well as its plasticity, is well documented and can vary significantly. Piscivory rates for brown trout in Arizona have been documented at 33% (Sweetser et al 2002). Because adult brown trout and adult Gila chub are similarly sized, predation on adult Gila chub is not likely. Predation could occur, however, on eggs, larvae, and juvenile Gila chub if the species co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates,

predation on Gila chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on Gila chub is possible if the species co-occur.

Cutthroat trout and rainbow trout.—Wild rainbow and cutthroat trout, not including steelhead or coastal populations of either species, are opportunistic feeders that primarily consume aquatic and terrestrial insects (see references in Background). Hatchery-reared rainbow are opportunistic feeders that primarily consume macroinvertebrates once stocked, and rarely consume fish (piscivory rates 0-9%). Piscivory in stocked hatchery-raised cutthroat trout has not been well documented. However, for wild native cutthroat trout species piscivory has ranged between 0-2.9% in stream systems (Fleener 1952; Young et al 1997; McGrath and Lewis 2007) and was documented at 22% for trout larger than 400 mm in Lake Washington (Nowak et al 2004). Because adult trout and adult chub are similarly sized, predation on adult Gila chub is not likely. Although stocked rainbow trout and cutthroat trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile Gila chub if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on Gila chub is possible if they co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur.

Threadfin shad.—Threadfin shad feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971). In Lake Chicot, Arkansas the primary constituents of the threadfin shad diet were algae (54%) and animal material (49.5%) with most of algae diet containing green algae (Chlorophyta) and most of the animal material consisting of protozoans and invertebrate eggs (Miller 1967). Because predation by threadfin shad on fish larvae has only been documented in lacustrine habitats, negative predatory interactions between threadfin shad and stream-dwelling Gila chub would be rare.

White crappie—The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since the diet of adult white crappie may contain fish, piscivory on Gila chub is possible if the species co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for predatory interactions. They are not known to persist in Arizona's streams.

Gila topminnow

Interaction species: black crappie, bluegill, channel catfish, cutthroat trout, largemouth bass, rainbow trout, redear sunfish, threadfin shad, white crappie

Habitat preferences and diet of Gila topminnow

Gila topminnow generally prefer shallow, warm, and fairly quiet waters; however, populations can become acclimated to a much wider range of environmental conditions. For example, environmental variability includes temperature tolerances that range from near freezing to 37°C, pH ranges of 6.6 - 8.9, dissolved oxygen concentrations ranging from 2.2 - 11mg/l, and salinities equal to seawater. Gila topminnow prefer habitats that contain dense algal mats and debris, usually along stream margins or below riffles, and sandy substrates sometimes covered with organic mud and debris. Gila topminnow is usually found in the upper third of the water column and frequents the warmest and shallowest areas.

Gila topminnow are viviparous fish (i.e., embryos grow and mature within the female and are born live). Breeding occurs primarily during January-August, but in thermally constant environments may occur throughout the year (Draft Gila Topminnow Recovery Plan and citations therein, Weedman 1999). The mean interval between broods is 21.5 days, and brood size can range form 1 - 31 individuals per brood. Under optimum conditions, Gila topminnow can produce 10 broods a year at intervals of 7 - 14 days.

Gila topminnow are opportunistic omnivores, feeding on detritus, vegetation, amphipods, ostracods, and insect larvae. Gila topminnow rarely consumes fishes, but can feed on larvae (Draft Gila Topminnow Recovery Plan and citations therein; Weedman 1999).

Interaction: competition

Black crappie.—Both black crappie and Gila topminnow feed on macroinvertebrates which could lead to competition for food or habitat, where limiting, if they co-occur. The opportunities for competition are reduced because the occurrence of black crappie in streams is rare and many populations of Gila topminnow occupy isolated springs and ponds where overlap with black crappie would not occur.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are minor differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with topminnow is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, because macroinvertebrates are a major food source for

topminnow and catfish, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are a major food source for topminnow. This could lead to competition for food or habitat, where limiting, between the species if they co-occur. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in topminnow habitat because of high summer water temperatures. Although there are differences in general habitat preferences between the species, rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Redear sunfish.—Because redear sunfish diets contain aquatic insects, competition with Gila topminnow for food or habitat, where limiting, is possible if they co-occur. Differences in general habitat preferences between the two species may reduce the opportunity for competition.

Threadfin shad.—In Arizona, threadfin shad are a small prey fish found primarily in reservoirs. Differences in habitat preferences between the two species may reduce the opportunity for competition. Because of some similarities in diet, competition for food or habitat, where limiting, is possible if they co-occur.

White crappie— The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since white crappie diets contain aquatic insects, competition with Gila topminnow for food or habitat, where limiting, is possible if they co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for competition.

Interaction: predation

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%. Thus, predation by black crappie on Gila topminnow is possible if they co-occur.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on topminnow is possible if the species co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on topminnow eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on topminnow is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on Gila topminnow is possible if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preference. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Rainbow trout stocked into topminnow habitat would not be expected to survive more than a few months due to high water temperatures in the summer. Although rainbow trout feed predominately on macroinvertebrates, predation on Gila topminnow is possible if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preference. However, habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur.

Threadfin shad.—Threadfin shad feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971). In Lake Chicot, Arkansas the primary constituents of the threadfin shad diet were algae (54%) and animal material (49.5%) with most of algae diet containing green algae (Chlorophyta) and most of the animal material consisting of protozoans and invertebrate eggs (Miller 1967). Because predation by threadfin shad on fish larvae has only been documented in lacustrine habitats, negative predatory interactions between threadfin shad and topminnow would be rare.

White crappie— The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since the diet of adult white crappie may contain fish, piscivory on Gila topminnow is possible if they co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for predatory interactions.

Headwater chub

Interaction species: channel catfish, rainbow trout

Habitat preferences and diet of headwater chub

Adult headwater chub occupy cool to warm water in mid- to headwater stretches, up to 6500 ft elevation, of mid-sized streams in the Gila River basin. They are associated with deep, near-shore pools adjacent to swift riffles and runs, and near obstructions. Preferred cover consists of root wads, boulders, undercut banks, submerged organic debris, or deep water. Substrates they associate with are gravel, small boulders, and large instream objects and preferred water temperatures range between 20-27°C with minimum temperature around 7°C. Juveniles are associated with shallow, low velocity habitat with overhead cover. In Fossil Creek, they seem to select depths between 0.9-1.5 m and velocities of 0.15 mps and are found over sandy substrates.

Headwater chub first reproduce at approximately 2 to 5 years of age. As in roundtail chub, both males and females exhibit spawning coloration and tubercules, though the male's display is usually more extensive than females. Spawning generally occurs at similar water temperatures as roundtail chub and has been observed by Bestgen (1985b) at the East Fork of the Gila River when afternoon water temperatures reached 22°C. Minckley (1981) described spawning by headwater and roundtail chub as similar to other cyprinids in that several males escort each spawning female and release sperm as the female releases ova.

Headwater chub life span is 8-10 years. They grow rapidly but growth is dependent on water temperature. Headwater chub first reproduce between 2-5 years of age. Females are about 100-180 mm total length. Both males and females produce spawning tubercles. In males, tubercles are usually uniformly distributed from the head to the base of the dorsal fin and rarely to the base of the tale. Females display tubercles only on the head, operculum, pectoral and caudal fins. Both males and females may develop red/orange coloration on the opercles, posterior parts of the lips and fin bases. Spawning occurs in spring and early summer at the end of spring runoff. Suitable water temperatures range 14-24°C. Each female is escorted by several males and spawning is performed in pool, run and riffle habitat. Eggs are scattered randomly over substrate. Eggs hatch in 4-7 days at a water temperature of 19-20°C. Larval stage lasts up to 53 days.

Stomach analysis of fish from Fossil Creek in 1976 showed headwater chubs fed on aquatic and terrestrial insects, ostracods, and some plant material. Adults show seasonal variation in their diets, with the greatest diversity in spring and summer. Various aquatic invertebrates, macrophytes, and algae where present in diets in the spring with terrestrial insects and diatoms added in the summer. No piscivory was documented in headwater chubs from Fossil Creek, but there was evidence of a low level of predation on iguanid lizards. Juvenile chubs (<50mm) consisted almost exclusively of filamentous algae and diatoms. Young chubs fed on small insects, crustaceans, and algae in quiet backwaters until they reached 25 to 50 mm (0.99 to 1.97 in.) in length.

Interaction: competition
Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Macroinvertebrates are a major food source for channel catfish, especially for juveniles. Since macroinvertebrates are a major food source for headwater chub, competition for food or habitat, where limiting, is possible if the two species co-occur.

Rainbow trout.—Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Interaction: predation
Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on headwater chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on headwater chub is possible if the species co-occur.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Because adult trout and adult chub are similarly sized, predation on adult headwater chub is not likely. Although stocked rainbow trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile headwater chub if they co-occur.

Humpback chub
Interaction species: bluegill, channel catfish, rainbow trout, redear sunfish, walleye, yellow perch

Habitat preferences and diet of humpback chub
The humpback chub is found in a variety of habitats, but because of its rarity, habitat preferences are poorly understood (USFWS 1990). The humpback prefers deep, fast-moving, turbid waters often associated with large boulders and steep cliffs. Chub can also be found in the quiet inlet water of river confluences.

In general, the species persists only in turbulent, high gradient, canyon-bound reaches of large rivers in the Colorado River Basin. Larvae prefer shallow, low-velocity nearshore pools in the Little Colorado River, and progressively move to deeper, faster areas with increasing size and age (AGFD data, Gorman 1994). In the Colorado River in Grand Canyon, young-of-year are found in backwater and other nearshore, slow-velocity sites (Maddux et al. 1987, Angradi et al. 1992), with similar ontogenetic tendencies (Valdez et al. 1992). Adults in the Colorado River in Grand Canyon and in the Upper Basin are associated with large eddy complexes (Valdez et al.

1982, 1992, Valdez and Hugentobler 1993). Humpback chub appear to be more active at night (Kaeding and Zimmermann 1983, Gorman 1994).

Humpback chub reach sexual maturity at total lengths of 5 - 11.8 inches total length. Spawning probably takes place in June and July in the Grand Canyon and lower Colorado River; however, others recorded ripe fish as early as April in the main stem Colorado River (USFWS 1990b and citations therein). Both field observations and laboratory tests indicate that humpback chub reproduce at water temperatures of approximately 68°F.

Humpback chub is thought to be a bottom feeder, due mainly to its sub-terminal mouth, but also has been observed foraging throughout the water column taking epipelagic and epilithic diatoms, as well as small invertebrates, and Chironomidae larvae and adults. Humpback chubs feed predominately on small aquatic insects, diatoms and filamentous algae *Cladophora glomerata*

Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with humpback chub is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Macroinvertebrates are a major food source for channel catfish, especially for juveniles, and larger catfish may exhibit piscivory. Since macroinvertebrates are a major food source for humpback chub, competition for food or habitat, where limiting, is possible if the two species co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams. Rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Redear sunfish.—Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Etnier and Starnes 1993; AGFD 2003). In rivers and streams, they prefer deep, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks) and are not reported in riffle, run, or glides, and avoid turbidity. Redear sunfish feed primarily on invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur. Differences in general habitat preferences between the two species may reduce the opportunity for competition.

Walleye.—In Arizona, walleye inhabit several lakes and are generally bottom oriented fish due to their sensitivity to light. Competition between walleye and humpback chub for habitat is unlikely since they occupy different habitat types in Arizona (lacustrine vs. fluvial). Competition between walleye and humpback chub for food is not likely because of significant differences in diets.

Yellow perch.—Yellow perch prefer the shoreline areas of clear lakes and ponds with moderate amounts of aquatic vegetation (Sublette et al 1990). They may also be found in pools and backwaters of rivers. Preferred water temperatures are between 18-21oC. Fingerlings are found in shallow water and move to open, deeper water in fall. Adults generally associate with the lake bottom. Because yellow perch and humpback chub share some similar dietary preferences, competition for food or habitat, where limiting, is possible if they co-occur. Differences in general habitat preferences between the two species may reduce the opportunity for competition.

Interaction: predation

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on humpback chub is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile chub due to size similarities between adult bluegill and adult humpback chub.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on humpback chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on humpback chub is possible if the species co-occur. Predation would likely be limited to eggs, larvae, and juvenile chub due to size similarities between adult catfish and chub..

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Because adult trout and adult chub are similarly sized, predation on adult humpback chub is not likely. Although stocked rainbow trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile humpback chub if they co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur and would likely be limited to eggs, larvae, and juvenile chub due to size similarities between adult sunfish and chub.

Walleye.—The diets of walleye in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al 1984). Walleye older than 1 year were predominately piscivorous, consuming shiners, clupeids, and spiny-rayed fishes depending on seasonal availability. Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad where the species co-occur (Minckley 1973). Thus, predation by walleye on humpback chub is possible if they co-occur.

Yellow perch.—In Arizona, the yellow perch diet may be dominated by invertebrates, with a small level of piscivory exhibited. Elsewhere, different ecotypes of yellow perch were observed that may consume fish exclusively (16%), invertebrates exclusively (35-59%), or a combination of both (25-48%; Paradis et al 2006). Bonar et al (2005) documented piscivory in yellow perch at approximately 7%, with invertebrates as the dominant prey type. Thus, predation by yellow perch on humpback chub is possible if they co-occur.

Little Colorado spinedace

Interaction species: Apache trout, Arctic grayling, bluegill, brook trout, channel catfish, largemouth bass, rainbow trout

Habitat preferences and diet of Little Colorado spinedace

Little Colorado spinedace have a wide tolerance for physio-chemical factors and occupy a variety of habitats. Stream flow preferences vary from stagnant pools to slight or swift flow, preferred substrates vary from silt to boulders, and water depth ranges from <0.5 m to 2 m. Little Colorado spinedace will occupy mid-water areas of the stream, as well as undercut banks, eddies behind boulders, and pools. They typically avoid the deepest and heavily shaded pools and relatively shallow areas (USFWS 1998 and citations therein). The Primary Constituent Elements of Critical Habitat for Little Colorado spinedace are clean permanent flowing water with pools and a fine gravel or silt-mud substrate.

Eggs are presumably randomly deposited over the stream bottom, on aquatic vegetation, or other debris (Minckley 1973). Minckley (1973) and Minckley and Carufel (1967) suggest that spinedace spawn from early summer to early autumn, and may spawn more than once a year. Minckley and Carufel (1967) reported gravid females with 650-1,000 eggs per female.Little Colorado spinedace is predaceous, feeding primarily on aquatic invertebrates with preferences changing seasonally. In spring, Little Colorado spinedace takes primarily chironomid larvae and ephemopteran nymphs. Summer preferences include cladocerans, Heteroptera, Coleoptera, filamentous green algae, detritus, and terrestrial invertebrates (Formicidae, Diptera, Thysanoptera, and Crustacea). Fall preferences include terrestrial insects, chironomid larvae, corixidae, and elmididae. Winter feeding habits include chironomid larvae, plecopteran nymphs, and corixidae (USFWS 1998a; Blinn and Runck 1990). Blinn and Runck (1990) found that

smaller fish diets are comprised of a higher percentage of small aquatic insects, ephemopterans, and chironomids.

Interaction: competition

Apache trout.—If stocked trout leave the stocking area and travel to occupied spinedace habitat, because these trout feed primarily on macroinvertebrates, similar to spinedace, competition for food or habitat, where limiting, is possible if they co-occur. Stocked trout should be considered transient in some of the warmer habitats where spinedace occur, since they would not be expected to survive in high summer water temperatures.

Arctic grayling.—Natural reproduction of Arctic grayling stocked in Arizona has not been documented and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. Exposure to spinedace would only occur in rare events when stocked lakes spill and grayling move into occupied spinedace habitat. Because diets and habitat preferences may overlap between Arctic grayling and spinedace, competition for food or habitat, where limiting, is possible if they co-occur. The lower temperature tolerances of grayling may reduce the opportunities for competition.

Bluegill.— Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with Little Colorado spinedace is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, because macroinvertebrates are a major food source for spinedace and catfish, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are a major food source for spinedace. This could lead to competition for food or habitat, where limiting, between the species if they co-occur. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in some occupied spinedace habitats because of high summer water temperatures. However, since hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates and macroinvertebrates are a major source of food for spinedace, competition for food and habitat, where limiting, is possible if they co-occur.

Interaction: predation

Apache trout.— Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and spinedace would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al 2007; Jones et al 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and spinedace would be rare.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on Little Colorado spinedace is possible if the species co-occur.

Brook trout.—Brook trout are more predacious than rainbow trout and cutthroat trout. Piscivory has been documented to range between 3-60% (Fraser 1981; Cunjak et al 1987; L'Abée-Lund et al 2002; Mistak et al 2003; Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al 2002). Thus, predation by brook trout on Little Colorado spinedace is possible if they co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on spinedace eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on spinedace is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on Little Colorado spinedace is possible if they co-occur.. The occurrence of interactions may be reduced due to differences in habitat preferences. However habitat use may overlap when preferred habitat is not available.

Rainbow trout.— The literature documents a range of piscivory in stocked rainbow trout (0-9%), thus rainbow trout may predate on spinedace if they co-occur.

Loach minnow

Interaction species: Apache trout, Arctic grayling, brook trout, cutthroat trout, rainbow trout

Habitat preferences and diet of loach minnow

Loach minnow are habitat specialists occupying shallow (<20 cm), turbulent, high current velocity (30-59 cm/sec) riffle habitat (Propst and Bestgen 1991; Rinne 1992). The loach minnow is primarily a bottom-dweller that moves in the water column only briefly when moving between rocks (Marsh 1991). Loach minnow spend much of the day under protective cover (Marsh et al. 2003). The primary cause for listing the species as threatened was habitat destruction and alteration due to damming, diversions, groundwater pumping, and introduction and spread of exotic predatory and competitive fish species, especially red shiner and catfishes (USFWS 1991). Ictalurid catfishes are the only nonnative species likely to interact strongly with loach minnow due to the piscivorous feeding behavior of these catfishes and the spatial overlap in riffle habitat (USFWS 1991). Some evidence also indicates that competition with red shiner has contributed to the decline of loach minnow (Minckley and Carufel 1967; Minckley and Deacon 1968).

Little information exists concerning the breeding biology of loach minnow. In the wild, eggs are typically deposited underneath and on the downstream side of cobbles and boulders that are partially embedded (Britt 1982; Propst et al. 1988; Vives and Minckley 1990). Spawning usually occurs in riffles that have approximately three percent gradient and suitable cobbles and boulders are typically found on the upstream edge and the sides in a horseshoe-shaped pattern around the riffle (D.L. Propst, Pers. Comm). Loach minnow were observed to spawn during February through May in Aravaipa Creek (Vives and Minckley, 1990) in the same riffles occupied by non-breeding adults at other times of the year (Marsh 1991). Water temperatures recorded at sites of known egg deposition range from 16 to 20ºC (Propst and Bestgen 1991) to as high as 23 ºC (Vives and Minckley 1990). The loach minnow was observed to breed in the laboratory at water temperatures as low as 12.2ºC.

Loach minnow forage for invertebrates in and on the substrate in shallow, turbulent riffles and do not rely on drift to feed (Marsh 1991). The loach minnow is an opportunistic benthic insectivore, feeding on larval ephemeropterans (mayfly nymphs), simuliid, and chironomid dipterans (midges). Aquatic insect groups vary in importance seasonally or among life stages. Chironomids are important to larval and juvenile loach minnow (USFWS 2000).

Interaction: competition

Apache trout, cutthroat trout, and rainbow trout.—Stocked Apache trout, cutthroat trout, and rainbow trout may occupy the same stream reaches as loach minnow. However, due to highly specialized habitat use of loach minnow, the opportunities for competition for food or habitat

between these trout species and loach minnow would be rare. If habitat use overlaps when preferred habitat is not available, competition is possible if the species co-occur.

Arctic grayling.—Natural reproduction of Arctic grayling has not been documented in Arizona and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. Due to highly specialized habitat use of loach minnow, it is not likely that competition will occur between Arctic grayling and loach minnow. If habitat use overlaps when preferred habitat is not available, competition is possible if the species co-occur.

Brook trout.—Due to highly specialized habitat use of loach minnow, it is not likely that competition will occur between brook trout and loach minnow. If habitat use overlaps when preferred habitat is not available, competition is possible if the species co-occur.

Interaction: predation

Apache trout.— Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory on loach minnow has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and loach minnow would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al 2007; Jones et al 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and loach minnow would be rare. The highly specialized habitat use of loach minnow may reduce opportunities for predation.

Brook trout.—Brook trout are more predacious than rainbow trout and cutthroat trout. Piscivory has been documented to range between 3-60% (Fraser 1981; Cunjak et al 1987; L'Abée-Lund et al 2002; Mistak et al 2003; Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al 2002). Thus, predation by brook trout on loach minnow is possible if they co-occur. The highly specialized habitat use of loach minnow may reduce opportunities for predation.

Cutthroat trout and rainbow trout.—Wild rainbow and cutthroat trout, not including steelhead or coastal populations of either species, are opportunistic feeders that primarily consume aquatic and terrestrial insects (see references in Background). Hatchery-reared rainbow are opportunistic feeders that primarily consume macroinvertebrates once stocked, and rarely consume fish

(piscivory rates 0-9%). Piscivory in stocked hatchery-raised cutthroat trout has not been well documented. However, for wild native cutthroat trout species piscivory has ranged between 0-2.9% in stream systems (Fleener 1952; Young et al 1997; McGrath and Lewis 2007) and was documented at 22% for trout larger than 400 mm in Lake Washington (Nowak et al 2004). Although stocked rainbow trout and cutthroat trout feed primarily on macroinvertebrates, predation could occur on loach minnow if they co-occur. The highly specialized habitat use of loach minnow may reduce opportunities for predation.

Razorback sucker

Interaction species: black crappie, bluegill, brook trout, brown trout, channel catfish, largemouth bass, rainbow trout, redear sunfish

Habitat preferences and diet of razorback sucker

Razorback sucker habitat preferences change seasonally depending on water type and life stage (USFWS 1998b, 2008). In riverine systems, adult razorback suckers prefer deep runs, eddies, flooded off-channel environments, and backwaters during spring. During summer, razorback suckers can be found in shallow water associated with submerged sandbars, and in runs and pools. During winter, slower, deeper water is preferred including runs, slack-water, eddies, and pools. In impoundments, razorback suckers use both backwater and the main impoundment. Juvenile razorback suckers in reservoirs use near-shore habitats but disperse within a few weeks. Little information is available on juvenile habitat selection within rivers; however young razorback suckers presumably require quiet, warm, shallow water as nursery habitats in rivers and backwaters can provide quiet water where there is the potential for increased food availability. In reservoirs, coves provide warm, shallow shorelines suitable as nursery habitat.

Spawning is documented to occur in mainstem rivers, riverine-influenced areas of large impoundments, and wave-washed shorelines of reservoirs. In lacustrine habitats (Lake Mohave), spawning occurs early in the year (January-April/May). Water temperatures during spawning can range from 11.5-18°C (52.7-64.4^{o}F). Fish congregate and spawn over flat or gently sloping shoreline areas with gravel, cobble, or mixed substrates (Douglas 1952; Bozek et al. 1990; Minckley et al. 1991) and razorback suckers are observed to spawn in water up to 5m deep. In riverine habitats, staging occurs in flooded lowlands and in eddies formed in the mouths of tributary streams. Fish then move to main-channel sand, gravel, and cobble bars for egg deposition (Tyus 1987; Tyus and Karp 1990).

The razorback sucker diet varies depending on life stage, habitat, and food availability. When larvae hatch, the mouth is terminal, which appears to facilitate great diversity in feeding behavior. In Lake Mohave, larvae feed primarily on phytoplankton and small zooplankton. As the razorback sucker grows the mouth becomes inferior and more benthic invertebrates are consumed. Juvenile feeding habits are not clearly identified. Diet contents from adult razorback

suckers in riverine habitats consisted of immature Ephemeroptera, Trichoptera, Chironomidae, along with algae, detritus, and inorganic material. The diets of reservoir fish are dominated by planktonic crustaceans, but also contain some algae and detritus.

Interaction: competition

Black crappie.—Both black crappie and razorback suckers feed on macroinvertebrates which could lead to competition for food or habitat, where limiting, if they co-occur. Differences in habitat preferences between the species may reduce opportunities for competition.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with razorback sucker is possible if they co-occur.

Brown trout.—Brown trout can be piscivorous, but also consume macroinvertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preference and temperature tolerances between the species may reduce opportunities for competition.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Because macroinvertebrates are a major food source for razorback suckers and catfish, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and can be a major food source for razorback suckers. This could lead to competition for food or habitat, where limiting, between the species if they co-occur.

Redear sunfish.—Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Etnier and Starnes 1993; AGFD 2003). In rivers and streams, they prefer deep, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks) and are not reported in riffle, run, or glides, and avoid turbidity. Redear sunfish feed primarily on invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in razorback sucker habitat because of high temperatures and turbidity. Rainbow trout diets consist primarily of invertebrates, thus competition for food or

habitat, where limiting, is possible if they co-occur. Differences in habitat preference and temperature tolerances between the species may reduce opportunities for competitive interactions.

Interaction: predation

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%). Given the feeding preferences of black crappie, predation on razorback sucker eggs, larvae, or juveniles is possible if they co-occur. Predation would likely be limited to these life stages of razorback sucker because of size similarities between adult crappie and suckers. Difference in habitat preferences between the species may reduce opportunities for predation.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on razorback sucker is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile suckers due to size similarities between adult bluegill and adult razorback suckers.

Brown trout.—A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Their piscivorous behavior, as well as its plasticity, is well documented and can vary significantly. Piscivory rates for brown trout in Arizona have been documented at 33% (Sweetser et al 2002). Thus, predation on eggs, larvae, and juvenile razorback sucker is possible if they co-occur. Predation would likely be limited to these life stages of razorback sucker because of size similarities between adult trout and suckers. Differences in habitat preference and temperature tolerances between the species may reduce opportunities for competition.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on razorback sucker eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on razorback sucker is possible if the species co-occur. Predation would likely be limited to eggs, larvae, and juvenile suckers due to size similarities between adult catfish and razorback suckers..

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass, however, they can be highly piscivorous; thus, there predation by stocked largemouth bass on razorback sucker, primarily eggs, larvae, and juveniles, is possible if they co-occur. Due to the large sizes of adult largemouth bass and razorback sucker, predatory interactions between species adults are unlikely.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Because adult trout and razorback suckers are similarly sized, predation on adult suckers is not likely. Although stocked rainbow trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile razorback suckers if they co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur and would likely be limited to eggs, larvae, and juvenile suckers due to size similarities between adult sunfish and suckers.

Roundtail chub

Interaction species: Apache trout, Arctic grayling, black crappie, bluegill, brook trout, brown trout, channel catfish, cutthroat trout, largemouth bass, rainbow trout, redear sunfish, smallmouth bass, threadfin shad, walleye

Habitat preferences and diet of roundtail chub

Roundtail chub prefers to occupy cool to warm water, mid-elevation streams and rivers where typical adult microhabitat consists of pools up to 2.0 m deep adjacent to swift riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water. Smaller chubs generally occupy shallow, low velocity water adjacent to overhead bank cover. Other preferred forms of cover, especially in streams lacking deep pools, are instream boulders, undercut banks, overhanging vegetation, and root wads (Rinne and Minckley 1991). According to Minckley and DeMarais (2000), roundtail chub are less prone to using instream cover than other species of *Gila*. Adults feed in swift water and move back to pools or other forms of cover when disturbed (Vanick and Kramer 1969; Minckley 1973). Juveniles occupy backwater habitats and tend to reside primarily in shallow, swifter habitats, as they grow older (Minckley 1973, 1991; Propst 1999; Brouder et al. 2000; Bryan et al. 2000).

Roundtail chub breeds in spring and early summer as spring runoff is subsiding, frequently in association with submerged cover such as fallen trees and brush. Fertilized eggs are broadcast over gravel substrate with no parental care.

Roundtail chub follow a seasonal spawning cycle, with spawning beginning in late spring and extending to early summer (Bestgen 1985b; Propst 1999). In some instances in the upper basin, roundtail chub are found in breeding condition as late as July in years with extended high flows (Karp and Tyus 1990). In the upper Colorado River Basin, roundtail chub were observed spawning at temperatures within a range of 14-24°C (Kaeding et al. 1990). Other researchers in the upper Verde River and the Colorado River have observed spawning behavior in roundtail chub when water temperatures reached approximately 18°C to 22°C (Vanicek and Kramer 1969;

Brouder et al. 2000). Spawning has also been associated with a descending hydrograph, when lower flows and warmer water temperatures become more prevalent (Bestgen 1985b; Vanicek and Kramer 1969; Kaeding et al. 1990).

Roundtail chub in reproductive condition tend to display breeding coloration and tubercules. Color and tubercules are more prevalent and more intensely displayed in males that generally have bright red to orange around the cheeks and ventro-lateral surfaces of the head, abdomen, and paired anal fins (Minckley 1973; Propst 1999). Tubercules in males tend to cover most of the anterior body and fins and occasionally extend to the caudal peduncle and anal fin. Female coloration tends to be restricted to the bases of the paired fins (Bestgen 1985b). Tubercules develop to a lesser degree around the head, pectoral fins, and between the dorsal fin and the head (Bestgen 1985b; Propst 1999). Fecundity tends to be size dependent in roundtail chub (Propst 1999). Anecdotal evidence for this is given from Fossil Creek, where Neve (1976) observed females ranging from 100 to 260 mm in size that contained between 1,000 and 4,300 eggs. Brouder et al. (2000) observed females in the Verde River ranging from 270 to 427 mm that contained between 7,267 and 26,903 eggs. Brouder et al. (2000) also reported that the average female from this site measured 328 mm in length and contained 13,948 eggs.

Roundtail chub hatch approximately 5 to 7 days after fertilization (Muth et al. 1985). Propst (1999) observed that roundtails grew to lengths of 50 mm in the first year. For individuals in this study, growth began to slow at age 4, though by age 7 some individuals had attained lengths of 300 mm. Growth, fecundity, mortality, and a host of life history characteristics vary by locality; however, the period of greatest growth was consistently the first summer after hatching (Bestgen 1985). Brouder et al (2000) found that late winter and early spring runoff was strongly correlated with survival of age-0 fish through their first year in the Verde River; this observation supports Bestgen's (1985) observation that late runoff delays spawning by adults and growth of progeny.

In the Gila River, adult roundtail chubs feed primarily on aquatic and terrestrial insects (including stoneflies, mayflies, caddisflies, and dipterans), but also on filamentous algae, crayfish, other fishes (Bestgen 1985). Roundtail chubs up to 170 mm fed primarily on macroinvertebrates and algae, and the diversity of consumed macroinvertebrates increased with fish size. Out of 17 roundtail chub over 170 mm caught in Turkey Creek, 14% consumed fish and 14% consumed crayfish. Young fish typically moved from slower water to the heads of pools to feed; adults fed away from the streambanks in run habitat with medium flows.

Interaction: competition

Apache trout, cutthroat trout, and rainbow trout.—Stocked Apache trout, cutthroat trout, and rainbow trout may occupy the same stream reaches as roundtail chub. Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Arctic grayling.—Natural reproduction of Arctic grayling in Arizona has not been documented and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. However, because diets and habitat preferences overlap between Arctic grayling and Apache trout, there may be competition for food or habitat, where limiting, if they co-occur.

Black crappie.—Black crappie inhabits warmer sloughs, lakes, reservoirs and larger slow flowing rivers. Preferred habitat is lentic habitats with clear water and substantial vegetation (Etnier and Starnes 1993; Pacey and Marsh 1998). While crappie is common in lakes and reservoirs, there are very few records of crappie establishing or persisting in streams or rivers in Arizona. However, because there are similarities in the diets of chub and crappie, competition for food or habitat, where limiting, is possible if they co-occur.

Bluegill.— Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Aquatic insects are a major food source for both bluegill and roundtail chub. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with roundtail chub is possible if they co-occur.

Brook trout and brown trout.—Due to similar habitat and diet preferences among brook trout, brown trout, and roundtail chub, competition for food or habitat, where limiting, is possible if they co-occur.

Channel catfish.—Macroinvertebrates are a major food source for channel catfish, especially for juveniles. Since macroinvertebrates are a major food source for roundtail chub, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preference between the species may reduce opportunities for competitive interactions.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass and are primary major food source for roundtail chub. This could lead to competition for food or habitat, where limiting if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preferences. However habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Because the diets of redear sunfish may contain aquatic insects, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences may reduce opportunities for competitive interactions.

Smallmouth bass.—This bass inhabits mid-order streams and lakes cooler in temperature, free of turbidity with shallow rocky areas, clear and gravel-bottom runs and flowing pools of rivers, cool flowing streams and reservoirs fed by such streams. They prefer shady areas with submerged structures of stumps, trees or crevice within clay banks for retreat (Moyle 1976; Sublette et al. 1990). Severe temperature drops and siltation that occur during flood events may result in nest desertion and loss of eggs and fry. Smallmouth bass prefer rocky habitats in streams and lakes with clear waters. A portion of the smallmouth bass diet includes macroinvertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Threadfin shad.—In Arizona, threadfin shad are a small prey fish found primarily in reservoirs. Differences in habitat preferences between the two species may reduce the opportunity for competition. Because of some similarities in diet, competition for food or habitat, where limiting, is possible if they co-occur.

Walleye.—In Arizona, walleye inhabit several lakes and are generally bottom oriented fish due to their sensitivity to light. Competition between walleye and roundtail chub for habitat is unlikely since they occupy different habitat types in Arizona (lacustrine vs. fluvial). Competition between walleye and roundtail chub for food is not likely because of significant differences in diets.

Interaction: predation

Apache trout.— Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and roundtail chub would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al 2007; Jones et al 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and roundtail chub would be rare.

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%. Given the feeding preferences of black crappie, predation on roundtail chub eggs, larvae, or juveniles could occur if the two species occupy the same habitat. Predation would likely be

limited to these life stages of chub because adult crappie and roundtail chub are similarly sized. Since the occurrence of black crappie in streams is rare, the opportunities for predation may be reduced.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on roundtail chub is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile chub due to size similarities between adult bluegill and adult roundtail chub.

Brook trout and brown trout.—Piscivory has been documented to range between 3-60% (Fraser 1981; Cunjak et al 1987; L'Abée-Lund et al 2002; Mistak et al 2003; Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al 2002). A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Their piscivorous behavior, as well as its plasticity, is well documented and can vary significantly. Piscivory rates for brown trout in Arizona have been documented at 33% (Sweetser et al 2002). Because stocked brown trout and brook trout and adult roundtail chub are of similar sizes, predation by brown or brook trout may be limited to the egg, larvae, or juvenile life stages of chubs.

Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on roundtail chub is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on roundtail chubs is possible if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preferences. However habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur and would likely be limited to eggs, larvae, and juvenile chub due to size similarities between adult sunfish and chub.

Smallmouth bass.—Young feed on plankton, immature aquatic insects, and fish while adults take in crayfish, fish, and aquatic and terrestrial insects in lakes and streams. Piscivory rates for smallmouth bass have been documented to range between 3.4-100%, with rates varying by size, season, and location (Mittelbach and Persson 1998; Olson and Young 2003; Bonar et al 2004; Fritts and Pearsons 2004; Naughton et al 2004). Bonar et al. (2004) documented piscivory rates in smallmouth bass to be less than 4% (n = 1441) and most fish consumed were nonnative fish

(2.8% nonnative, 0.7% native, 0.7% unknown). Because smallmouth bass may be highly piscivorous, predation on roundtail chub is possible if the species co-occur. If predation occurs, it will likely be upon eggs, larvae, or juvenile chub because of size similarities between adult smallmouth bass and roundtail chub.

Threadfin shad.—Threadfin shad are feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971). In Lake Chicot, Arkansas the primary constituents of the threadfin shad diet were algae (54%) and animal material (49.5%) with most of algae diet containing green algae (Chlorophyta) and most of the animal material consisting of protozoans and invertebrate eggs (Miller 1967). Because predation by threadfin shad on fish larvae has only been documented in lacustrine habitats, negative predatory interactions between threadfin shad and stream-dwelling roundtail chubs would be rare.

Walleye.—The diets of walleye in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al 1984). Walleye older than 1 year were predominately piscivorous, consuming shiners, clupeids, and spiny-rayed fishes depending on seasonal availability. Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad (Minckley 1973). If interactions between walleye and roundtail chubs do occur, predation by walleye on chubs of any life stage is possible.

Spikedace

Interaction species: Black crappie, bluegill, brook trout, brown trout, channel catfish, largemouth bass, rainbow trout, redear sunfish

Habitat preferences and diet of spikedace

Spikedace can be found in moderate to large perennial streams; it inhabits shallow riffles, with sand and gravel substrates, and moderate to swift currents and pools over sand or gravel substrates (Barber et al. 1970; Propst et al. 1986; Rinne 1991). Spikedace microhabitat preferences include shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand or gravel bars, and eddies of downstream riffle edges (Propst et al. 1986; Rinne and Kroeger 1988). Juveniles prefer slow to moderate flow velocities in shallow water with moderate amounts of instream cover. Larval spikedace are found in slow to moderate flow in shallow water with abundant instream cover.

Spikedace breeding occurs over shallow (8-15 cm deep), sand bottomed areas with moderate flow. Spawning begins in March when water temp reach 19°C, and proceeds until June, but mature ovaries have been detected in female fish through September (Minckley 1981).

Macroinvertebrates are the primary food source for spikedace, specifically baetid ephemeropterans (mayfly), Hydropsychid trichopterans (net-spinning caddisflies), Chironomid

dipterans (midges), and Simuliid dipterans (black flies) (Anderson 1978; Schreiber and Minckley 1981; Barber and Minckley 1983; Abarca 1989).

Interaction: competition

Black crappie.—Both black crappie and spikedace feed on macroinvertebrates which could lead to competition for food or habitat, where limiting, if they co-occur. However, since the occurrence of black crappie in streams is rare, the opportunities for competition may be reduced.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers (AGFD 2003). Aquatic insects are a major food source for both bluegill and spikedace. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with spikedace is possible if they co-occur.

Channel catfish.—Macroinvertebrates are a major food source for channel catfish, especially juveniles. Since macroinvertebrates are a major food source for spikedace, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences between the species may reduce opportunities for competition.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass and are a major food source for spikedace. Thus, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences between the species may reduce opportunities for competition. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Since hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences and temperature tolerances between the species may reduce opportunities for competition. Long-term survival of stocked rainbow trout would not be expected due to high summer water temperatures in spikedace habitat.

Redear sunfish.—Because redear sunfish diets contain aquatic insects, competition for food or habitat, where limiting, is possible if they co-occur. However, redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Etnier and Starnes 1993, AGFD 2003). Pacey and Marsh (1998) also include rivers and streams as potential habitat, with microhabitat preferences of deeper, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks). They are not reported in riffle, run, or glides, and avoid turbidity. Since spikedace prefer shallow, flowing water (Minckley 1973) the opportunity for competition with redear sunfish may be reduced.

Interaction: predation

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%. Given the feeding preferences of black crappie, predation on spikedace is possible if they co-occur. The occurrence of black crappie in streams is rare, which may reduce opportunities for predation on spikedace.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on spikedace is possible if they co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on spikedace is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on spikedace is possible if they co-occur. Differences in habitat preferences between the species may reduce opportunities for predation. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Thus, predation by rainbow trout on spikedace is possible if they co-occur. Differences in habitat preferences and temperature tolerances between the species may reduce opportunities for competition. Long-term survival of stocked rainbow trout would not be expected due to high summer water temperatures in spikedace habitat.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur.

INTERACTIONS BETWEEN STOCKED FISH AND BIRDS AND MAMMALS

Mexican Spotted Owl

Effects Discussion: Disturbance

The PAC, and the area immediately around it, is where most MSO activity during the breeding season is likely to occur. Human disturbance during the breeding season is the important disturbance effect for this analysis. PACs are delineated to include the best MSO habitats for nesting and roosting, but that does not mean that habitats immediately adjacent to the boundary

are not suitable for owl activities during the breeding season, including nesting, roosting, and foraging. While it is likely that most activities associated with the breeding season occur within the PAC for a given owl pair, it is also likely that the further from the PAC boundary the less likely MSOs are to be found there during the breeding season. There may be human disturbance to MSO outside of this area or this season and this is acknowledged to occur, however, angler use during the stocking season in the vicinity of the PACs is concentrated during the breeding season for MSO and is most relevant. We acknowledge that MSO may be disturbed at areas outside of PACs or CH during the non-breeding season and that a small portion of that disturbance may be due to anglers accessing fishing opportunities provided by the stocking, but this potential disturbance is a very minor component and is not specifically addressed in this analysis.

Human presence and noise created by recreationists including anglers accessing a stocking site or extended area by passing through or adjacent to a PAC can affect individual MSOs. Direct effects may occur when these activities impact individual birds at nests, roosts, and foraging sites. Indirect effects may occur when human-caused disturbance stimuli act as a form of predation risk (Frid and Dill 2002).

There are a growing number of studies attempting to describe and quantify the impacts of non-lethal disturbance on the behavior and reproduction of wildlife, and MSO in particular. The potential effects of aircraft noise have received the most attention. Delaney et al. (1997) reviewed literature on the response of owls and other birds to helicopter noise and reported the following: 1) raptors in general are more susceptible to disturbance-caused nest abandonment early in the nesting season; 2) ground-based disturbances have a greater effect on reproductive rates; and 3) the tendency to flush from a nest declines with experience or habituation to the noise, although the startle response cannot be completely eliminated by habituation. Delaney et al. (1999) found that ground-based disturbances (noise from chain saws) elicited a greater flush response than aerial disturbances.

Swarthout and Steidl (2001) found that MSO in canyon habitats modified their behavior (e.g., increased perch height) and/or flushed in response to recreationists (hikers) based on observations during the early morning, midday, and evening. Based on their results, they recommended placing buffer zones (conservative buffer = 180 ft; less conservative buffer = 40 ft.) around known roosting sites to minimize impacts. Further, Swarthout and Steidl (2003) noted that female MSOs decreased the amount of time they handled prey by 57% and decreased the amount of time they performed daytime maintenance activities by 30% while hikers were present. In addition, hikers caused both female and male owls to increase the frequency of contact vocalizations. MSO perched higher above the ground were less likely to flush than those on lower perches; however, at higher perches MSO flushed when hikers were further away likely because the owls could see the approaching hiker from a greater distance. Because this work was

done in canyon habitats, perch height may or may not provide the same visual cues on flat ground or hillsides.

MSO may respond to disturbance during the breeding season by abandoning their nests or young; by altering their behavior such that they are less attentive to the young, increasing the risk of the young being preyed upon or disrupting feeding patterns; or by exposing young to adverse environmental stress (Knight and Cole 1995). MSO primarily forage at night with the hours around dawn and dusk particularly important (Delany et al. 1997). During the day, they perch at roost sites or are on/at the nest incubating or caring for the owlets (Gutiérrez et al. 1995). Early morning or evening hiking may overlap with the foraging period for MSO. There is also evidence that disturbance during years of a diminished prey base can result in lost foraging time which, in turn, may cause some raptors to leave an area or not to breed at all (Knight and Cole 1995). Topographic screening between the area of disturbance and the bird's location creates a noise buffer, and may assist in the reduction of noise disturbance (Knight and Cole 1995).

In addition, Delaney et al. (1999) found that MSO did not flee from helicopters when caring for young at the nest, but fled readily during the post-fledgling period. This may be a result of optimal fleeing decisions that balance the cost-benefit of fleeing. Frid and Dill (2002) hypothesize that this may be explained using predator risk-disturbance theory and perhaps the cost of an adult MSO fleeing during the nestling period may be higher than during the post-fledgling period.

Research on all subspecies of the MSO indicate that it exhibits docile behavior when approached by researchers, and there is no clear evidence of significant impact by research activity except for a negative effect on reproduction from back-pack radio transmitters (Gutierrez *et al.* 1995). However, researchers usually minimize disturbance to the extent possible, which may not be the case for recreational trail users. In the long-term, some species may become less responsive to human disturbance if they are not deliberately harassed; others may become very stress-prone towards humans (Bowles 1995, Hammitt and Cole 1987). Excessive interaction with humans may cause a lowering of call response rates or habituation; the effects of habituation on MSOs are unknown (Gutierrez *et al.* 1995). Habituation, though it may occur to some extent, often is partial or negligible (Frid and Dill 2002) and is not fully understood.

Effects Discussion: Habitat

For habitat effects, the potential changes to key habitat components (KHCs) of protected and restricted habitats and the PCEs of CH potentially resulting from angler access to fishing opportunities is the important effect for this analysis.

The PCEs of designated critical habitat for the MSO were described in detail in the final rule (USFWS 2004). Three categories of PCEs were developed: 1) elements related for forest structure; 2) elements related to maintenance of adequate prey species; and 3) elements related to

canyon habitats. Important components are the presence of a variety of conifer and hardwood tree species in the community and the physical structure of the community (canopy closure, tree diameter, snags, fallen trees and other woody debris, other shrub/herbaceous plants) that will vary between particular critical habitat units based on location. The KHCs for restricted and protected MSO habitat, as described in the Recovery Plan (USFWS 1995) consist of similar habitat components (e.g., large trees, large logs and snags, high canopy closure) and there is little to no distinction that needs to be made between them for the analysis.

The final rule designating critical habitat and the Recovery Plan discussed the types of federal activities that would require section 7 consultations if critical or other MSO habitat would be affected. Recreational development was listed as one of those activities. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure.

Recreational activities, including angler access to fishing opportunities, can have localized indirect effects to habitat if habitat parameters related to the PCEs/KHCs are altered by trampling of vegetation, soil compaction, removal of woody debris or other physical degradation. These activities potentially alter the productivity of the site for maintaining the prey base and succession/regeneration of the vegetation community along paths and trails or other areas with recreation use. Increased fire risk from inappropriate disposal of smoking materials or campfires at recreation sites is also a concern due to increases in wildfire risk. Table 26 provides a list of all proposed stocking sites potentially impacting Mexican spotted owl PAC's.

Effects Analysis

The effects of angler-related disturbance to individual MSOs depends on location of the access relative to important owl habitat (intensity), the number of such encounters (frequency), and the time over which the effect occurs (duration) (USFWS 1995). As discussed previously, location of the disturbance effect during the breeding season outside the PAC or within the PAC contributes to the potential level of the effect during the breeding season.

For effects within a PAC, those that are closest to the nest or roosting sites are more likely to result in a disturbance effect to MSO. As discussed above, MSO at nest and roosting sites alter their behavior when humans are present, with human presence within 200 feet potentially resulting in a flushing response. MSO likely use the entire PAC during the breeding season and since the location of nest and roost sites may change over time, disturbance effects within a PAC

are not distinguished by where in the PAC they occur. The more human presence at one time (intensity) likely exacerbates the disturbance effects.

Intensity of the effect can be related to the noise level resulting from human presence as well as the nearness of the humans to the MSO. Anglers walking to a fishing area may be speaking to other persons. Normal conversation at three to five feet away is 60-70db (GCAudio 2009), and sound attenuates with distance. At distances of over 200 feet, sound levels from normal conversation (70 db) attenuate to 25 db (Engineering Page 2009). This level of sound is comparable to whispering or rustling leaves (OMSI 2005) and may no longer be detectable over background noise.

Frequency and duration of the disturbance are also factor for both increasing the number and intensity of disturbing events and habituating MSO to the disturbance events. Angler related disturbances are concentrated during the stocking season for trout species. The prime trout stocking season in areas inhabited by MSO is the spring and summer, which also coincides with the MSO breeding season (March 1- August 31), so the timing of the peak risk of disturbance is also the most sensitive period for disturbances within the PAC.

Habitat alteration outside of the PAC through creation or maintenance of access for recreationists (including anglers) is not identified as a significant issue for MSO survival and recovery (USFWS 1995) but may occur on a localized scale. As noted previously, this assumption is based on the limited amount of significant effects to PCEs and KHCs from recreationists, including anglers, accessing MSO habitats.

Table 4. Sportfish stocking sites with potential effects to Mexican spotted owls.

Watershed	**Stocking site**	**Within PAC**	**Within buffer**	**Within CH**
Havasu Creek	Dogtown Reservior	n	n	y
Little Colorado River	Hulsey Lake	n	n	y
	Mexican Hay Lake	n	n	y
	Carnero Lake	n	n	y
	Bunch Reservoir	n	n	y
	River Reservoir	n	n	n
	Tunnel Reservoir	n	n	y
	LCR Greer	y	y	y
	LCR Sheep's Crossing	n	n	y
	Chevelon Canyon Lake	n	y	y
	Black Canyon Lake	n	y	y

Watershed	Stocking site	Within PAC	Within buffer	Within CH
	C.C. Cragin Reservoir	n	y	y
	Knoll Lake	y	y	y
Gila River	Luna Lake	n	n	y
Wilcox Playa	Riggs Flat Lake	y	y	y
Salt River	Workman Creek	y	y	y
	Canyon Creek	y	y	y
	Ackre Lake	n	n	y
	East Fork Black River	n	y	y
	West Fork Black River	n	n	y
	Christopher Creek	n	y	y
	Haigler Creek	n	n	y
Santa Cruz River	Pena Blanca Lake	n	n	y
	Rose Canyon Lake	n	y	y
Verde River	Elk Tank	n	n	y
	JD Dam Lake	n	n	y
	Middle Tank	n	n	y
	Perkins Tank	n	n	y
	Oak Creek	n	y	y
	Goldwater Lake	n	n	y
	Huffer Tank	n	n	y
	Dude Creek	n	n	y

Mount Graham Red Squirrel

New Mexico Meadow Jumping Mouse

Effects Discussion:

The New Mexico meadow jumping mouse (MJM) is a 7.4-10 inch rodent recognizable by its long hind feet, smaller, delicate forelegs, and an extremely long, sparsely furred tail that is longer than the body. The pelage is coarse, with a broad dorsal band of brown or yellowish-brown darkened by brownish black hairs; sides paler; under parts white or palely yellow. This is the only mammal with 18 teeth (AGFD 2007, USFWS 2009).

The MJM is generally nocturnal but may exhibit some diurnal activity. It is active only during the growing season of the grasses and forbs it uses for food, hibernating for about nine months,

longer than most mammals. Day length is a likely trigger for hibernation preparation (resting and eating to develop a sufficient fat layer to survive the winter and breed in the spring). Home range size varies between 0.37 and 2.7 acres and may overlap. One litter of two to seven young is born between June and August. The female provides all care for the young until they are independent after four weeks.

A habitat specialist, the MJM nests and hibernates in dryer soils adjacent to moist streamside or marshy, dense riparian/wetland vegetation (Morrison 1990) in two community types: persistent emergent herbaceous wetlands (i.e., beaked sedge and reed canarygrass alliances); and scrub-shrub wetlands (i.e., willow and alder riparian areas along perennial streams) (Frey 2005, 2006). Microhabitats of patches or stringers of tall, dense, sedges on moist soil along the edge of permanent water are particularly used.

Effects Analysis: Habitat:

Improper livestock grazing is the greatest cause of habitat loss for the MJM; however, the recreational use of riparian areas is also an ongoing threat USFWS 2009). The very wet, marshy habitat areas are generally avoided by recreationists (Frey 2005), but the dryer areas are not. In general, recreationists (including campers, ORV users, hikers, and anglers) use of riparian areas paralleling streams may result in creation of open trails through the drier riparian and herbaceous vegetation that fragments the habitat areas, tramples sedges and other low vegetation, and contributes to soil compaction. Effects to MJM from stocking sport fish are related to angler use of their riparian habitats to access fishing areas. Frey (2005) reported significant habitat degradation and elimination at heavily used recreation sites in the San Juan and Jemez mountains in New Mexico, where she noted that anglers and hikers were less of a problem than campers. Along a portion of the Rio Grande that was heavily fished (Frey 2006), anglers may have a more significant impact, particularly if camping is not allowed in the riparian areas. Heavy use of MJM habitats by anglers along the West Fork Little Colorado River in Arizona precluded surveys in that area due to risk of traps being stolen or damaged (Frey 2008). Once a habitat area is degraded by trails, Frey (2005) noted anglers using existing trails to access the stream. Continuing recreational use of MJM habitats likely maintains the habitat degradation and fragmentation resulting from trails and paths.

Habitat for the MJM at Sheep's Crossing and along the West Fork Little Colorado River is in the area affected by recreation use, including access for fishing by anglers. Frey (2008) did not conduct surveys along the West Fork because of heavy angler use of the site and the risk that traps would not be secure from interference. The newly located site on the East Fork Little Colorado River may also be affected by anglers as it is part of the area near Greer that is stocked. The population at the West Fork Black River is also within that stocking area and angler access will continue.

Effects Analysis: Disturbance/Mortality:
Information on MJM does not contain information on their vulnerability to disturbance events from noise or human presence. Most activity is nocturnal when human activity is less likely to occur. Foraging or other daytime activities by MJM may be influenced by noise or human presence. Most habitat patches are small (USFWS 2009) and in smaller patches there may be more potential for disturbance responses.

MJM nests are on the surface in dense vegetation in the drier areas away from the water (Wright and Frey 2009). Since they are largely nocturnal, their daytime resting places may also be in these drier areas. While most recreationists, including anglers, likely use existing trails and paths through MJM habitat, any crossing of habitat areas may result in injury or mortality to young MJM that are unable to move away from the nest to evade trampling.

Southwestern Willow Flycatcher
Effects Analysis

Between the Verde Valley and White Mountains, trout stocking and angling will occur at different times within flycatcher habitat. Trout angling could occur year-round in the Verde Valley, but stocking and angling would mostly coincide with each other and occur from the late fall to early spring. The primary stocking and angling actions in the Verde Valley would primarily overlap the time when breeding flycatchers are on their wintering grounds in central and northern South America. This time frame would also occur when tree species that flycatchers rely upon are mostly dormant. However, there is some warm water fish stocking at Dead Horse State Park during the flycatcher's breeding season. In contrast, angling and stocking at high elevation is most likely to occur in the late spring and summers because of the harsh winters and difficult access. However, during these instances flycatchers could be nesting and it would be during the nesting habitat's growing season.

Anglers can be expected to behave similarly in the Verde Valley to those in high elevation areas. However, anglers are limited in access throughout the Verde Valley due to the abundance of private lands. In contrast, in the White Mountains, the primary limit to angler use is the location of stocked trout and access. However, in both areas, anglers are not anticipated to wander remarkably far from the stocked locations. As a result, we can anticipate that most effects would occur near where trout are stocked. The Apache-Sitgreaves NF staff estimate that approximately 70,000 to 75,000 people use the recreation area in and around the Greer Area and forks of the Little Colorado River annually.

In both locations, we anticipate that anglers will likely be on foot and either alone or in small parties. These trout stocking actions are an ongoing action that has a long history of occurring in both of these areas. As a result, we anticipate that anglers will likely continue to visit areas that

they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, we do not anticipate anglers once they reach their destination to be fishing in tight areas where vegetation is dense that causes casting to be difficult.

Western Yellow-Billed Cuckoo

Effects Discussion:

As was provided in Table 15, sport fish stocking sites covered by this consultation may be in proximity to cuckoo nesting habitats and the presence of anglers drawn by the fishing opportunities may result in disturbance effects depending upon location and timing of sport fish stocking and possibly some habitat degradation due to anglers accessing streams or lakes. Effects to yellow-billed cuckoos from stocking sport fish therefore are in two categories: 1) angler use of riparian areas that reduces habitat quality through creation of trails, trampling of understory, and opening of waterfront edges to create access; and 2) disturbance of birds by human presence.

Effects Analysis: Habitat

Angler access to stocking sites has some potential to affect cuckoo habitat through trampling of plants and creating trails and paths through cutting or breaking branches through the under- or mid-story vegetation. Other factors are more likely to create such trails or openings, and anglers are more likely to use existing access than to attempt to move through the dense growth that characterizes intact cuckoo habitat.

Effects Analysis: Disturbance

Yellow-billed cuckoos are more sensitive to human presence/noise during their nest-building and incubation periods and less sensitive while hatchlings or fledglings are present. Distance from the human presence to the nest area may be a factor in the degree of response from attending adult cuckoos. In locations with regular human presence from recreationists, including anglers, cuckoos may tolerate the disturbance or locate nests away from trails or paths used by people. Human disturbance during the migration period is likely not an issue for cuckoos.

Yuma Clapper Rail

Effects Discussion:

YCR are secretive marsh birds that are found in cattail and cattail bulrush marshes along the lower Colorado, Gila, and Salt rivers in Arizona. They are seldom seen as they tend to remain in dense cover provided by marsh and adjacent low-growing riparian vegetation. They are generally presumed to be resident and non-migratory along the lower Colorado and lower Gila rivers

(Eddleman 1989); however, it is uncertain if the Gila River/Phoenix metro population remains in the area year round (Corman and Wise-Gervais 2005).

Potential effects to YCR from activities of anglers pursuing stocked sport fish are in three categories: 1) creation or maintenance of trails to access fishing sites; 2) disturbance of individuals by human presence or noise; and 3) exposure to lead from discarded fishing tackle or entanglement in monofilament attached to dead fish.

Habitat for YCR is dense marsh (cattail and bulrush) with a mix of riparian shrub and tree species along the shoreline with interspersed areas of open, shallow (less than one foot deep) water with some bare ground areas for foraging and movement (summarized in USFWS 2010). Minimum patch size for YCR habitat has not been established; however, information on sizes of home ranges and resultant management recommendations suggest creation of patches at least 20 acres in size (summarized in USFWS 2010). Use of smaller habitat areas is documented (USFWS compiled annual survey data), and these sites likely contain lower numbers of pairs than the larger, more contiguous marsh areas. Dense YCR habitat is not conducive to angling, although the open water along the edges of the marsh is used if shore access between marsh patches or boat access is available. Creation of trails or paths through cattails or bulrush to access open water may occur where other access is limited; however, where open areas exist those are more likely to be utilized.

YCR initiate breeding activities with pair-bonding calls in February with initiation of nesting in March with a peak in May on the lower Colorado River (Eddleman 1989). Along the Gila River in the metropolitan Phoenix area, calling is later (March) with nesting probably peaking later in the spring than along the lower Colorado River. Nests are constructed in dense vegetation within the marsh or associated riparian vegetation. Young YCR are cared for by the adults for several weeks following hatching (Eddleman and Conway 1998). Adults molt during the summer and are flightless during that period.

Information on the effects of noise or human presence on YCR is very limited. Annual survey information indicates that YCR can be found in close proximity to areas of human activities (recreation areas, boat ramps, roads) where those activities have been ongoing for many years. The size of the available habitat may be important as larger areas can provide larger buffer areas or refuge sites than smaller habitats. YCR in these areas may be tolerant of the existing level of potential disturbance through having sufficient habitat area and acclimation. While YCR are secretive, examples exist of them crossing roads or launch ramps in front of vehicles or humans. The amount of disturbance reaching the occupied habitat will vary depending on the distance between the disturbance and the habitat, as noise attenuates over distance.

Crayfish, small fish, tadpoles, clams and other aquatic invertebrates comprise the diet of all life stages of YCR (summarized in USFWS 2010). Stocked fish may compete with YCR for

invertebrate foods; however, the foraging sites of YCR tend to be on mudflats and in vegetative cover where fish are unlikely to access. They hunt by sight and have an acute sense of smell (Eddleman and Conway 1998) but it is unknown if they use dead fish. Only one reference cited in Eddleman and Conway (1998) mentioned carrion as a minor food source, but it was not clear if this was dead fish or other dead animals. Their bills are not designed to dismember large prey items, so their ability to utilize moribund fish containing hooks or other fishing tackle is likely reduced. The secretive nature of the YCR reduces the potential for any individual caught in fishing line to be located; however, this is not identified in the literature as an issue for clapper rails in general. Clapper rails may be exposed to lead from sinkers or jigs lost from angling activities. Jones (1939) noted that the probing for animal foods feeding style of clapper rails reduced the likelihood of them ingesting lead shot pellets (only five instances were found in 423 stomachs), and with the use of steel shot for waterfowl hunting, this avenue of exposure is likely reduced. The compiled research on ingestion of lead sinkers or jigs does not document occurrences in clapper rails (Perry 1994, Schuehammer et al. 2003).

Effects Analysis: Habitat:

Angler access to stocking sites through YCR habitat may result in trampling of some vegetation, particularly the adjacent riparian shrubs. Attempts to create trails through extant cattail patches would be extremely difficult. Existing trails created by recreationists, including anglers do fragment habitat patches; however, these are limited in scope and the resultant open area can be used by YCR for foraging when humans are not present. Where there is no or small amounts of cattail/bulrush habitat at a stocking site, it is unlikely to be used by YCR.

Effects Analysis: Disturbance:

Literature on YCR does not suggest they are particularly vulnerable to disturbance events even during nesting. Nests are sheltered within dense habitats, and noise from human presence likely attenuates due to the vegetation and distance from the source. Boat motors may be heard within habitats; however, anglers with boats approaching marshes to fish in the open water area generally at low speeds with reduced noise.

Effects Analysis: Fishing tackle:

The presence of discarded monofilament line or broken line with hooks or other tackle attached to moribund fish has not been identified as an issue of concern for YCR, which are not known to feed on dead fish. While there is some past evidence of lead shot in clapper rails, no records for ingestion of lead sinkers or jigs was found in the literature.

INTERACTIONS BETWEEN STOCKED FISH AND AMPHIBIANS AND REPTILES

Arizona Tree Frog

Interaction species:

Largemouth bass, bluegill, redear sunfish, channel catfish, rainbow trout

Arizona tree frogs are active from late June to early October and use mesic habitats such as shaded oak groves, wet seeps, and other moist locations (Holm and Lowe 1995). Breeding takes place primarily in ephemeral waters. Although they sometimes use permanent sites, such as stock tanks, they are less likely to support treefrog larvae because of the increased presence of aquatic invertebrate and vertebrate predators, including predatory insects, crayfish, bullfrogs or fish species (Collins 1996).

Competition

While specific data are not available for Arizona tree frogs, tree frogs (*Hyla* spp.), in general, primarily prey on a variety of terrestrial invertebrates, and do so primarily in terrestrial habitats (e.g., Oplinger 1967). Adults occupy aquatic habitats only during breeding activity, and are not likely to feed at that time. Treefrog larvae feed on aquatic algae, bacteria and detritus. Therefore, competition between adult or larval Arizona tree frogs and stocked fish species is unlikely.

Predation

The Arizona treefrog is active from April to October, and moves to breeding sites during the summer monsoon season. Arizona tree frogs typically breed in ephemeral sites that fill with summer rainfall. There is minimal potential for exposure with the stocked species at breeding sites, and overlap would be of short duration, and only in the unusual case in which a treefrog would stray into a stocked site. In addition, trout stocking season is from October to April thus minimizing potential contact.

There are no movement data for Arizona tree frogs, so the extent to which they are likely to move to sites with stocked fish is unknown. Studies of other, ecologically similar and similarly-sized species of hylid frogs provide a conservative basis for comparison. Maximum movement distances have been reported for pine barrens tree frogs (102 m), gray tree frogs (about 300 m) and western chorus frogs (about 200 m) (Freda and Gonzalez 1986, Johnson et al. 2007, Kramer 1973), all of which breed in ephemeral waters and spend most of the non-breeding season feeding in adjacent forests. Importantly, all of those species occur in more mesic habitats in the eastern U.S., which would facilitate terrestrial movements. Thus, we conservatively suggest that Arizona tree frogs might move up to 300 m from breeding sites.

The distribution of Arizona tree frogs in and around the Huachuca Mountains is incompletely understood (USFWS 2008). Nearest known breeding sites include Hannah Tank (1.7 km [1.05 mi] E of Parker Canyon Lake) and Whiner Tank (2.9 km [1.8 mi] N of Parker Canyon Lake); other nearby sites include those in Scotia Canyon northeast of the lake > 3 km (> 1.9 mi)

(USFWS 2008). Although these known sites are farther than 300 m from Parker Canyon Lake, we do not know if there are populations of Arizona tree frogs closer to the lake. Thus, it is possible that Arizona tree frogs could enter Parker Canyon Lake, but we do not know how likely that would be.

Although there are no definitive data to address pre-breeding behavior in Arizona tree frogs, one would expect there to be strong selection against individuals that would enter permanent water, such as an impoundment with a large population of potential predators. Surprisingly few experiments have tested the generality of this hypothesis. Experiments with other similarly-sized species of hylid frogs that also breed in ephemeral waters (e.g., gray tree frogs) have shown that predation pressures in permanent waters typically prevent those treefrog species from entering potential breeding sites that harbored predators (Resetarits and Wilbur 1989). This suggests that a stocked site would not provide suitable habitat for Arizona tree frogs due to the presence of predatory, nonnative fishes already present. Nonetheless, studies of some ranid frogs suggest that choice of egg-laying sites with or without predatory fishes differs among different species, i.e., some species avoid sites with fishes, others do not (Hopey and Petranka 1994, Laurila and Aho 1997). In the Canelo Hills north of Parker Canyon Lake there is a record of an Arizona treefrog at a stock tank that supported exotic fishes, and had for many years (AGFD Sonoran tiger salamander database, T. Jones and A. Owens, pers. comm.), suggesting that avoidance of such habitats is not perfect.

Any dispersing Arizona treefrog that moves into a stocking site is at risk of predation by largemouth bass, channel catfish and rainbow trout. Hovey and Ervin (2005) reported juvenile largemouth bass predation on a California treefrog (*Pseudacris cadaverina*), a species about the same size as the Arizona treefrog. Matthews et al. (2001) documented a strong negative correlation between the distribution of Pacific tree frogs (ecologically similar to Arizona tree frogs) and introduced nonnative trout species (*Onchorhynchus* spp.), and suggested that predation was the probable cause.

Baitfish/Live Bait Issues

Use of live baitfish or tiger salamanders is prohibited at Parker Canyon Lake. The habitats of the Arizona tree frog in the Huachuca Mountains are in both perennial and ephemeral waters that may be at risk for illegal baitfish introduction (USFWS 2008). Arizona tree frogs are unlikely to persist in large numbers where there are bullfrogs or nonnative fish species. For example, experiments have demonstrated that predation by mosquitofish (*Gambusia* sp.) had a disproportionately greater effect on hylid frog tadpoles than did other similarly-sized native and nonnative fishes (Baber and Babbit 2003). Nonetheless, overlap with nonnatives has been observed. For example, bullfrogs were observed seasonally in an Arizona treefrog breeding site in the Huachuca Mountains, but those bullfrogs had also consumed several adult Arizona tree frogs (Jones and Timmons in review). In June 2008, an adult Arizona treefrog was seined out of

Turkey Tank in the Canelo Hills from which over 1200 green sunfish had also been seined (A. Owens, pers. comm.). Exotic fishes have been documented at that site over many years, including 1995 (T. Jones, pers. comm.), 1997 and 2006 (AGFD Salamander database). Thus, tree frogs might persist at low numbers with exotic predators for many years until the treefrog population has been completely depleted.

Chiricahua Leopard Frog

Interaction species

Rainbow trout, brook trout, cutthroat trout, brown trout, Apache trout, channel catfish, Arctic grayling, largemouth bass, bluegill sunfish, redear sunfish, yellow perch, walleye, black crappie, flathead catfish.

The Chiricahua leopard frog (*Rana chiricahuensis*) is a large member of the *Rana pipiens* complex that is found in a variety of permanent and semi-permanent aquatic habitats in Arizona, New Mexico, Sonora and Chihuahua. The primary threats to this species are predation by nonnative, introduced bullfrogs, fish, and crayfish, and an introduced fungal skin disease (chytridiomycosis) that is implicated in global decline of frogs and toads. Other limiting factors include drought, floods, habitat degradation, loss and fragmentation, populations that are small in number and size, environmental contamination, poor livestock management, and altered fire regimes (U.S. Fish and Wildlife Service 2007).

Chiricahua leopard frogs, like other leopard frogs, are typically habitat generalists, found in springs, cienegas, canals, small creeks, main stem rivers, lakes, and earthen cattle tanks. This species is the most aquatic of all Arizona leopard frogs and requires permanent to semi-permanent water to survive and reproduce. Important habitat requirements are typically heterogeneous in nature and generally include shallow water with emergent vegetation for breeding and deeper water, undercut banks and other structure for escaping predators (Sredl and Jennings 2005, U.S. Fish and Wildlife Service 2007).

Larval Chiricahua leopard frogs are herbivorous, feeding on bacteria, diatoms, phytoplankton, filamentous green algae, water milfoil (*Myriophyllum* sp.), duckweed (*Lemna minor*) and detritus (Marti and Fisher 1998) and likely feed on other aquatic vegetation. Adults consume a wide variety of insects and other arthropods (Degenhardt et al. 1996), and they occasionally consume small vertebrates, including other amphibians and birds (Stebbins 1951).

The Chiricahua leopard frog has a complex life cycle: they are aquatic as larvae and become terrestrial as adults. Breeding may occur any time of the year. Eggs are deposited in shallow water and are attached to vegetation or sometimes to the bottom substrate. Chiricahua leopard frog tadpoles can metamorphose in 3 months, but may over winter, taking up to 9 months or more to metamorphose (Sredl and Jennings 2005).

Predation

Studies that have implicated nonnative fish in declines of Chiricahua and other leopard frogs in Arizona include Clarkson and Rorabaugh (1989), Sredl and Howland (1994), Rosen et al. (1994, 1996), and Snyder et al. (1996). These studies and the Chiricahua leopard frog recovery plan (U.S. Fish and Wildlife Service 2007) identify predation by nonnative fish as one of the primary threats to the Chiricahua leopard frog. Specifically, predation by stocked fish in the family Centrarchidae (e.g., *Micropterus* spp., *Lepomis* spp.) is thought to have the most dramatic impact on Chiricahua leopard frog larvae, metamorphs, and adults. Additionally, other species such as catfishes (*Ictalurus* spp.), the flathead catfish (*Pylodictus olivaris*), and species of trout (*Oncorhynchus* spp. and *Salvelinus* spp.) are thought to prey upon life stages of the Chiricahua leopard frog.

The interactions of stocked trout and Chiricahua leopard frogs have been poorly studied. However, examining the interactions of other ranid frog species and trout may provide some insight. The best studied "trout-frog" interaction is that between the mountain yellow-legged frog (*Rana muscosa*) in high lakes of the Sierra Nevada, California and stocked trout (*Oncorhynchus* spp. and *Salvelinus* spp.). Several authors have concluded that predation by these introduced species into the previously fishless lakes of the High Sierra have eliminated populations of mountain yellow-legged frogs (Bradford 1989, Bradford et al. 1993, Knapp and Mathews 2000, Vredenburg 2004).

Whether introduced trout would have the dramatic impact to Chiricahua leopard frogs as they did on mountain yellow-legged frogs is unclear for several reasons: 1) the High Sierra lakes occupied by the mountain yellow-legged frog were historically fishless, while the aquatic habitats historically occupied by the Chiricahua leopard frogs often contained fish, including native trout of the genus *Oncorhynchus*; 2) the High Sierra lakes are oligotrophic, with extremely high visibility and little vegetative cover, while aquatic systems that the Chiricahua leopard frog occupies are usually eutrophic, with poor visibility and good cover; and 3) mountain yellow-legged frogs in the High Sierra lakes have a 3-year larval period, while Chiricahua leopard frogs have, at most, a 1-year larval period.

It is worthwhile noting that most of the studies that have examined the interactions of nonnative fish and native leopard frogs base their conclusions on the negative co-occurrence of "fish and frogs" in the wild. Because of this, they provide limited insight into environmental conditions that mediate interactions or techniques to mitigate impacts between these taxa. However, in spite of the lack of details on the mechanics of these interactions, there is universal agreement the impacts of stocked fish on native aquatic organisms can be serious and dramatic.

Competition

Populations of Chiricahua leopard frogs and stocked fishes are unlikely to persist syntopically. However, if they did co-occur they may attempt to utilize some of the same resources, most notably food and space. Utilizing shared resources is not competition - for competition to occur, there must be a limited shared resource.

Chiricahua leopard frogs are known to inhabit aquatic habitats ranging from cienegas, stock tanks, small ponds, streams, and rivers. The best habitats are heterogeneous, with deep and shallow water, aquatic and emergent vegetation, root masses or other forms of cover (U.S. Fish and Wildlife Service 2007). These are often highly productive systems with abundant plant and animal life, making the likelihood that "fish and frogs" will compete for food resources low.

With water being a limited resource, competition for space within aquatic sites is more likely. Both frogs and stocked fish will utilize slow and slack water habitats (pools, eddies etc.) and while competition under these circumstances is possible, the consequences of predation are likely to be far more severe.

Bait fish issues

Most legal baitfish likely have little impact on native leopard frogs. Mosquitofish occupy all of the ponds at the Beatty Guest Ranch in the Huachuca Mountains, which support the largest and most robust populations of Chiricahua leopard frogs in the state. This suggests that predation by mosquitofish may be insignificant; however, the coexistence of these species could be influenced by other factors, such as abundant escape cover, high adult frog survivorship, and high reproductive output in terms of numbers of frog egg masses produced. Goldfish occupy Butch Tank, Coconino Co, which also contains a robust population of northern leopard frogs (M. Sredl pers. comm.).

Illegal stocking of earthen cattle tanks and other bodies of water to create bait fish populations can have a significant effect to leopard frogs, particularly when highly predaceous species are planted. Most areas of Chiricahua leopard frog occurrence are outside of locations where bait fish are legal to use. However, legal use of bait in the Gila, Salt, and Verde rivers and associated reservoirs can lead to illegal creation of bait fish populations in tanks within those watersheds.

Narrow-headed gartersnake

Interaction species

Rainbow trout, brown trout, brook trout, cutthroat trout, Arctic grayling, Apache trout, smallmouth bass, largemouth bass, bluegill, redear sunfish, black crappie, channel catfish, threadfin shad

Narrow-headed gartersnakes occupy primarily large, perennial streams and depend on rocky riffles for foraging and bank-side vegetation for basking and escape from predators (Rosen and Schwalbe 1988; Rossman et al. 1996). These snakes feed almost exclusively on soft-rayed fishes

and rarely move more than a few meters from the edge of these streams (Nowak and Santana-Bendix 2002, Nowak 2006). Hibbitts et al. (2009) explained that habitat specialists, such as narrow-headed gartersnakes, are highly susceptible to changes in their habitat, and introductions of nonnative fishes and streamside trampling from recreational use changes the microenvironment on which these snakes depend. Throughout their range in Arizona and New Mexico, narrow-headed gartersnakes have experienced significant population declines (Holycross et al. 2006, NMDGF 2007). The introduction of nonnative species, including sport fish, is thought to be a major threat and cause for population declines (Rosen and Schwalbe 1988, Rossman et al. 1996, Nowak and Santana-Bendix 2002), although the mechanisms through which these occur are incompletely understood.

The likely mechanisms by which nonnative species interact with narrow-headed gartersnakes are through predation, competition and habitat modification, though the degree to which either occurs is unclear. There is a strong negative correlation between sport fish (especially spiny-rayed fishes) and narrow-headed gartersnakes (Rosen and Schwalbe 1988, Nowak and Santana-Bendix 2002, Holycross et al. 2006, Pierce 2007). Nonnative spiny-rayed fishes are thought to be unsuitable prey because narrow-headed gartersnakes cannot safely ingest the fish without them becoming lodged in their throats or causing other physical damage to the digestive tract (Nowak and Santana-Bendix 2002).

During gartersnake surveys at 7 Arizona sites in the mid-1980s, narrow-headed gartersnakes were only abundant in areas where native fish predominated (Rosen and Schwalbe 1988). Rosen and Schwalbe (1988) surveyed Oak Creek in 1985 and 1986 and hypothesized that the abundance of narrow-headed gartersnakes in Oak Creek Canyon reflected the lack of introduced predatory fish. During gartersnake surveys in the lower reaches of Oak Creek Canyon in 2000-01, narrow-headed gartersnake populations were very low or undetectable. In those reaches, nonnative spiny-rayed fishes, bullfrogs and crayfish were detected (Nowak and Santana-Bendix 2002). Nowak and Santana-Bendix (2002) suggested that the abundance of spiny-rayed nonnative fishes in the lower reaches of the canyon (along with the loss of suitable prey) accounted for the decline of narrow-headed gartersnakes in those areas. Although these data are correlative, the correlations are strong and suggest that the introduction of nonnative fishes is directly or indirectly responsible for changes in gartersnake numbers, although other related factors might also be involved.

Competition

There is potential for nonnative sport fish to interact with narrow-headed gartersnakes through competition for food and habitat, though the degree to which this occurs is unknown. For example, piscivorous largemouth and smallmouth bass and various catfish species readily prey on other fishes, as will some trout species, and thus could compete with gartersnakes for food where these shared resources are limited. Narrow-headed gartersnakes prey primarily on small

soft-rayed fishes (Nowak and Santana-Bendix 2002), including native suckers and speckled dace, and nonnative rainbow and brown trout and red shiner. To a lesser extent, narrow-headed gartersnakes may prey on some spiny-rayed fishes such as sunfish and smallmouth bass (Degenhardt et al. 1996, NMDGF 2007, M. Lopez pers. comm.). In captive situations, narrow-headed gartersnakes have also been documented to prey on larval and adult anurans and larval tiger salamanders (Degenhardt et al. 1996). Competition for prey is likely to occur between narrow-headed gartersnakes and piscivorous fishes, including smallmouth bass and, to a lesser extent (because of habitat partitioning), largemouth bass and channel catfish where prey resources are limited.

Predation

There is potential for nonnative stocked sport fish to interact with narrow-headed gartersnakes through predation. Sportfish that consume vertebrate prey species (e.g., largemouth bass, smallmouth bass, channel catfish) likely prey on neonate and juvenile gartersnakes (Rosen and Schwalbe 1988, Schindler et al. 1997, Rosen et al. 2001). For example, Winemiller and Taylor (1982) reported aggressive attacks by nesting smallmouth bass directed towards common gartersnakes (*Thamnophis sirtalis*), though it is unclear whether these attacks were attempted predation or competition for habitat. Additionally, an overlap in habitat preferences will increase the likelihood of interaction between stocked sport fish and narrow-headed gartersnakes. For example, in Arizona, smallmouth bass are more likely than other piscivorous fishes to overlap in habitat with narrow-headed gartersnakes because they prefer clear, gravel-bottom runs in rivers and cool flowing streams. The frequency at which these species could interact is higher than for other stocked sport fish and may result in predation on the snakes or competition for food and habitat.

Apache and rainbow trout prey primarily on invertebrates (Metcalf et al. 1997) and are not considered important predators on vertebrates (Rosen and Schwalbe 1988). Historically, native trout (Apache and Gila) species and narrow-headed gartersnakes co-occurred across much of their distribution in Arizona, and it is likely that they evolved to co-exist. It is not known what effect the presence of nonnative trout has on narrow-headed gartersnakes. However, during 2009 surveys at Oak Creek, Brennan and Rosen (2009) observed that narrow-headed gartersnake occurrence was negatively associated with the presence of brown trout (presumably large trout) throughout the main stem and other tributaries of Oak Creek Canyon.

The stocking of sport fish might also result in positive interactions for narrow-headed gartersnakes, because, as described above, the snakes will prey on some species. In a diet analysis of narrow-headed gartersnakes, Nowak and Santana-Bendix (2002) found brown trout in 8 of 12 snakes that had food in their stomachs. Additionally, Nowak (2006) demonstrated that narrow-headed gartersnakes in the upper reaches of Oak Creek apparently prefer immature brown trout. Narrow-headed gartersnakes thrive in captivity on a diet of fingerling rainbow trout

(V. Boyarski pers. comm.). The stocking of fingerling trout could provide additional food sources to the snakes in areas where native prey species have been severely reduced.

Angler Impacts/Baitfish/Live Bait Issues

Recreational activities, such as fishing and access to stocking sites, may increase as the result of the sport fish stocking action and these activities could directly and indirectly impact narrow-headed gartersnake populations and their habitats. Angler/recreational use might increase the likelihood of direct mortality as well as habitat changes from streamside/vegetation trampling and the intentional/unintentional spread of nonnative live bait (e.g., baitfish, crayfish, etc.).

As is common in many cultures, people often dislike snakes because they believe snakes are venomous and a threat to their safety. As a result, people with such misperceptions intentionally kill snakes, including narrow-headed gartersnakes, even though they are not venomous (Nowak and Santana-Bendix 2002). In addition, some anglers believe that narrow-headed gartersnakes compete with sport fish, and therefore might kill the ones they encounter (NMDGF 2007).

Rosen and Schwalbe (1988) documented substantial human-caused mortality on narrow-headed gartersnakes at Oak Creek Canyon, a site used heavily by recreationists. Nowak and Santana-Bendix (2002) also reported high rates of direct mortality on narrow-headed gartersnakes at sites within Oak Creek that receive high recreational use (e.g., Slide Rock State Park), but they did not consider the overall impact of recreation on the population to be large. During interviews with bathers at Oak Creek Canyon, Rosen and Schwalbe (1988) found that people commonly caught narrow-headed gartersnakes and took them to Flagstaff, presumably for pets. Nowak (2006) also reported that visitors to Oak Creek, especially children, collected the snakes to keep as pets, despite outreach signs designed to explain the conservation needs of the snakes and to reduce negative snake-human interactions. Nowak and Santana-Bendix (2002) also documented other sources of direct human caused mortality of narrow-headed gartersnakes from recreationists and from vehicles at stream crossings, as well as entanglement in fishing line.

Oak Creek Canyon receives atypically heavy use since certain reaches are popular for hiking, bathing, and/or fishing. Therefore, additional impacts by recreationists/anglers might also degrade habitat conditions along streams where the snakes occur. Narrow-headed gartersnakes inhabit submerged interstitial spaces in emergent boulders within streams, a microhabitat that is vulnerable to degradation or elimination from heavy siltation (Rosen and Schwalbe 1988), which typically results from large scale soil erosion (e.g., that might result after catastrophic wildfires). Rosen and Schwalbe (1988) found only one instance of heavy siltation of narrow-headed gartersnake habitat (Cibecue Creek), and attributed it to channelization associated with agriculture. More recently, however, Oak Creek Canyon has experienced siltation caused by heavy recreational use. Nowak (2006) cited recreation-caused destruction of nursery habitat for

neonate snakes and their prey fish as a factor contributing to the decline of the species in Oak Creek Canyon, however, this has not been experimentally tested.

Habitat impacts might also result from intentional or unintentional spread of nonnative live bait. While use of live baitfish or tiger salamanders is prohibited in some parts of the state, it is still permitted in many areas. Crayfish and bullfrogs cannot be legally moved alive among most Arizona waters including those within the range of narrow-headed gartersnakes. However, despite these restrictions, some anglers may still use these for bait and could move crayfish and bullfrogs among aquatic systems. Anglers may also transport live baitfish or salamanders among waters and they may come in contact with narrow-headed gartersnakes.

There is considerable correlative evidence that suggests crayfish negatively impact narrow-headed gartersnakes. Nowak and Santana-Bendix (2002) observed that narrow-headed gartersnakes were less likely to be found in streams with crayfish. During 2009 gartersnake surveys along the Black River, narrow-headed gartersnakes were found in very low numbers where crayfish densities were high, and narrow-headed gartersnakes appeared to continue to decline at that site (Brennan and Rosen 2009). Crayfish also prey on other small aquatic vertebrates (Fernandez and Rosen 1996, Schwendiman 2001) and possibly compete with gartersnakes for prey. Crayfish remove aquatic vegetation (Saiki and Zeibell 1976, Fernandez and Rosen 1996), which could directly affect gartersnake prey species and their habitat. If given the opportunity, crayfish prey on, or at least attempt to prey on gartersnakes, especially neonates (Fernandez and Rosen 1996). At 3 of 5 sites at which narrow-headed gartersnakes were found during 2004-05 surveys, most snakes had scars or incomplete tails, injuries that were attributed to attempted predation by crayfish (Holycross et al. 2006), and consistent with experimental evidence (Fernandez and Rosen 1996). Furthermore, only 3 of 19 narrow-headed gartersnakes found in the Black River in 2009 had complete tails (Brennan and Rosen 2009). When foraging, narrow-headed gartersnakes use their tails to anchor themselves between boulders (V. Boyarski pers. comm.), and having an incomplete tail could decrease foraging effectiveness and therefore survivorship.

Bullfrogs have been implicated in the decline of other gartersnake species in Arizona (Rosen and Schwalbe 2002), and bullfrog presence was cited as one of several factors causing the decline of narrow-headed gartersnakes in the lower reaches of Oak Creek Canyon (Nowak 2006). Although direct predation of narrow-headed gartersnakes has not been documented, bullfrog predation on other gartersnake species has been documented (Schwalbe and Rosen 1988, V. Boyarski pers. comm.).

Northern Mexican Gartersnake
Interaction species

Rainbow trout, brook trout, cutthroat trout, Arctic grayling, Apache trout, largemouth bass, bluegill, redear sunfish, black crappie, channel catfish, brown trout, threadfin shad, flathead catfish

Northern Mexican gartersnakes are semi-aquatic, riparian obligates that inhabit cienegas, streams, rivers, stock ponds and other aquatic habitats with dense vegetation, and they feed primarily on a varied diet of native aquatic species (e.g., adult and larval native leopard frogs, native fishes) (Rosen and Schwalbe 1988, USFWS 2008). Gartersnakes will prey opportunistically on toads, tree frogs, earthworms, deer mice, lizards, and tiger salamanders (USFWS 2008) as well as on some nonnative species, particularly juvenile soft-rayed fishes, such as mosquitofish, and young bullfrogs (Holycross et al. 2006, V. Boyarski pers. comm.).

The introduction of nonnative species, such as bullfrogs, crayfish and sport fish (e.g., channel catfish, largemouth bass) is believed to have contributed to the decline of northern Mexican gartersnake populations throughout Arizona. Rosen et al. (2001) stated that gartersnake declines "have been associated with high-density bullfrog populations, predatory centrarchid fishes, and disappearance of primary prey—native ranid frogs and native fishes." The likely mechanisms by which these nonnative species interact with gartersnakes are through predation, competition, and habitat modification, though the degree to which any occurs has not been thoroughly documented. Also, attempts to prey on spiny-rayed nonnative fish may result in injury or death due to choking or injury from spines (e.g., as has been reported for narrow-headed gartersnakes Nowak and Santana-Bendix 2002, USFWS 2008).

Competition

There is potential for nonnative sport fish to interact with northern Mexican gartersnakes through competition where shared resources are limited, though the degree to which this occurs is unknown. For example, rainbow trout, one anticipated species proposed for stocking, feed primarily on invertebrates and could compete with native leopard frogs for food. Through their impacts on frog populations, trout could affect gartersnakes. Additionally, some trout species (e.g., brown trout) also prey on frogs and therefore could compete with northern Mexican gartersnakes for prey. Rosen and Schwalbe (1988) suggested that nonnative fishes, such as large catfish, bass and pike, might have contributed to the decline of native leopard frogs and small native fish, which are important prey species for gartersnakes.

In a California study, Matthews et al. (2002) evaluated the potential links among declining amphibians, nonnative trout (e.g., *Oncorhynchus mykiss* x *Oncorhynchus mykiss aguabonita* hybrids, *Salvelinus fontinalis* and *Salmo trutta*) introductions and the distribution of mountain gartersnakes (*Thamnophis elegans elegans*) in high elevation aquatic communities. Strong positive associations were observed between the presence and numbers of native anurans (*Pseudacris regilla*, *Rana muscosa*, and *Bufo spp.*) and the presence of mountain gartersnakes. In

lakes where amphibians were declining or from which they had disappeared, few to no gartersnakes were found. Matthews et al. (2002) reported a significant negative association between snake presence and presence of nonnative trout in the high elevation lakes. They surveyed 2103 lakes and ponds, and although they did not discount the possibility that trout occasionally preyed on snakes, none were found in stomach contents of >1200 fish. Matthews et al. (2002) commented that, "we suspect that the distribution of amphibian prey may be the primary factor determining snake distribution and abundance among lakes." Thus they concluded that introduced trout competed with gartersnakes for native amphibians, and by reducing the prey populations the trout had caused reductions in gartersnakes.

Predation

There is potential for nonnative stocked sport fish to interact with northern Mexican gartersnakes through predation. Sportfish that consume vertebrate prey species (e.g., largemouth bass, channel catfish, etc.) likely prey on neonate and juvenile gartersnakes (Rosen and Schwalbe 1988, Rosen et al. 2001). For example, Winemiller and Taylor (1982) reported aggressive attacks by nesting smallmouth bass directed towards common gartersnakes (*Thamnophis sirtalis*), though it is unclear whether these attacks were attempted predation or competition for habitat. We are not aware of any documentation of nonnative fish preying on northern Mexican gartersnakes, and more information is needed on this subject.

Rainbow trout prey primarily on invertebrates (Metcalf et al. 1997) and are not considered important predators on vertebrates (Rosen and Schwalbe 1988). It is not known what effect, if any, the presence of these nonnative trout has on northern Mexican gartersnakes. Additionally, the likelihood and frequency of interactions between stocked trout and snakes depends on the time of year that stocking occurs. Often, rainbow trout are stocked in reservoirs during the cool season months when snakes are in hibernation, and the trout are not expected to persist through the summer months when water temperatures exceed their thermal tolerance. Also, large rainbow trout maintained in a pond at the Page Springs state fish hatchery have not been observed to prey on northern Mexican gartersnakes, though trout stomach contents have not been examined (V. Boyarski pers. comm.).

Sportfish stocking could result in positive interactions for northern Mexican gartersnakes, because, as described above, the snakes will prey on some stocked species of soft-rayed fishes. Neonate gartersnakes at the Bubbling Ponds fish hatchery frequently consume nonnative mosquitofish, though these are not proposed for stocking (V. Boyarski pers. comm.).

Angler Impacts/Baitfish/Live Bait Issues

Recreational activities, such as fishing and access to stocking sites, may increase as the result of the sport fish stocking action and these activities could directly and indirectly impact northern

Mexican gartersnake populations and their habitats. Angler/recreational use might increase the likelihood of direct mortality as well as habitat changes from bank-side vegetation trampling and the intentional or unintentional spread of nonnative live bait (e.g., baitfish, crayfish, etc.).

As is common in many cultures, people often dislike snakes because they believe snakes are venomous and a threat to their safety. As a result, people with such misperceptions intentionally kill snakes, even if they are not venomous (e.g., as has been reported for narrow-headed gartersnakes, Nowak and Santana-Bendix 2002). In addition, some anglers might believe that gartersnakes compete with sport fish, and therefore might kill the ones they encounter (NMDGF 2007). The degree to which direct mortality to northern Mexican gartersnakes occurs is unknown.

Habitat impacts might result from intentional or unintentional spread of nonnative live bait. Northern Mexican gartersnake populations in the Verde River, Oak Creek, and Tonto Creek occupy areas where use of live bait is permitted (e.g., sunfishes, fathead minnow, threadfin shad, red shiner, mosquitofish, carp, etc.). Crayfish and bullfrogs cannot be legally moved alive among most Arizona waters including those within the range of northern Mexican gartersnakes. However, despite these restrictions, some anglers may still use these for bait and could move crayfish and bullfrogs among aquatic systems. Anglers may also transport live baitfish or salamanders among waters and they may come in contact with gartersnakes.

There is considerable evidence that suggests that bullfrogs negatively impact northern Mexican gartersnakes through predation and competition and they have been implicated in the species' decline in Arizona (Rosen and Schwalbe 1988; V. Boyarski pers. comm.). During surveys in the late 1980s, Rosen and Schwalbe (1988) found a disproportionate number of larger northern Mexican gartersnakes at sites where bullfrogs were present, and suggested that bullfrogs had probably consumed most of the juvenile gartersnakes. They also concluded that squeeze-type wounds or shortened, club-like tails were evidence of predation attempts on adult snakes by bullfrogs. They hypothesized that these injuries could reduce fitness or result in death. Rosen and Schwalbe (1988) observed that bullfrogs replace native leopard frogs through competition and predation, thus depleting native prey availability for the snakes. Bullfrogs are also known carriers of the emerging pathogenic fungus, *Batrachochytrium dendrobatis*, which has been implicated in the global decline of amphibians and the extinction of numerous species (Garner et al. 2006). By spreading disease to native leopard frogs, bullfrogs may indirectly affect the gartersnakes' prey base.

Crayfish prey on small aquatic vertebrates (Fernandez and Rosen 1996, Schwendiman 2001) and also likely negatively impact northern Mexican gartersnakes. Crayfish remove aquatic vegetation (Saiki and Zeibell 1976, Fernandez and Rosen 1996), which could directly affect gartersnake

prey species and their habitat. If given the opportunity, crayfish prey on, or at least attempt to prey on gartersnakes, especially neonates (Fernandez and Rosen 1996).

Northern Leopard Frog

Interaction species

Rainbow trout, brook trout, cutthroat trout, brown trout, Apache trout, channel catfish, Arctic grayling, largemouth bass, bluegill sunfish, redear sunfish, yellow perch, walleye, black crappie, threadfin shad.

For interactions of northern leopard frogs with stocked fish, see the section above on Chiricahua leopard frogs since the interactions between stocked species and northern leopard frogs would be the same.

Sonora Tiger Salamander

Interaction species

Largemouth bass, bluegill, redear sunfish, channel catfish, rainbow trout

Sonora tiger salamanders are restricted to stock tanks in the San Rafael Valley and adjacent foothills of the Patagonia and Huachuca mountains, and have been reported from one natural habitat (Los Fresnos cienega, Sonora, México). Populations are largely composed of mature branchiate individuals (for definitions of life history stages, see Collins 1981), although mature metamorphosed animals persist in the surrounding terrestrial environments and return to the tanks to breed from January to May (Collins et al. 1988, Jones et al. 1988). Mature branchiate Sonora tiger salamanders require permanent standing water to complete their life cycle, and there is no evidence to suggest that any Sonora tiger salamanders ever complete their life cycles in ephemeral waters (Collins et al. 1988).

The degree to which tiger salamanders would enter permanent water containing predatory fishes is not known. Although one might expect strong selection against those individuals that exhibit such behavior, data to test that assumption are few. Experiments with spotted salamanders (*Ambystoma maculatum*), an ecologically similar salamander, indicate that breeding spotted salamanders do not avoid ponds with predatory fishes (Sexton et al. 1994) despite the fact that those that failed to detect fish and bred in those ponds never produced metamorphosed young (Ireland 1989). Collins et al. (1988) provided data to suggest that Sonora tiger salamanders recolonized stock tanks that had recently supported fishes, indicating that the salamanders might not discriminate among breeding sites.

There are few data to evaluate the extent to which metamorphosed Sonora tiger salamanders move away from breeding ponds. But, marked Sonora tiger salamanders have been found 1.5 and 2 km (0.9 and 1.2 mi) from tanks where they had been found the previous spring, and others have been found 3–4 km (1.9 – 2.5 mi) from the nearest potential source population (Maret et al.

2006). The sites nearest to Parker Canyon Lake that have been known to support Sonora tiger salamanders and their straight-line distances from the lake include: Hannah Tank (1.7 km [1.1 mi]), Heidi Tank (2.8 km [1.75 mi]), High Berm Tank (2.7 km [1.7 mi]), Dinner Tank (3.4 km [2.1 mi]) and Bill Woods Tank (4.2 km [2.6 mi]), all of which are presumably close enough for salamanders to disperse to Parker Canyon Lake. Consequently, it is possible that Sonora tiger salamanders could enter Parker Canyon Lake, but we do not know how likely that would be.

Competition

Populations of tiger salamanders are unlikely to persist along with fishes. But, if salamanders and fishes did coexist, there might be limited use of similar resources. For example, like other tiger salamanders both mature metamorphosed or branchiate Sonora tiger salamanders feed on aquatic macro-invertebrates (T. Jones, pers. comm.); larvae feed primarily on zooplankton (USFWS 2002). Nonetheless, for competition to occur, there must be a limited shared resource, and evidence for resource limitation has not been demonstrated at Parker Canyon Lake, and stock tanks are generally highly productive and aquatic invertebrates are abundant (T. Jones pers. comm.). Also, permanent waters around Parker Canyon Lake are generally not connected to the lake, and stocked fish cannot move to those sites on their own to come into contact with salamanders in the tanks (largemouth bass and bluegill have been found in salamander habitats away from the lake [USFWS 2000], likely the result of illegal movement of fish). Therefore, competition between Sonora tiger salamanders and stocked fish species is possible, but not likely.

Predation

Collins et al. (1988) concluded that Sonora tiger salamanders were invariably eliminated by predatory exotic fishes, especially centrarchids and ictalurids, and predation by fish has been identified as a primary threat to the salamanders' continued existence (USFWS 2002). Maret et al. (2006) found that risk of local extirpation of salamander populations was increased by introduced fish, and if fish eliminated salamanders, the salamanders would not recolonize sites successfully unless fish had been eliminated. Adult metamorphosed Sonora tiger salamanders do not return to the water except to breed from January through May. At that time they are at risk of predation if they enter habitats like Parker Canyon Lake containing large predatory fishes. Any eggs or larvae produced in Parker Canyon Lake would be at similar or higher risk.

The degree to which tiger salamanders would enter permanent water containing predatory fishes is not known. Although one might expect strong selection against those individuals that exhibit such behavior, data to test that assumption are few. Experiments with spotted salamanders (*Ambystoma maculatum*), an ecologically similar salamander, indicate that breeding spotted salamanders do not avoid ponds with predatory fishes (Sexton et al. 1994), and those that failed to detect fish and bred in those ponds never produced metamorphosed young (Ireland 1989). Collins et al. (1988) provided data to suggest that Sonora tiger salamanders recolonized stock

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Baitfish/Live bait issues

Use of live baitfish or tiger salamanders is prohibited at Parker Canyon Lake and throughout the range of Sonora tiger salamanders. As indicated above, Sonora tiger salamanders at all life history stages are subject to predation by predatory fishes and might be at risk of illegal baitfish introduction (USFWS 2002). Bait fishes, including centrarchids, mosquitofish, etc., would likely feed upon salamander eggs and early larval stages (e.g., Baber and Babbit 2003) and eventually eliminate salamanders. For example, at FS799 Tank salamanders were documented in 1984; the tank was revisited in 1994 and only mosquitofish and bullfrogs were found. No salamanders have been documented their since then, despite at least 15 sampling visits from 1994 – 2008.

Crayfish and bullfrogs are permitted to be used as bait only in the body of water from which they are taken, but in some cases are probably moved among bodies of water despite restrictions, and therefore might be introduced into these systems by anglers. The introduction of nonnative fish, crayfish, and bullfrogs has had negative effects on native aquatic herpetofauna populations in Arizona. Bullfrogs have been implicated in the decline of native ranid frogs and northern Mexican gartersnakes in Arizona (Rosen and Schwalbe 1988, M. Sredl pers. comm.,V. Boyarski pers. comm.). Rosen and Schwalbe (1988) observed that bullfrogs replace native leopard frogs through competition and predation; they prey directly on and deplete native prey availability for northern Mexican gartersnakes. Bullfrogs prey on Sonora tiger salamanders (Maret et al. 2006, T. Jones pers. comm.). Bullfrogs are also known carriers of the emerging pathogenic fungus, *Batrachochytrium dendrobatis*, which has been implicated in the global decline of amphibians and the extinction of numerous species (Garner et al. 2006). By spreading Bd to Sonora tiger salamanders which can harbor the disease organisms probably for long periods of time (Davidson et al. 2003), bullfrogs might also indirectly affect Chiricahua leopard frog populations within the range of the salamanders.

Crayfish prey on small aquatic vertebrates (Fernandez and Rosen 1996, Schwendiman 2001) and also likely prey on salamanders, including their eggs and larvae. Crayfish are not found frequently within the distribution of Sonora tiger salamanders, but where they have been found they were abundant and salamanders did not co-occur (e.g., Rosemary Tank in 1982; T. Jones pers. comm.). It is highly unlikely that salamanders could persist in the presence of crayfish.

AREA-WIDE ANALYSES OF ILLEGAL STOCKING AND BAIT TRANSFER

State and federal regulations for illegal transport and introductions of wildlife

Several Arizona Revised Statutes (A.R.S.) directly or indirectly address the introductions of wildlife. In A.R.S. § 17-101, as amended, the definition of "wildlife" is all wild mammals, wild birds and the nests or eggs thereof, reptiles, amphibians, mollusks, crustaceans, and fish, including their eggs or spawn. A.R.S. § 17-102, as amended, states that wildlife, including native, migratory, and introduced species, is property of the state for regulatory and management purposes. As such, A.R.S. § 17-201, as amended, gives AGFD, under the direction of the Arizona Game and Fish Commission, responsibility for administering state laws relating to wildlife. In 1929, A.R.S. § 17-306 took effect regarding the importation, transportation, release or possession of live wildlife. In the original statute and subsequent amendments the law prohibits the "take" of wildlife, including fish and fish eggs, and language herein "No person shall plant any game fish or other fish, fish fry, or spawn in any of the bodies of water in the state, nor introduce nor liberate any game birds or game animals, or any other wild animals, on the lands or in the converts of the state without the written consent of the commission". The language as amended in 1969 and remaining current states "no person shall import or transport into the state or sell, trade or release within the state or have in his possession any live wildlife except as authorized by the commission or as defined in title 3, chapter 16." Per Administrative Code R12-4-409 (adopted in 1989), all sport fish stocked recreationally within the state are classified as Restricted Live Wildlife; as such, it is illegal for any private citizen, organization, or business to stock any species on this list unless an Aquatic Wildlife Stocking Permit (R12-4-410; adopted in 1989) has been issued by AGFD. Per R12-4-405 live wildlife (excluding Restricted Live Wildlife R12-4-406) such as for the aquarium trade, fish farm, restaurants or markets shall not be released beyond the aquarium or pond. The list of Restricted Live Wildlife includes an exhaustive list of species that may not be imported, transported, possessed, or released (without an appropriate special license) and this list includes many organisms that are considered Aquatic Invasive Species by the federal government (see below). Per R12-4-316 individuals may possess live baitfish as identified in the Administrative Code and may fish with live baitfish where and when authorized (per R12-4-317); however, the intentional release of live baitfish is prohibited (A.R.S. § 17-306).

There are a number of federal laws that prohibit illegal stocking of aquatic species including the Lacey Act of 1900 and amendments (16 U.S.C. 42), which provides "for the control of illegally

taken fish and wildlife" and makes the import, export, or transport of fish, wildlife, and plants in violation of federal or state law a federal offense (Clugston 1986). The Code of Federal Regulations (Part 16 of Title 50 "Injurious Wildlife") implements these regulations. Executive Order 11987 (1977) allows federal agencies to prevent, enforceable by law, the introduction of exotic species on federal lands and encourages private citizens and state and local governments to prevent illegal introductions. In 1999, Executive Order 13112 established the National Invasive Species Council, which revoked Executive Order 11987. In part, the new order requires federal agencies to prevent the introduction of invasive species when their actions may affect the status of native species, and the Invasive Species Council oversees the implementation of the order. In addition, federal agencies are to encourage state, local, and Tribal level governments to support the regulations enforced by the order as well as to support these governments when such regulations are violated. Other federal laws that directly or indirectly address the illegal introductions of invasive species that pertain to aquatic species include the National Environmental Policy Act of 1969, as amended (16 U.S.C. 4321 *et seq.*), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 *et seq.*), and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*) (www.invasivespeciesinfo.gov/laws/execorder.shtml).

While sport fish species are not considered invasive species in Arizona, there are other organisms associated with recreational angling that are considered invasive species in the state. The Arizona Invasive Species Management Plan (2008) defines invasive species as "a species that is (1) nonnative to the ecosystem under consideration and, (2) whose introduction causes or is likely to cause economic or environmental harm, or harm to human health". In addition to the regulations discussed above, state and federal agencies have also created public awareness campaigns or outreach publications to educate anglers and boaters on the prevention of aquatic hitchhikers such as Quagga and zebra mussels and illegal baitfish species such as gizzard shad and inland silversides.

Pathways for fish introductions

It is challenging to clearly identify the sources of illegal stockings because of the number of potential pathways for introductions as well as the lack of documentation due to the illegal nature of the introductions. Similarly, authorized stocking records prior to the 1960s were inconsistently recorded. This produces uncertainty, resulting in inferential theories associated with the introduction pathways, and making law enforcement and documentation challenging and variable.

In general, there are two primary pathways for fish species to be introduced to the landscape and those are by legal methods and illegal methods. Authorized introductions of nonnative fish are likely the primary pathway for the spread of fish across the landscape (Kerr et al 2005). Legal pathways for nonnative fish introductions include stocking activities authorized by federal, state,

local and tribal governments, as well as by private citizens (e.g. stock ponds) or businesses (e.g. vegetation control for irrigation canals) that acquired a stocking permit for waters on privately-owned land, if warranted (regulations described above). The historical spread of nonnative fish throughout North America has also been called the Frankenstein Effect (Moyle and Light 1996) to account for the consequences of intentional introductions. Hydrological connectivity among waters is also a pathway for movement and the potential introduction of species into areas where they weren't purposefully stocked.

The second pathway for introductions is the illegal introduction of fish species. These types of introductions typically result from the release of fish into the wild from the baitfish industry, recreational anglers, ornamental ponds and aquaria, private aquaculture, live food fish, uninformed members of the public, and commercial shipping. Such actions may be intentional or unintentional. Although state and federal laws as described above prohibit illegal introductions of wildlife and have been in effect for decades, both legal and illegal introductions have occurred both historically and at present through a multitude of pathways (see for example Marsh and Minckley 1982; Courtenay and Taylor 1986; Whittier and Kincaid 1999; Schade and Bonar 2005; Kerr et al 2006; Marchetti et al 2006).

Sixty-three species of nonnative fish have been introduced into Arizona through a variety of pathways, primarily by authorized stockings of the AGFD or the federal government (Figure 5 and Table 27 Table 29). The majority of these introductions occurred prior to 1975. Of these, 19 (30%) were likely unauthorized or unintentional introductions, primarily from releases of baitfish, or fish from aquaria or ornamental ponds (Table 29; n = 12/19). Six species are considered sport fish and were stocked primarily between 1937 and 1950, corresponding to an era where fish were stocked across North America to provide food (see "Fish hatcheries and stocking practices"). These fish may have been stocked by the U.S. Commission of Fish and Fisheries, but there is no documentation as such.

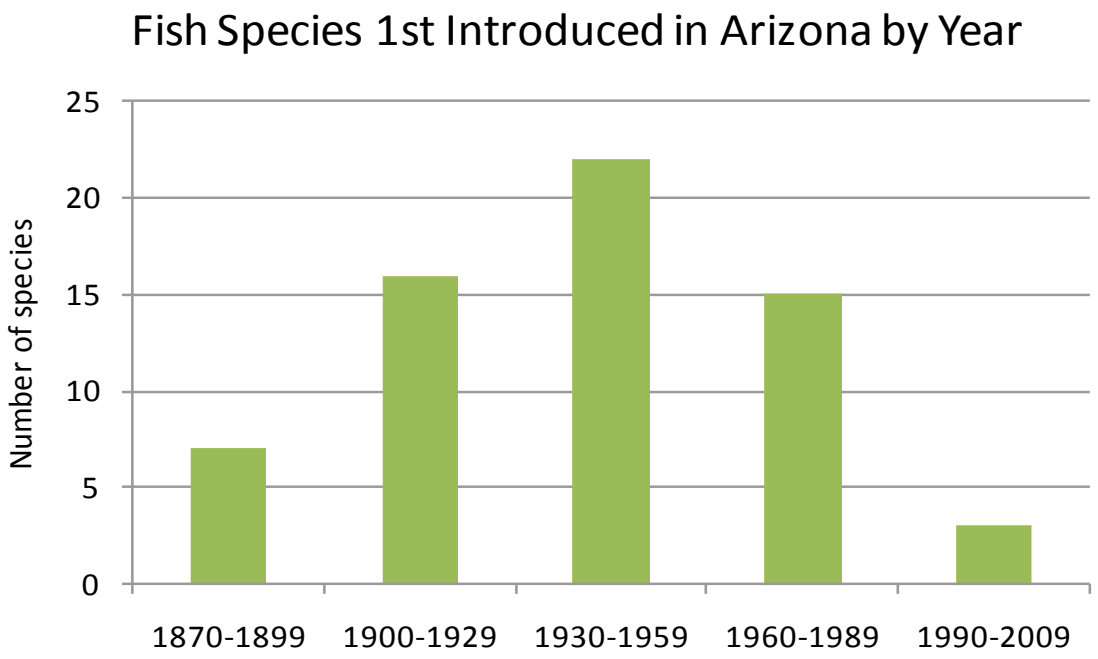

Figure 1. The number of fish first introduced in Arizona using data from the U.S. Commission of Fish and Fisheries, newspaper records, and the Arizona Statewide Hatchery Database. The number includes both authorized and unauthorized introductions.

Table 5. Records of original nonnative fish stockings in Arizona by species and known stocking source.

Common Name	**Scientific Name**	**1st Stocked**	**Origin**
American shad	Alosa sapidissima	1883	Fisheries Commission
Bigmouth buffalo	Ictiobus cyprinellus	1917	Fisheries Commission
Yellow bass (barfish)	Morone mississippiensis	1929	Fisheries Commission
Spotted bass	Micropterus punctulatus	1941	AZ Game and Fish Dept
Redear sunfish	Lepomis microlophus	1948	AZ Game and Fish Dept[a]
Threadfin shad	Dorosoma petenense	1955	AZ Game and Fish Dept (from Tennessee)
Kokanee	Oncorhynchus nerka	1957	AZ Game and Fish Dept
Tilapia species	Tilapia spp.	1959	Page Springs Hatchery
Northern pike	Esox lucius	1965	Fish and Wildlife Service

Common Name	Scientific Name	1st Stocked	Origin
Bairdiella (croaker)	Bairdiella icistia	1967	Sterling Springs Hatchery
Orangemouth corvina	Cynoscion xanthulus	1967	Sterling Springs Hatchery
Sargo	Anisotremus davidsoni	1967	Sterling Springs Hatchery
White sturgeon	Acipenser transmontanus	1967	AZ Game and Fish Dept
Redbelly tilapia	Tilapia zilli	1968	University of Arizona
Striped bass	Morone saxatilis	1969	California & Page Springs Hatchery
Muskie	Esox masquinongy	1973	Wisconsin
Blue tilapia	Tilapia aurea	1975	Bubbling Ponds Hatchery

Legal pathways

Fish hatcheries and stocking practices

Most nonnative fish species documented in Arizona were associated with an authorized stocking activity (Table 27 and Table 28). The history of legally stocking fish across the landscape began with the creation of hatcheries in the United States and dates back to 1872 when the U.S. Commission of Fish and Fisheries (hereby termed "Fisheries Commission") was tasked by Congress to supplement declining "native stocks of coastal and lake food fish through fish propagation" and the federal fish hatchery system was formed (National Fish Hatchery System; www.fws.gov/fisheries/fisheries.html). Because the original purpose of forming a federal hatchery system was to provide food fish to replace declining native food fish, federal hatcheries were created beginning in 1872 and operated in most states (Stein 2010). The Fisheries Commission was renamed the US Bureau of Fisheries in 1903 and as the federal hatchery system grew, fish were transported and stocked across the US using fish cars via the railroad system (1871-1933; www.fws.gov/policy). In 1940, the US Fish and Wildlife Service (FWS) was created and the Bureau of Fisheries merged into the FWS. Stocking programs continued and increased to offset the decline of fish resulting from the creation of dams and other federal water projects (www.fws.gov/fisheries/nfhs/). Currently, over 70 federal FWS hatcheries operate in the US and raise at least 60 species of fish. The creation of federal hatcheries spurred the development of state-run hatcheries, which are now more numerous in comparison.

Stocking efforts and the development of fishery management programs, including hatcheries, increased greatly after 1951, when the Dingell-Johnson Federal Aid to Fisheries Act was passed

by the U.S. Congress and provided federal funds to states for fisheries research and management programs through excise taxes on fishing equipment. Stocking records in Arizona, by both federal and state-run hatcheries, were sparse until Federal Aid dollars were available and in the 1960s when hatchery production in Arizona was at its peak.

Table 6. Records of the first documentation of stocking by species in Arizona, origin unknown or suspected (not verified), and the first year of known stockings with known stocking source, if applicable. The first introduction of fish from unknown sources were subsequently stocked by the state or federal agency.

Species Name	**1st Documented**	**Suspected Source**	**1st Year of Known Stocking**	**Subsequent Stocking Source**
Carp	1880	Fisheries Commission		
Largemouth bass	1896	Fisheries Commission	1964	Page Springs Hatchery
Rock bass	1896	Fisheries Commission		
Rainbow trout	1897	Fisheries Commission	1936	Tonto Creek Hatchery
Cutthroat trout	1899	Fisheries Commission	1965	Sterling Springs Hatchery
Black crappie	1902	Fisheries Commission	1964	Page Springs Hatchery
Brook trout	1902	Fisheries Commission	1964	Tonto Creek Hatchery
White crappie	1902	Fisheries Commission	1991	Bubbling Ponds Hatchery
Channel catfish	1904	Fisheries Commission	1964	Fish and Wildlife Service & Page Springs Hatchery
Black buffalo	1917	Fisheries Commission		
Yellow perch	1918	Fisheries Commission	1965	McClelland Lake
Black bullhead catfish	1919	Fisheries Commission**		
Smallmouth bass	1920	Fisheries Commission	1970	Black River
Brown trout	1924	Fisheries Commission	1964	Page Springs Hatchery

Species Name	1st Documented	Suspected Source	1st Year of Known Stocking	Subsequent Stocking Source
Green sunfish	1925	Fisheries Commission**		
Mosquitofish	1925	Unknown	1968	AZ Game and Fish Dept
Golden shiner	1929	Fisheries Commission		
Bluegill	1931	Fisheries Commission	1964	Page Springs Hatchery
Sunfish hybrid	1931	Unknown	2008	Commercial
Brown bullhead catfish	1935	Fisheries Commission**		
Arctic grayling	1939	Fisheries Commission	1965	Sterling Springs Hatchery
Flathead catfish	1940	Unknown	1968	Page Springs Hatchery
Plains red shiner	1948	Unknown	1965	Page Springs Hatchery
Fathead minnow	1950	Unknown*	1978	Bubbling Ponds Hatchery
White bass	1951	Unknown	1975	Lake Pleasant
Walleye	1956	Unknown	1965	Page Springs Hatchery
Kokanee	1957	U.S. Fish and Wildlife Service**	1964	Tonto Creek Hatchery
Mozambique tilapia	1959	Unknown	1962	AZ Game and Fish Dept
Coho salmon	1966	Unknown	1969	Page Springs Hatchery

*First record found fish in a bait tank on the AZ side of the Colorado River in 1950.

**Suspected source based on California records.

In Arizona, the stocking efforts for warmwater fish and coldwater fish were similar prior to the 1940s, which was when the emphasis began on raising and stocking coldwater fish, primarily trout (Bassett et al 1998). The availability of Federal Aid funds prompted the creation of a lake development program within the Department in the 1950s, 1960s, and early 1970s and instigated the creation of many lakes within the state including Luna, Big, Crescent, Ashurst, Kinnikinick,

Woods Canyon, Riggs Flat, Fool's Hollow, Rose Canyon, Arivaca, Pena Blanca, Parker Canyon, Lynx, Knoll, Bear Canyon, Chevelon Canyon, Black Canyon, and Willow Springs lakes among others. The creation of these lakes greatly increased the number of stockings and number of species stocked during this time period (Figure 5). Most of these lakes provided substantial recreational opportunities to the public as well as food on their tables. Threadfin shad were initially harvested from the lower Colorado River to stock into warmwater lakes as a forage base for lakes with bass and crappie populations. Trout stockings in Arizona and across the western U.S. were most numerous in the 1960s also due to increased funding, the improvement of existing hatcheries, creation of new hatcheries, and improved propagation techniques (Schade and Bonar 2005).

Table 7. Records of first capture of a fish species stocked illegally (intentionally or unintentionally) through suspected sources: bait releases (B), aquaria releases (Aq), and unknown (potentially angler introductions or by the Fisheries Commission).

Species Name	**Scientific Name**	**1st Record**	**Suspected Source**
Goldfish spp	Carassius spp.	1925	B, Aq
Rio Grande killifish	Fundulus zebrinus	1937	B, Aq
Bream	Acanthopagrus spp.	1937	Unknown
Warmouth	Lepomis gulosus	1939	Unknown
Bullhead catfish	Ameiurus spp.	1941	Unknown
Redside shiner	Richardsonius balteatus	1948	B
Mexican tetra	Astyanax mexicanus	1949	Aq
Pumpkinseed sunfish	Lepomis gibbosus	1949	Unknown
Blue catfish	Ictalurus furcatus	1950	Unknown
Sailfin molly	Poecilia latipinna	1951	Aq
Variable platyfish	Xiphophorus variatus	1962	Aq
Green swordtail	Xiphophorus helleri	1964	Aq
Guppy	Poecilia reticulata	1967	Aq
Mexican sailfin molly	Poecilia velifera	1967	Aq
Sacramento perch	Archoplites interruptus	1967	Unknown
Convict cichlid	Archocentrus nigrofasciatus	1968	Aq
Gizzard shad	Dorosoma cepedianum	2007	Federal hatchery (accidental)

Inland silverside	Menidia beryllina	2007	B
Alligator gar	Atractosteus spatula	2008	Aq

The greatest number of new introductions of fish species (both authorized and unauthorized) occurred between 1940 and 1960 (Figure 5 and Figure 6). Both the Department and Fisheries Commission were responsible for stocking the majority of nonnative fish into the state during this period, primarily for human consumption (Table 27 and Table 28). It is evident that the number of species first introduced into Arizona decreased after 1960, particularly after 1990, perhaps based on a few developments such as the adoption of baitfish regulations (1976; Figure 5), the creation of ESA (1973; Figure 5 and Figure 6) and incorporating native fish work into the fisheries branch beginning in the 1960s and 1970s. However, this is difficult to verify. More specifically, the introduction of fish from aquaria or ornamental pond releases as well as from baitfish releases of fish not approved for use as bait in Arizona, has been substantially lower since 1960. Between 1990 and today, only three fish species have been newly documented in Arizona, none of which were attributed to fish stocking by the Department (Figure 6; Table 29; gizzard shad, inland silversides, and alligator gar). As stated previously, documentation of the stocking source (e.g., state or federal agency) for the original stockings of most introduced fish species in Arizona was inconsistent prior to the mid 1950s and into the early 1960s, when reporting guidelines for Federal Aid funding required this information. The Hatchery Stocking Database was created in 1985 and houses a comprehensive record of fish stockings conducted by the Department since the mid 1950s and a portion of stocking records by the Fish and Wildlife Service.

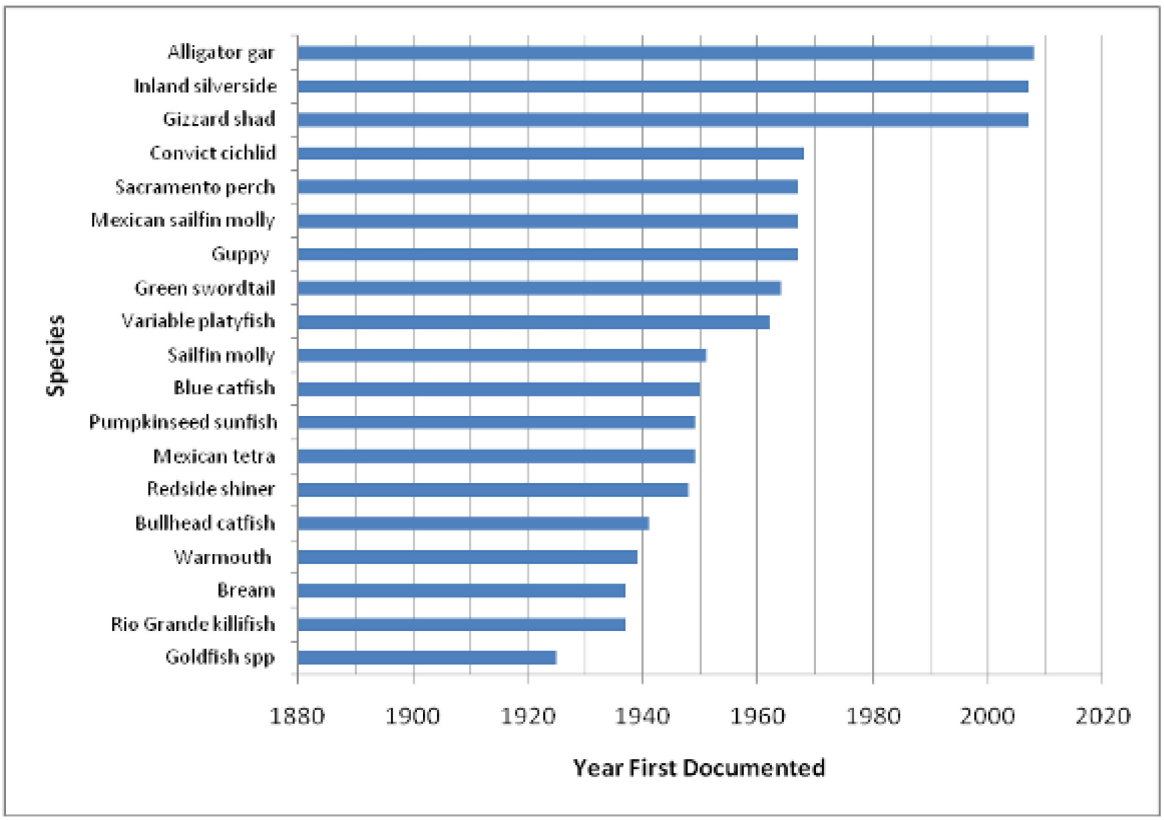

Figure 2. Nonnative fish introduced in Arizona by an unknown source and the year they were first documented in the state.

Federal hatcheries.—In Arizona, there are two federal hatcheries operating currently, Alchesay-Williams Creek National Fish Hatchery Complex (AWCNFH) and Willow Beach National Fish Hatchery (WBNFH). Part of the AWCNFH, the Williams Creek Unit was established in the mid-1930s as a joint federal and state-run hatchery, and stocked Apache, brook, brown, cutthroat and rainbow trout varying by species and year throughout the state. The FWS took over operations of the Williams Creek Unit in 1961, but fish raised at Williams Creek were stocked across the state until 1992. The Alchesay Unit was established in 1959, raising brook and rainbow trout which were also stocked throughout the state until the late 1970s, when FWS took over operations. The AWCNFH now provides Apache trout fertilized eggs to Arizona state hatcheries and stocks rainbow, brown, and Apache trout into waters on Tribal lands. The WBNFH was established in 1962 raising brook and rainbow trout that were stocked statewide until the early 1990s. Other stocking records by Federal hatcheries located outside of Arizona include channel catfish and largemouth bass from the Inks Dam National Fish Hatchery in Texas that were stocked into Arizona lakes from 1995 through 2008. Channel catfish from the Tisamingo National Fish Hatchery in Oklahoma were stocked into Arizona lakes from 1989 to 1990. Northern pike and

channel catfish were stocked by the Fish and Wildlife Service (origin unknown) into Arizona lakes between 1964 and 1967.

State hatcheries.—Currently, there are six Arizona State Hatcheries operating, but historically there were many more small hatcheries from the 1920s through 1950s. Recreational fish raised in Arizona State Hatcheries were stocked into Arizona waters beginning in the 1920s with the South Fork (1922-1934), Squirrel Springs (1926-1934), Horton Creek (1928-1932), and Sterling Springs (1925-present) hatcheries, all of which were rearing facilities (eggs to fry) for trout and South Fork also produced small trout. Indian Gardens (1930-1941), Double Springs (1930-1937), and Porter Springs (1955-1956) hatcheries were created to raise trout, but all were closed due to declining water supplies. The Hunt hatchery (1932-1947), where the Phoenix Zoo is now located, raised warmwater fish including largemouth bass, smallmouth bass, bluegill, and crappie.

Tonto Creek hatchery (1937-present) has focused primarily on raising salmonids in its history (Apache, brook, brown, cutthroat, and rainbow trout; Arctic grayling; coho salmon; kokanee) with the exception of briefly raising a small number channel catfish in the mid 1980s. Currently, Tonto Creek hatchery raises rainbow, brook, and Apache trout. Similarly, the Silver Creek (1979 to present), Pinetop (1931-1954), and Canyon Creek (1971 to present) hatcheries have primarily raised and stocked salmonids historically. Silver Creek hatchery currently raises Apache trout only and the Canyon Creek hatchery raises rainbow trout only. The Page Springs Hatchery (1938 to present) has housed multiple species including black crappie, bluegill, brown trout, channel catfish, largemouth bass, Plains red shiner, rainbow trout, tilapia, and walleye. Other species raised at the hatchery and stocked into Arizona waters in subsequent years included Apache trout, Arctic grayling, brook trout, brown trout, coho salmon, cutthroat trout, flathead catfish, redear sunfish, striped bass, and yellow perch. Currently, Page Springs hatchery raises rainbow trout only. Bubbling Ponds Hatchery (1954 to present) has a similar history as far as the diversity of species that have been historically raised and stocked, with the addition of fathead minnow, smallmouth bass, and yellow perch. Currently, native fish species such as razorback sucker, Colorado pikeminnow, and roundtail chub, in addition to warm water sport fish including largemouth bass, smallmouth bass, and bluegill are raised at Bubbling Ponds hatchery.

Illegal pathways

Live baitfish industry

The history of fish hatcheries played a significant part in the introduction of nonnative sport fish on the landscape, yet there are many other methods of introduction that should be considered, including the release of live baitfish. The live baitfish industry got its start in the 1930s through concerns by fisheries managers that the removal of baitfish from donor waters would have impacts to the forage base for sport fish species inhabiting donor waters. Thus, the culture of baitfish species began across the US and Canada and bait restrictions followed. Conversely and

some years later, there were also concerns about recipient waters and the potential impacts of introducing nonnative fish to the ecosystem including disease, displacement of other fishes, and changes in food web dynamics. These concerns brought the need for regulations to protect existing native species and their habitats, and prompted stricter live baitfish regulations to prohibit the release and transport of baitfish species.

Live baitfish were first prohibited for use in Arizona as early 1947 in all lakes in Coconino County, several lakes in Apache and Graham counties, as well as in the Agua Fria River, Lake Pleasant, and any lake in the state containing protected trout. Additionally, goldfish were prohibited as live bait in the Colorado River along the Arizona/California border in the 1950 fishing regulations as well. Beginning in 1952, the use of live bait was prohibited in all waters of the state containing trout, except for the Colorado River. Finally in 1959, fishing regulations specified that fathead minnow, threadfin shad, red shiner, and mosquitofish were legally authorized for use as live bait in approved locations (per R12-4-305). The fish may be purchased by licensed bait dealers or captured wild and used at the capture sites. At present in Arizona, these four species of live baitfish are prohibited in Coconino, Navajo, Apache, Pima, and Cochise counties; they are permitted on all waters of the counties of La Paz, Maricopa, Mohave, Pinal, and Yuma counties. No waters of any other counties are open except: 1) the mainstem portions of the Gila and Salt rivers, and the portion of the Verde River downstream of the Tuzigoot Bridge including impounded reservoirs, 2) Tonto Creek from Gisela downstream, 3) the portions of Apache, Horseshoe, Pleasant, and Roosevelt lakes lying outside of prohibited counties, and 4) the portion of the San Francisco River in Greenlee County.

Golden shiner and goldfish may be used as live baitfish in fewer areas in the state and they must be captured wild and used at the capture locations. They are permitted on all waters of the counties of La Paz and Yuma, and within no other counties with the following exceptions: 1) Lake Mead, 2) Alamo Lake, and 3) the Colorado River downstream from Hoover Dam to the international boundary with Mexico, including impounded reservoirs. Sunfishes, tilapia, and carp are also permitted for use as baitfish but must be collected at the location of use; they are not approved for sale as bait in Arizona. Per R12-4-316, anglers in Arizona may possess live baitfish for use as live bait, and live baitfish legally captured in one location are to be used only at that location and not transferred to another water body (R12-4-317). Per the original regulations adopted in 1947, it is illegal to release live baitfish and they must be disposed of by burial on land far from water. At present, waters where baitfish are legally permitted have historically been permitted at those locations, or are in locations where there is no conflict or perceived resource issue.

Many of the approved live baitfish species have also been historically stocked by AGFD into lakes to provide a forage base for top predator fishes, and mosquitofish have been stocked extensively across the state into ponds for insect control. Because all of the baitfish species

discussed above have been legally introduced into the state, it is impossible to determine if they became established in certain waters because of these legal introductions or through the illegal disposal of live baitfish. Litvak and Mandrake (1993) reported that although regulations have prohibited the release of live baitfish for decades, the release or improper disposal of baitfish has enabled many species to establish throughout the state as well as throughout North America. However, once again, because these species may have been legally stocked at one time it is virtually impossible to determine what mechanism of introduction was responsible for their establishment. Over the past 70 years, only three species of fish found to be in Arizona illegally are thought to be attributable to the baitfish industry and the use of live baitfish. These include inland silverside (2007), redside shiner (1948), and Rio Grande killifish (1937; Table 29).

A common criticism of existing regulations is that anglers are unaware of proper disposal of baitfish and that bait dealers do not always follow regulations regarding the distribution of legal baitfish species. It is also now quite simple to transport baitfish for long distances using equipment readily available in retail sportsman supply stores, making the enforcement of current regulations even more challenging. Because the baitfish industry is an economically and socially important industry in the U.S. (Litvak and Mandrake 1993), the most effective ways to prevent the release and transport of legal and illegal baitfish is through proper regulations and education of both anglers and dealers.

Ornamental pond and aquaria

At least 10 species of nonnative fish that have been documented in Arizona likely resulted from ornamental pond and/or aquaria industries (Figure 6; Table 29). Fish are sometimes released into waters by owners that no longer want them and are unaware of the potential consequences of the introductions. Most of these species including sailfin molly, Mexican molly, guppy, swordtail, convict cichlid, and goldfish have been occasionally found in the Phoenix metropolitan area, likely due to the number of urban waters located within Phoenix (Marsh and Minckley 1982). Most are not expected to survive due to habitat incompatibility and their captive histories. Neither AGFD nor the Arizona Department of Agriculture regulate the ornamental pond or aquaria industries and there are no stocking permits or aquaculture permits required by law for possession of these fish used in these industries. However, per R12-4-405 the release of these fish is prohibited beyond the aquarium or pond.

A direct link between the increased likelihood of fish introductions in proximity to highly developed or urban areas has been documented (Whittier and Kincaid 1999). Warmwater fishes are the most common with regard to introduced species, and urban areas are often geographically close to large warmwater lakes and reservoirs. In California, Marchetti et al (2006) found direct correlation between urbanization, the decline in native fish species, and the increase in homogenous species diversity of nonnative fish species. Careless introductions through aquaria releases, ornamental pond releases, and other introductions were greater when associated with

highly developed urban areas. However, the authors postulate that many or most of these introductions (near urban areas) will not spread outside of the introduction watersheds because of loss of connectivity associated with urbanization and the haphazard nature of the actual introductions. In summary, they acknowledged the complexity involved with the linkages between urbanization and the introduction of nonnative fishes due to the complex human behavioral component which drives introductions through multiple pathways and can vary at the stream as well as watershed level.

Angler introductions

Another source of illegal introductions and/or illegal transport of nonnative fish is by the anglers themselves. Although current and historic laws in Arizona strictly prohibit such actions, it does occur on occasion. Many times anglers take such actions out of dissatisfaction with existing conditions at their favorite locations or they want to attempt to create an opportunity in a new location. In Arizona, there are a number of illegal introductions that can be attributed to anglers. For example, black bullhead were illegally stocked into Walnut Creek and Rainbow Lake; northern pike were illegally introduced into Rainbow Lake and Parker Canyon; and green sunfish into Kearny Lake. Although the majority of nonnative fish in Arizona and across the U.S. were intentionally stocked originally to provide recreational opportunity and subsistence; this fact and the number of fishing licenses sold each year reveal the economic and social importance of angling (Courtenay and Taylor 1986). As such, anglers can be both advocates and opponents of fishing regulations and quality (see for example Churchill et al 2002), and may have substantial influence on regulation changes through a state agency's commission process.

Most introduced species listed in Table 28 were first introduced by the Fisheries Commission and subsequently stocked by state hatcheries. There are a smaller number of fish, not including those suspected from baitfish or aquaria releases, that may have been introduced by anglers, but that is very difficult to verify (Table 29). For example, there are records of bream, bullhead catfish, blue catfish, pumpkinseed sunfish, and Sacramento perch found in Arizona between 1937 and 1967. However, the source of the introductions is unknown. The species are all considered sport fish and were likely introduced by the Fisheries Commission because the timing coincides with the era of fish introductions across the country.

There are several reasons why it is very challenging to verify the unauthorized introduction or movement of fish by anglers. For example, nonnative trout found in Apache trout recovery streams may have arrived there via several scenarios: nonnative trout breached the barrier and moved upstream into recovery areas, illegal angler introduction, or incomplete chemical removal of nonnative trout prior to stocking Apache trout. All three scenarios are possible, but it's challenging to document angler introductions vs. the other, more verifiable, pathways.

The complexity of human behavior is also another challenging aspect to understanding the motivation of anglers to introduce a fish species illegally. When a new fish species not previously documented from a water is detected, it is not possible to identify where that fish came from, and it is further not logistically possible to determine if a fish species stocked on the landscape will serve as a source for illegal stocking. Assumptions can be made that illegal transportation of fish occurs within some reasonable traveling distance from source locations, taking into account access, desirability of a fish species and survivability of the target species in transport.

It is impossible to please every angler. Regulations that prohibit the unauthorized introduction or transport of fish may reduce the frequency of these activities, however, they are difficult to document, manage, and eliminate. Reducing the number of species stocked or number of stocked location could result in an unintended increase in the number of unauthorized angler introductions because of the decrease in angling opportunities and species diversity.

Private aquaculture

A person who wishes to raise fish in captivity as a commercial enterprise is required to obtain an aquaculture permit from the Arizona Department of Agriculture. The permit application will require that information regarding the location, water source and water disposal, the responsible person be provided. The application also must include the species being cultured. Individuals or businesses may also apply for stocking permits for private waters (R12-4-410; adopted in 1989) issued by AGFD for species that may be beneficial for vegetation control (e.g., white amur) or insect control (e.g., mosquitofish). AGFD evaluates any risk per stocking permit request including the geographic location and proximity to open water as well as the security of the facility. These regulations ultimately have an impact to reduce unintentional releases of cultured fish; however, there is still a risk that may be manageable, but variable.

Relevance to current stocking practices in Arizona

As discussed previously, the illegal introduction of fish in Arizona waters likely resulted from a combination of pathways. Public sentiments regarding the “ethical” release of unwanted aquarium, ornamental pond fish, and live baitfish are difficult to assess, and the transport of fish by anglers among waterbodies is likely a factor of angler dissatisfaction for angling opportunities in a specific location. The human behaviors associated with unauthorized introductions are difficult to manage and standing regulations and education outreach are the best preventative measures at preventing unauthorized releases of nonnative fish.

Of the species proposed for stocking in this consultation (Figure 7; Table 30), there is only one species proposed for stocking within a watershed that has not been stocked previously by AGFD, which is white crappie. White crappie are proposed for stocking into two locations within the Agua Fria watershed. Although there are no stocking records for white crappie in the Agua Fria

watershed, they are self-sustaining in Lake Pleasant from an undocumented introduction over 40 years ago. The only documented introduction of white crappie is to Canyon Lake in 1958 and Coors Lake in 1991. The remaining fish proposed for stocking are either currently stocked, historically were stocked, or are present via an unknown source within each respective watershed. Thus, with the exception of white crappie in the Agua Fria watershed, the remaining species proposed for stocking are not "new" on the landscape (at the watershed scale). In general, the percent of new stocking locations proposed is lower than previous stockings for most species, except for white amur and yellow perch (Figure 7; Table 30). White amur and yellow perch are proposed for stocking in only a few locations, but more than were stocked historically.

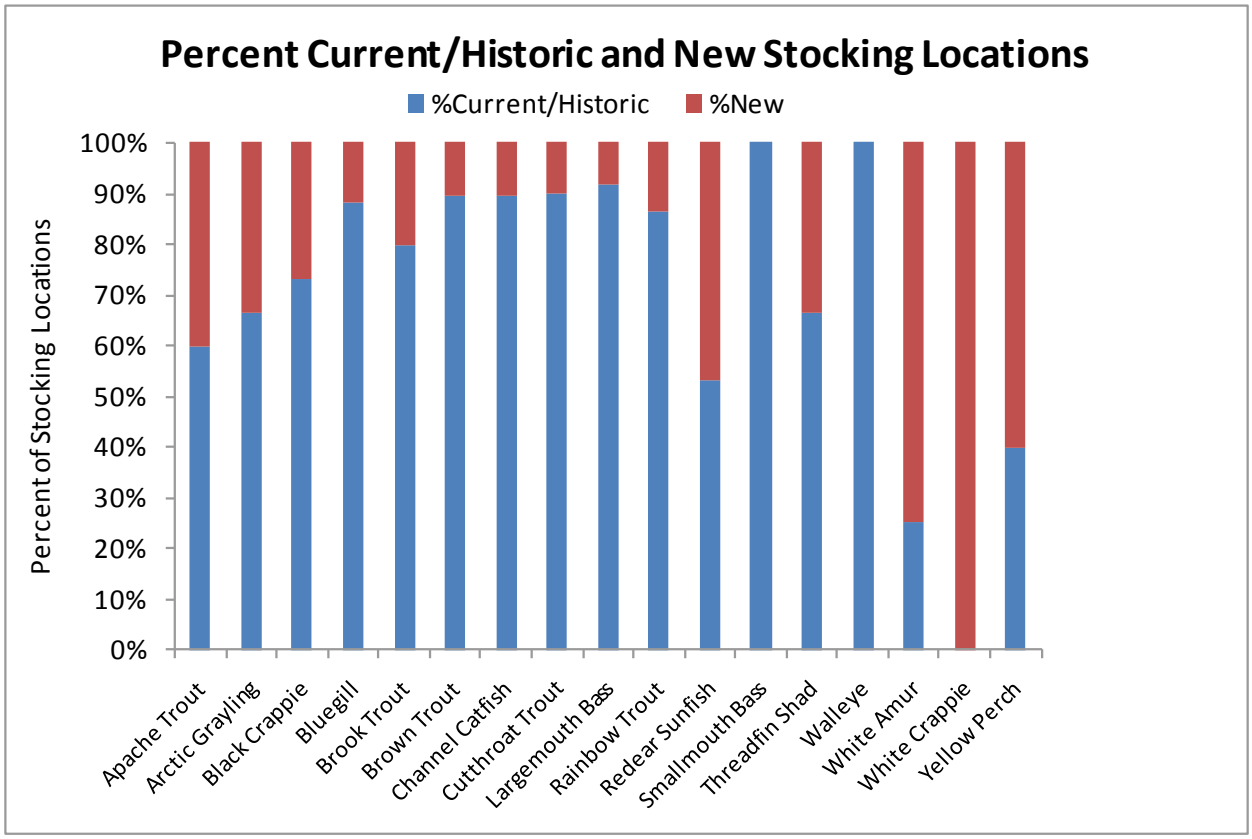

Figure 3. Comparison between the percent of proposed stocking locations considered new (red; no previous stocking records per location) and the percent of locations currently stocked or historically stocked within the respective watersheds. The data are grouped by fish species and all watersheds combined.

In summary, nonnative fish are introduced through a variety of pathways that have been discussed including: hydrological connectivity, authorized stockings, live baitfish release, ornamental pond and aquaria release, fish from aquaculture, and angler introductions. Fishing

regulations in Arizona have historically prohibited unauthorized releases of fish via these pathways and will continue to do so in the future. The number of both authorized and unauthorized introductions of fish in Arizona decreased substantially between 1960-1989, and even more so after 1990. Regardless, unauthorized introductions are challenging to eliminate and the risks will vary by location, species, and demographics, and it is anticipated that such activities will occur regardless of whether AGFD continues to maintain a managed stocking program as proposed in this consultation. Thus, unauthorized introductions should be addressed in the cumulative impacts section of this consultation. Cumulative impacts are defined as follows: "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR §1508.7).

Table 8. Number and percent of proposed stocking locations by species proposed for stocking considered new (no previous stocking records per location) and the number and percent of locations currently or historically stocked within the respective watersheds.

Species	**Total new locations (no previous records)**	**Total current/ historical locations**	**Total**	**%Current/ historic**	**%New**
Apache Trout	6	9	15	60	40
Arctic Grayling	3	6	9	67	33
Black Crappie	4	11	15	73	27
Bluegill	11	84	95	88	12
Brook Trout	3	12	15	80	20
Brown Trout	2	17	19	89	11
Channel Catfish	10	85	95	89	11
Cutthroat Trout	1	9	10	90	10
Largemouth Bass	7	78	85	92	8
Rainbow Trout	19	120	139	86	14
Redear Sunfish	31	35	66	53	47
Smallmouth Bass	0	3	3	100	0
Threadfin Shad	1	2	3	67	33
Walleye	0	4	4	100	0
White Amur	3	1	4	25	75

Species	Total new locations (no previous records)	Total current/ historical locations	Total	%Current/ historic	%New
White Crappie	2	0	2	0	100
Yellow Perch	3	2	5	40	60

INTERDEPENDENT, INTERRELATED ACTIONS AND CUMULATIVE EFFECTS

INTERDEPENDENT ACTIONS

Interdependent actions have no independent utility apart from the proposed action [50 CFR § 402.02]. In order for us to consider an effect to be caused by an interdependent action, there must be a confirmed link through data that the action could not be considered independent but for our action. The potential increase in angler usage for an area could be considered interdependent, however, the majority of proposed stocking activities are taking place on federal lands and the federal land management agency planning documentation would include such recreational impacts. Other factors, such as lake levels and angler use days would impact these actions.

These actions can be minimized and/or reduced through the AGFD's coordinated efforts with the federal land management agency for specific locations with seasonal closure restrictions (nest sites, critical habitat, etc.), minimizing the number of improvements made (boat ramps, etc.), access regulation changes, enforcement and other.

INTERRELATED ACTIONS

Interrelated actions are those that are part of a larger action and are dependent on the larger action for their justification [50 CFR § 402.02]. In order for us to consider interrelated actions in the effects analysis, there must be a demonstrated link to the larger action confirmed through observation and/or data. The AGFD's statewide fish stocking program may potentially cause interrelated actions having effects to listed, candidate, proposed species and/or critical habitat through:

Transmission and spread of disease or pathogens carried by sport fish.
Potential impacts are minimized, reduced or eliminated by the AGFD's fish stocking procedures (Chapter 1). Fish are tested and screened for disease before stocking in Arizona waters. In addition, the AGFD HACCP plans have been developed to further minimize or reduce the potential for spread of unwanted organisms.

Incidental catch and harm to listed, candidate, proposed species and/or critical habitat fish species.
Potential impacts are minimized, reduced or eliminated through the AGFD's regulations identifying listed, candidate, proposed for listing species and /or critical habitat and calls for the immediate release of the fish unharmed.

Use of live bait (baitfish, crayfish, waterdogs) in some waters of the state.
Potential impacts are minimized, reduced or eliminated by the AGFD's regulations controlling the possession, transport, and use of live bait in Arizona waters. Specific restrictions will be described in each Watershed Section.

Unintended transport and introduction of organisms other than sport fish during stocking (e.g., invasive mussels or plants) that may have harmful ecological impacts.
Potential impacts are minimized, reduced or eliminated through the AGFD's fish stocking protocols: prior to loading, transporting, and stocking fish, vehicles and tank water are inspected and unwanted organisms are removed. The AGFD HACCP plans have been developed to further minimize or reduce the potential for spread of unwanted organisms.

Unauthorized sport fish transport and introduction into waters by the public.
Potential impacts are minimized, reduced or eliminated through the AGFD's regulations prohibiting possession, transport, and introduction of sport fish without prior authorization.

Effects of Recreational Anglers at Fishing Sites
In response to angler demand, AGFD stocks a variety of waters throughout the state with sport fish and every year over 225,000 anglers take advantage of fishing opportunity in Arizona. In addition to angling, most stocked waters and surrounding areas are also used for a variety of other recreational activities such as camping, boating, canoeing, kayaking, swimming, wading, hiking and wildlife observation and photography. Many of the impacts to wildlife and habitat caused by anglers are also caused by other recreational users, confounding a precise assessment of the contribution of angler impacts. However, angling has an incremental contribution to the totality of recreational impacts to wildlife and habitat, which can vary due to site-specific conditions.

Recreational angling may have a variety of impacts including: 1) disturbance of riparian or benthic systems by walking through the area; 2) degradation of water quality from stream bank destabilization, wading, human waste and trash, 3) disturbance from motor boats; 4) introduction of angler debris; 5) inadvertent spread of pathogens, diseases and invasive species by anglers, and 6) direct mortality to non-target fish species and to snakes.

The potential for angling to produce negative impacts depends on the frequency, intensity, location, and type of use. For terrestrial wildlife, infrequent, but unpredictable recreation without

pattern can be more damaging than frequent predictable use. Activities with patterns may cause species to avoid areas of frequent use and they may still be successful. Habituation by species can also occur in areas of high, frequent use. Activities without patterns can create more of an impact per event. Any activities conducted off established recreational areas, such as trails or boat docks, and in the habitat itself are more likely to startle nesting birds or other wildlife and damage habitat (USFWS 2002c).

Consequently, if fishing opportunities begin during nesting season, there is a concern for nest abandonment or decreased viability of the young who might receive less food and protection from stressed parent-birds. If fishing opportunities begin before nesting season, either the birds would tolerate the disturbance and nest, successfully or unsuccessfully, or move to an undisturbed location where they would nest, successfully or unsuccessfully.

Riparian areas receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than those farther away from development (Turner 1983). The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations. Impacts can be more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country.

Shoreline vegetation along stocked lakes and streams may be trampled by anglers or their vehicles (primarily automobiles, ORV's, or beached watercraft). The potential severity of such effects depends on the type of vegetation, the type of shoreline, and the intensity of angler use.

The type of shoreline also determines angler effects. Habitat that has already been lost to developed areas such as bridges and docks and anglers would incur no further damage. However, riparian areas are particularly vulnerable to vegetation disturbance. The loss of plant cover due to trampling may cause indirect effects such as erosion and sedimentation associated with loss of roots and the plants' ability to hold soils. These changes may alter plant communities and alter food and nutrient inputs to surrounding lakes and creeks with listed and candidate species. Terrestrial insects and other organisms that get into the lake and become prey to aquatic organisms may also be affected indirectly through loss of shoreline vegetation that serves as habitat. (CDFG 2010 p 4-121)

However, in riparian areas it is anticipated that anglers will likely be on foot and either alone or in small parties. It is also anticipated that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, it is expected that anglers once they reach their destination to be fishing in tight areas where vegetation is dense that causes casting to be difficult

Anglers in trout streams commonly wade in the stream. There is a risk that this activity could disturb redds of Gila and Apache trout species. Roberts and White (1992+) report a Montana study of experimental trampling of eggs in the manner of an angler wading through redds. In a laboratory setting, they found that a single wading killed up to 43% of trout eggs and pre-emergent fry. However, sport fish stocking usually does not occur in areas where the redds of Gila and Apache trout occur. (CDFG 2010 p 4-122)

Riparian bird, amphibian, and reptile species and aquatic species could be disturbed by anglers moving through aquatic areas where sport fish stocking occurs within the range of these listed and candidate species. Such disturbance could take many forms, e.g. flushing animals from feeding and holding areas, animals relocating within the water column, animals seeking cover, or animals injured by powerboat activity.

Tuite et al.1983 concluded that fishing not done from a motorboat is less disturbing to terrestrial wildlife than either hunting or motorized boating because anglers are usually quiet and relatively stationary. Knight et.al 1991 found that anglers had no apparent effect on presence or absence of bald eagles, ravens and common crows along a river in Washington; however, fewer bald eagles and ravens used the river when anglers were present and angler presence also caused decreased foraging in these two species.

Arizona's Invasive Species Management Plan (2008) produced by the Arizona Invasive Species Advisory Council in June 2008 identifies water-based recreation, including fishing, as a potential vector for introduction of aquatic invasive species (AIS), noting that introductions can occur when bait buckets and live tank contents are dumped. Equipment and supplies used for fishing (boats, nets, floats, anchors, wading boots, tackle, etc.) can spread AIS. Examples of AIS introductions within the sport fish stocking program area include the distribution of aquatic weeds such as giant salvinia on boats, boat trailers and other gear; and the distribution of invasive crayfish used as bait. Recreational boaters have a very high probability of dispersing organisms that can be dispersed in bilge water, live wells or attachment to vessels, trailers or anchors; and that even strict enforcement of precautionary measures is unlikely to be fully effective due to the intensity of boating activity in popular waters.

Anglers may also disperse invasive species via gear other than boats, for instance, on rafts, float tubes, or waders. It is widely thought that some diseases of fish and amphibians may be transmitted on waders or wading shoes. Diseases implicated by this mechanism include whirling disease and amphibian chytridiomycosis, which are present and causing harm to trout and amphibian populations in Arizona. The introduction of any of these diseases is potentially a highly significant event that can result in substantial declines or even extirpation of local populations of special-status species. Other AIS that are commonly introduced on fishing gear

include aquatic weeds such as Eurasian water milfoil and invasive animals such is the zebra mussel, quagga mussel, and New Zealand mud snail.

Currently, the Arizona Governor's Office and AGFD has an active program to educate boaters, anglers and other recreationists concerning the risks of AIS and the methods available to address those risks. These offices' web sites prominently feature information on mussel control and invasive species in general. Additionally, the AGFD Fishing Regulations booklet includes detailed information on AIS and laws.

Although recreational boating is very likely to result in the distribution of invasive species, potentially resulting in a significant adverse impact on native aquatic ecosystems and sensitive species therein, it is likely that in many waters such introductions would occur regardless of angler activities because anglers constitute only a fraction of the recreational water users. In some waters, though, anglers may be the predominant recreational users and one of the principal vectors for human introduction of invasive species. These include waters such as cold mountain lakes and streams that are inaccessible to boaters but may be visited by anglers equipped with gear such as waders and float tubes; as well as waters used by drift boaters, where anglers may comprise the majority of the boating traffic. In such settings, anglers may cause effects on local ecosystems and special-status species by introduction of aquatic invasive species and/or pathogens with or without sport fish stocking.

Tiger salamanders sold as bait may be collected in the wild, often in eastern states where they are abundant, and are then transported in interstate commerce. Use of salamanders as bait is illegal in parts of Cochise and Santa Cruz counties (Arizona Game and Fish Commission Order 40).

Non-targeted fish species may incidentally be caught while angling for stocked fish. Twenty-six fish species in Arizona are fully protected and may not be taken or possessed at any time (AGFD 2011-2012 Fishing Regulations). Of those, the only the Gila trout, headwater chub and roundtail chub are likely to be inadvertently caught in stocked waters. Incidentally hooked fish that are either fully protected or that are under a zero bag limit restriction must be immediately released unharmed to the waters where they are hooked.

Cumulative Effects

Cumulative effects include those effects of future State, tribal, local, or private actions not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation [50 CFR § 402.02]. Future Federal actions unrelated to the proposed action are not considered in this section because they require separate consultation under Section 7 of the Endangered Species Act.

As mentioned in Chapter 1, the proposed action includes stocking activities for fish throughout the state of Arizona. Arizona has 15 watersheds and the proposed activities would include

stocking native and nonnative sport fish within 8 of the watersheds. The majority of proposed actions are to continue the stocking regimes with minimal changes to species compositions and few additional new stocking areas.

Changes in land use including urbanization and development, population growth, recreation, agricultural runoff, sand and gravel mining, other mining activities, roads and trails, livestock grazing, and wildfire will continue to have cumulative effects on the environment. In turn, these cumulative activities result in modification of water quantity, water quality, watershed condition, hydrology, stream channel characteristics, riparian and aquatic vegetation, bank stability, and other aquatic habitat characteristics, which would lead to adverse effects to covered species.

Cumulatively, the proposed action in combination with other non-federal actions associated with continued development and resource consumption could adversely affect the populations of covered species. However, impacts to covered species from continued stocking actions are offset and minimized by implementation of mitigation measures actively practiced through AGFD Nongame Programs, Strategic and other AGFD Conservation Plans, reintroduction protocols, operational procedures, HACCP planning, rules/laws/regulations; partnered conservation efforts and best management practices.

Projected urban growth

Projected urban growth and concomitant increases in use of natural resources (e.g., increased groundwater withdrawals, stream diversions, land clearing, and recreation) will have profound and negative impacts across the Arizona landscape.

The 2002 U.S. Census found that 5.1 million people currently reside in Arizona. The Arizona Department of Economic Security projects that the population of Arizona will grow to 11.2 million people by 2050 (Figure 8; ADES 2003). Arizona Department of Water Resources Third Management Plan for the 5 Active Management Areas (AMA) in Arizona note that the state will face significant challenges to provide renewable water supplies in the future. Both the Phoenix and Prescott AMAs will not be at safe-yield conditions (groundwater uses exceeds recharge) by 2025. While site-specific data and assessment is not available, continued growth will place increased demands for water and has the potential to reduce stream flows impacting riparian obligate species.

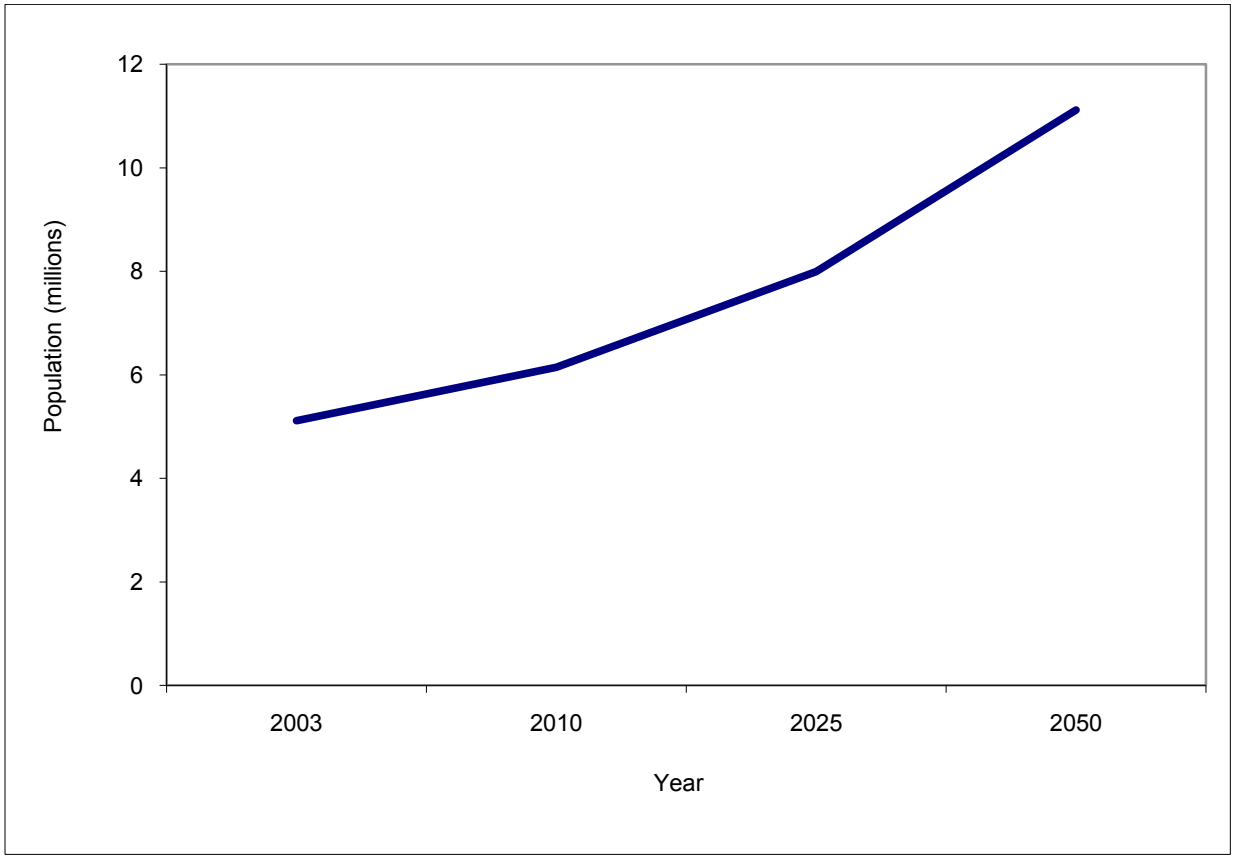

Figure 4. Estimated population increase in Arizona 2003 – 2050.

The AGFD Aquatic Stocking Permit Program

As part of the cumulative effects , the AGFD's Aquatic Stocking Permit program allows private citizens to stock waters with aquatic species. Under Arizona Game and Fish Commission rule R12-4-410, the AGFD's permit process allows the import, purchase, possession, transport, and stocking of certain aquatic species by private citizens, businesses, or institutions. The application requirements as outlined in the statute include: the purpose of the introduction, benefits, adverse economic impacts, dangers to indigenous or game fish species, ecological problems associated with the species, anticipated disease inherent with the introduction, hybridization concerns, and suggestions for post-introduction evaluation of status and impacts of introduced species. All aquatic wildlife and live eggs and milt shall be obtained from a licensed Arizona fish farm operator or from a private noncommercial fish pond, or from a fish farm out of state that has been certified free of disease and causative agents listed in the statute (see Rule R12-4-410 § D.1.2 - for list of diseases and pathogens). The application is reviewed by AGFD Regional Fish Program Managers; a determination by the AGFD that negative impact on Arizona wildlife may result from issuance of the permit, including the area and drainage where the stocking will occur, is grounds for denial of the permit.

Other major land uses potentially creating impacts on listed, candidate, proposed for listing species and/or critical habitat (i.e., grazing, mining, and timber harvests) generally have a direct federal nexus (subject to NEPA consultation) and do not need to be considered within this assessment.

Chapter 5 COLORADO RIVER WATERSHED

This chapter includes Havasu Creek and Lower Colorado River Sub-Watersheds.

Chapter 5 Colorado River Watershed 5-1
Colorado River Watershed 5-3
Havasu Creek Sub-Watershed 5-3
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COLORADO RIVER WATERSHED

HAVASU CREEK SUB-WATERSHED

Physical Geographic Description

Drainage area and elevations

All fish stocking activities within the Havasu Creek sub-watershed (Figure 1) occur within the Cataract Creek Complex (Figure 2). Cataract Creek drains a portion of the Colorado Plateau south of the Grand Canyon encompassing 325 square miles. Cataract Creek is the major tributary to Havasu Creek and comprises most of the drainage area that flows into lower Havasu Creek near the Grand Canyon. Most all washes and streams in the Havasu Creek sub-watershed are ephemeral. Cataract Creek is also ephemeral upstream of Havasu Springs, which is where Havasu Creek and perennial flow begins, on the Havasupai Indian Reservation, approximately 9.5 miles upstream from confluence of Havasu Creek and the Colorado River. Cataract Lake, Kaibab Lake, Santa Fe Reservoir, City Reservoir, and Dogtown Reservoir are located on the headwaters of Cataract Creek near the town of Williams. Cataract Creek becomes Havasu Creek at Havasu Springs before entering the Colorado River more than 135 miles downstream from the stocking sites. Russell Tank is located on the headwaters of Red Horse Wash, which runs into Cataract Creek and finally into Havasu Creek before entering the Colorado River more than 120 miles downstream from the tank. Elevations range from 6,775 feet near Williams to 1,870 feet where Havasu Creek enters the Colorado River in the Grand Canyon. Ownership of land within this complex includes Federal, Tribal, State, and private.

CATARACT CREEK COMPLEX

Russell Tank

Site Description

Russell Tank is located on the Kaibab National Forest approximately 20 miles from the community of Tusayan and the Grand Canyon National Park. Russell Tank is a 2-acre impoundment on ephemeral Russell Wash with an average depth of approximately 15 feet. The tank sits at an elevation of 7,000 feet and is supported by rainfall and annual snowmelt. The tank is one of the few sites that regularly retains water in the area and is a popular fishing spot for the local residents of Tusayan and surrounding areas. Lake levels fluctuate dramatically based on precipitation, from going completely dry to spilling over into Russell Wash.

Russell Tank can be accessed off of FR 311; the tank is along a short spur road off of FR 311. Access is also available through Grand Canyon National Park, but an entrance fee must be paid. From the South Entrance Station follow state route 64 east toward Desert View. Two miles past Grandview Point, an Arizona Trail sign indicates a right turn on to a gravel road. This road becomes FR 310 at the Park boundary line. Follow FR 310 for 8.3 miles to FR 311. Turn right

and drive 1.7 miles to the Russell Tank turn off. All roads are accessible for passenger cars in dry weather.

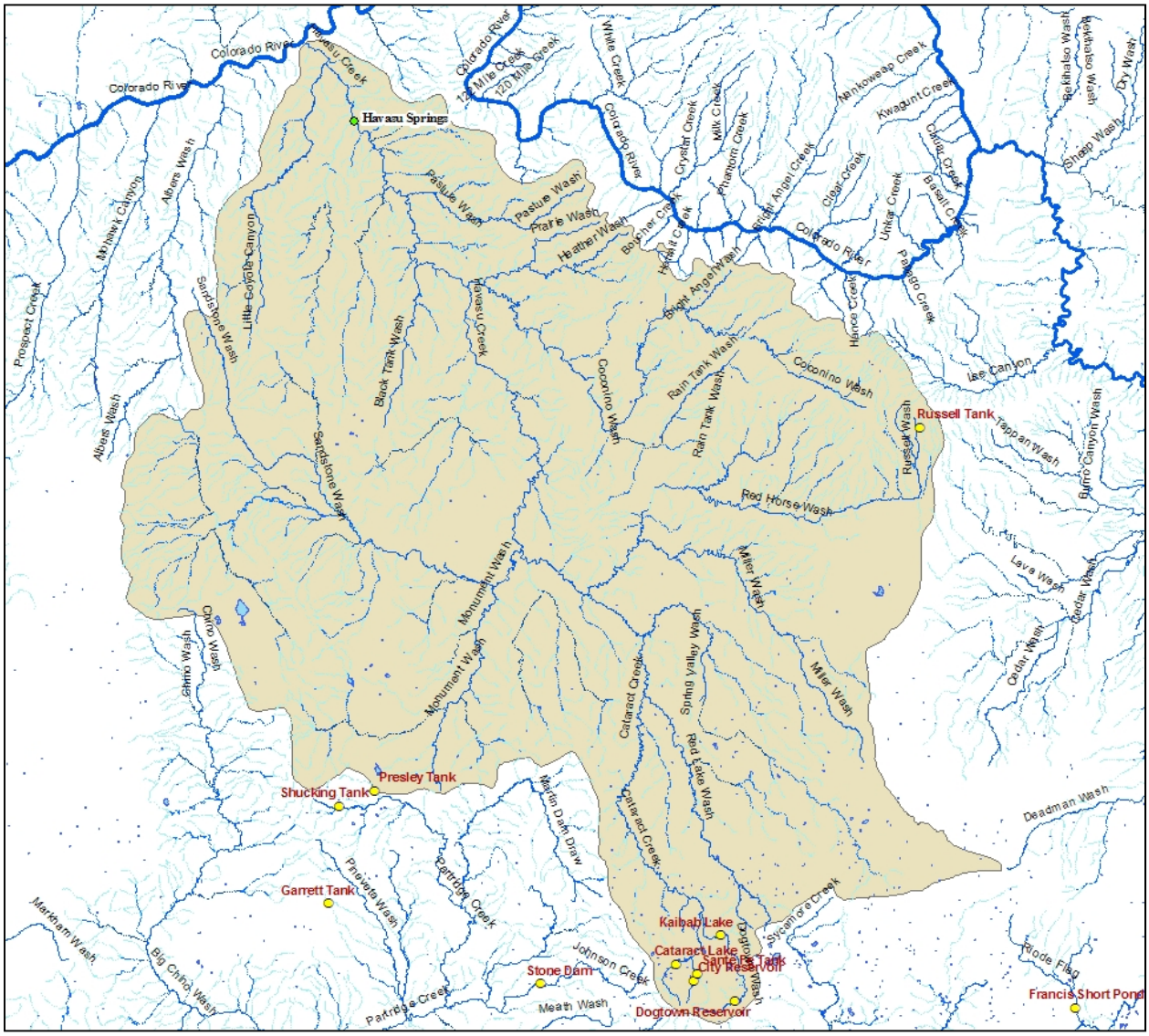

Figure 1. Overview of Havasu Creek Sub-Watershed and stocking sites.

Management of Water Body

Primary fishery is a cold water rainbow trout put-and-take / put-grow-and-take fishery in years when water level and quality permits. Catchable, sub-catchable, and/or fingerling rainbow trout, are stocked multiple times during the stocking season. This fishery is opportunistic in response to precipitation events significant enough to sustain a fishery; in the last 10 years Russell Tank was stocked in 2005, 2007, 2008, and 2009. One historic stocking of channel catfish occurred in

1983; since that time the tank has not been managed for channel catfish. Current stocking clearance is for rainbow trout.

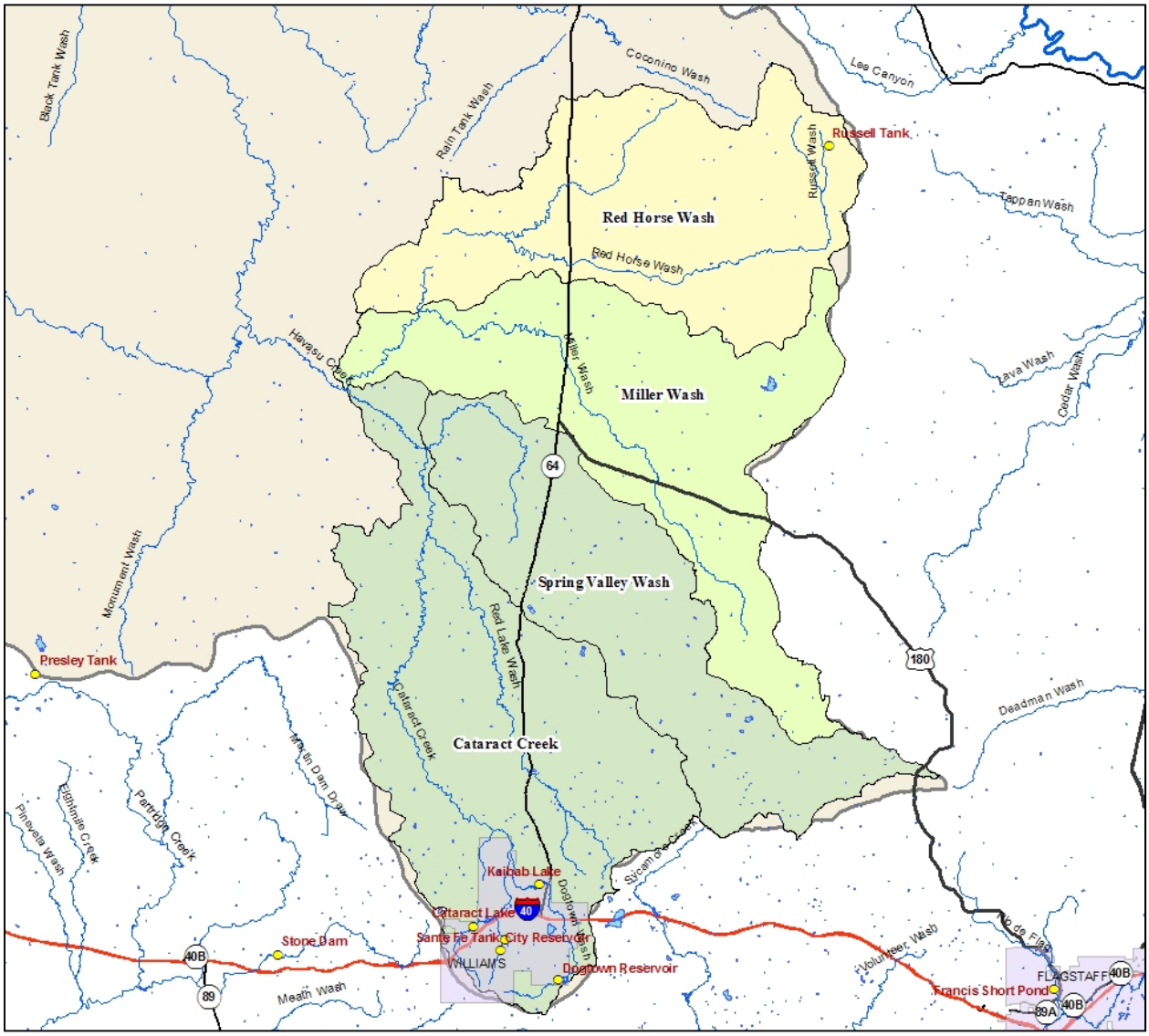

Figure 2. Cataract Creek complex Map.

Map depicts the location of the 6 proposed stocking locations in relation to Cataract Creek, Spring Valley Wash, Miller Wash and Red Horse Wash sub-drainages. Municipalities are depicted in light purple.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable, sub-catchable and fingerling, rainbow trout will be stocked multiple times annually from March-October; numbers of trout stocked may be from 0-8,000 fish annually.

Water Distribution/Connectivity
In the event of flooding, outflow from Russell Tank will travel 4.2 miles down ephemeral Russell Wash to Anderson Tank. It is 2.6 miles from Anderson Tank to East Harbison Tank in ephemeral Red Horse Wash. From East Harbison Tank, Red Horse Wash meanders 0.75 miles to Harbison Tank. It is 4.9 miles from Harbison Tank to New Automobile Tank. From New Automobile Tank, Red Horse wash flows 3.22 miles to Huff Tank. From Huff Tank it is 4.11 miles to a pair of unnamed tanks. From the unnamed tanks it is 4 miles to another unnamed tank. From this unnamed tank it is 7.3 miles to Red Horse Tank. Outflow from Red Horse Tank travels 2.8 miles to the Atchison, Topeka, and Santa Fe Railroad. The wash follows the railroad for 1.3 miles to an unnamed tank. Outflow from the unnamed tank travels 4.5 miles to Lumpkin Tank. It is 3.7 miles from Lumpkin Tank to Miller Tank. From Miller Tank it is 5 miles to Islands Tank and the confluence of Red Horse Wash and Cataract Canyon. The entire length is 48.35 miles from Russell Tank to the confluence with Cataract Canyon and it is ephemeral.

Fish Movement
The upstream movement of fish from Russell Tank when precipitation events are significant enough to cause Russell Wash to flow would terminate at the head waters of the wash 1.25 miles upstream. In the event of flooding, fish from Russell Tank could potentially travel as described above in the Water Distribution/Connectivity section.

Community Description
Rainbow trout is believed to be the only fish currently present in Russell Tank. No sampling data are available for Russel Tank. Historical Department stocking records indicate 1 stocking of channel catfish in 1983 and multiple stockings of rainbow trout between 1969 and the present (Table 1). Russell Tank was dry in 2002 (C. Benedict pers. comm.) and only rainbow trout have been stocked since. There is no information on fish assemblages in any channel located between Russell Tank and Havasu Springs on the Hualapai Reservation, most of which is typically dry. Havasu Springs to the Colorado River is described in the complex analysis below.

Table 1. Russell Tank stocking history.

Species	**First Year**	**Last Year**	**Number of Stockings**	**Num. Stocked**
Channel catfish	1983	1983	1	1,000
Rainbow trout	1969	2009	36	40,196

Total	37	41,196

Consultation Species or Critical Habitat
Humpback chub is covered in the Havasu Creek Sub-Watershed analysis at the end of this section because this species is found downstream from all of these proposed sites.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below

Northern Leopard Frog
Local Analysis: Although Russell Tank is within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Russell Tank is low. There are no historical northern leopard frog records from Russell Tank or within the buffered stocking site area (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm is low, because there are no historical records for frogs in the drainages into which the fish would disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Cataract Lake

Site Description
Cataract Lake is an approximately 37 acre lake on the west side of the town of Williams in northern Arizona. The lake is an impoundment located on an ephemeral tributary of Cataract Creek, and sits at an elevation of approximately 6,825 feet. The majority of the lake is located on the Kaibab National Forest, with a portion of the northwest shoreline on private property. The lake is a popular camping and fishing destination for locals and tourists, primarily during the summer months.

The road to Cataract Lake (accessed from I40) is paved and is open year-round. A short walk to the lake is required in the winter when the campground is closed. The boat ramp area is closed in winter. There are 18 campsites with picnic tables and fire rings, and there is a fee for camping.

Pit toilets are provided, and drinking water is available but limited. There is a concrete boat-launch ramp. Power boats can have only single electric motors or single gasoline engines of 10 HP or less.

Management of Water Body

Cataract Lake is managed primarily as a high intensity use, cold water put-and-take rainbow trout fishery and a put-grow-and-take brown trout fishery, and secondarily as a warm water fishery. Catchable or sub-catchable brown trout are stocked in the fall; catchable channel catfish are stocked in the spring/summer; and catchable sized bluegills are stocked when necessary to maintain the warm water fishery, or to recover the fishery following catastrophic events. Historic management included one brook trout stocking in 1964; since that time the lake has not been managed for this species. Similarly redear sunfish were stocked twice (1989 and 1996) and have not been stocked since 1996 (Table 2). The current clearance is for bluegill, redear sunfish, rainbow trout, brown trout, channel catfish, and largemouth bass.

Angler preference for Cataract Lake is for a warm water emphasis that is more resistant to changes in water quality. Temperatures on the lake in the summer months, and especially during low water years, will often be too high for trout to bite or for trout to be stocked. Trout can survive below the thermocline but are not as vulnerable to anglers, nor do they feed as much. Trout catch rates decline on most of the region's reservoirs in the mid to late summer and then increases again in the fall as water temperatures decline (C. Benedict pers. comm.). Angler preference for a warm water fishery was receivedduring a 2003 Region II fisheries questionnaire. Responses in that survey indicated that 67.5% of the anglers surveyed said they would like to see one or more of the lakes in the Williams' area, such as Cataract, City, and Santa Fe Reservoirs, shifted from a trout fishing emphasis to a warm water emphasis of largemouth bass, bluegill, and channel catfish. To that end, on February 26, 2004 approximately 9,000-fingerling bluegill were stocked into the reservoir in an attempt to enhance the already existing warm water species fishery.

Table 2. Cataract Reservoir AGFD stocking history 1950 to 2009.

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Bluegill	1987	2004	10	48, 522
Brook trout	1964	1964	1	5,070
Brown trout	1952	2008	36	163,552
Channel catfish	1974	2008	19	27,850

Largemouth bass	1987	1996	4	4,813
Rainbow trout	1950	2009	544	1,151,969
Redear sunfish	1989	1996	2	10,510
Total			603	1,407,794

Proposed Action

The Department proposes to stock rainbow trout, brown trout, bluegill sunfish, redear sunfish, largemouth bass and channel catfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times annually from March to November; number of fish stocked may vary from 0-35,000 fish annually.

Catchable and sub-catchable brown trout will be stocked multiple times annually in the fall; numbers of brown trout stocked may vary from 0-20,000 annually.

Catchable channel catfish will be stocked multiple times annually in the spring and summer; numbers of catchable channel catfish may vary from 0-1500 annually.

Channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables), largemouth bass (fingerling, sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity

In the event of spilling, Cataract Lake water flows 0.7 miles down an unnamed ephemeral wash into Gonzalez Lake; from there it is an additional 0.45 mi to the confluence with Cataract Creek. Cataract Lake spills during runoff events with the majority of the spill events occurring during spring runoff. Cataract Lake spills on the average of 3 out of 10 years (C. Benedict, pers. comm.). For downstream analysis of Cataract Creek and Canyon, see Havasu Creek Sub-Watershed analysis.

Fish Movement

During precipitation events significant enough to cause West Cataract Creek to flow, fish could potentially move out of Cataract Lake up stream to West Babbit Tank. From West Babbit Tank fish could potentially move up West Cataract Creek to the headwaters on Bill Williams Mountain. During wet cycles significant enough to cause Cataract Lake to spill, fish can potentially exit the reservoir downstream 0.7 miles into Gonzalez Lake. When spilling, fish from Gonzalez Lake can travel 0.45 miles to the confluence with Cataract Creek in Cataract Canyon.

For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Community Description

In the late 1980's the fish assemblage in Cataract Lake was dominated by green sunfish (Table 3). Cataract Reservoir species assemblage currently includes largemouth bass, black crappie, channel catfish, bluegill, rainbow trout, and brown trout. A recent survey conducted in 2008 detected largemouth bass, black crappie, channel catfish, and rainbow trout (Table 4); however bluegill, brook trout, brown trout and redear sunfish have historically been stocked in the reservoir (Table 2). Green sunfish, although not stocked by the Department, were historically present (C. Benedict, pers. comm.). There is no information on fishes downstream of Cataract Lake until downstream of Havasu Springs on the Hualapai Reservation. Black crappie and smallmouth bass were never stocked by the Department into Cataract Lake.

Table 3. 1987-1995 Cataract Lake electrofishing and netting data.

Year	Green Sunfish	Bluegill	Black Crappie	Largemouth Bass	Smallmouth Bass	Channel Catfish	Brown Trout	Rainbow Trout
1987	543		7			9	43	64
1988	139	3	23	7	1		1	47
1989	302	9	51	9	1		5	8
1990	160	56	63	5		1		7
1991	55	46	44	8		4	8	54
1992	12	54	73	20		2		37
1994	3	51	7	26				
1995	5	8	53	13		2		

Table 4. 2008 Cataract Lake electrofishing data.

Species	Num.	catch/min	% total	Mean TL (mm)	min-max TL (mm)
rainbow trout	7	0.11	0.53	238.33	225-258
channel catfish	2	0.03	0.15	466.5	440-493
black crappie	1,274	21.79	97.33	138.99	64-255
largemouth bass	26	0.44	1.99	202.69	90-443
Totals	1,309	22.37	-	-	-

Total effort 3,508 seconds (58.47 minutes).

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to humpback chub are covered in the Havasu Creek Sub-Watershed analysis at the end of this section because it is found downstream from all of these proposed sites.

Northern Leopard Frog

Local Analysis: Although Cataract Lake and the Havasu Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Cataract Lake is low. The likelihood of frogs being exposed to fish stocked in other sites within the Havasu Creek buffered stocking complex is also low. Cataract Lake was surveyed once in 1992 and there are no historical northern leopard frog records. There have been 19 surveys at 12 sites within the buffered stocking complex between 1991 and 1998 (Figure 3; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were observed at 1 of these sites, Coleman Lake in 1980 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Coleman Lake was surveyed during 3 visits after 1994; northern leopard frogs were not observed during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is not likely that northern leopard frogs occupy the buffered stocking complex.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached dam is low, because there are no historical records for frogs in the drainages into which the fish would disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

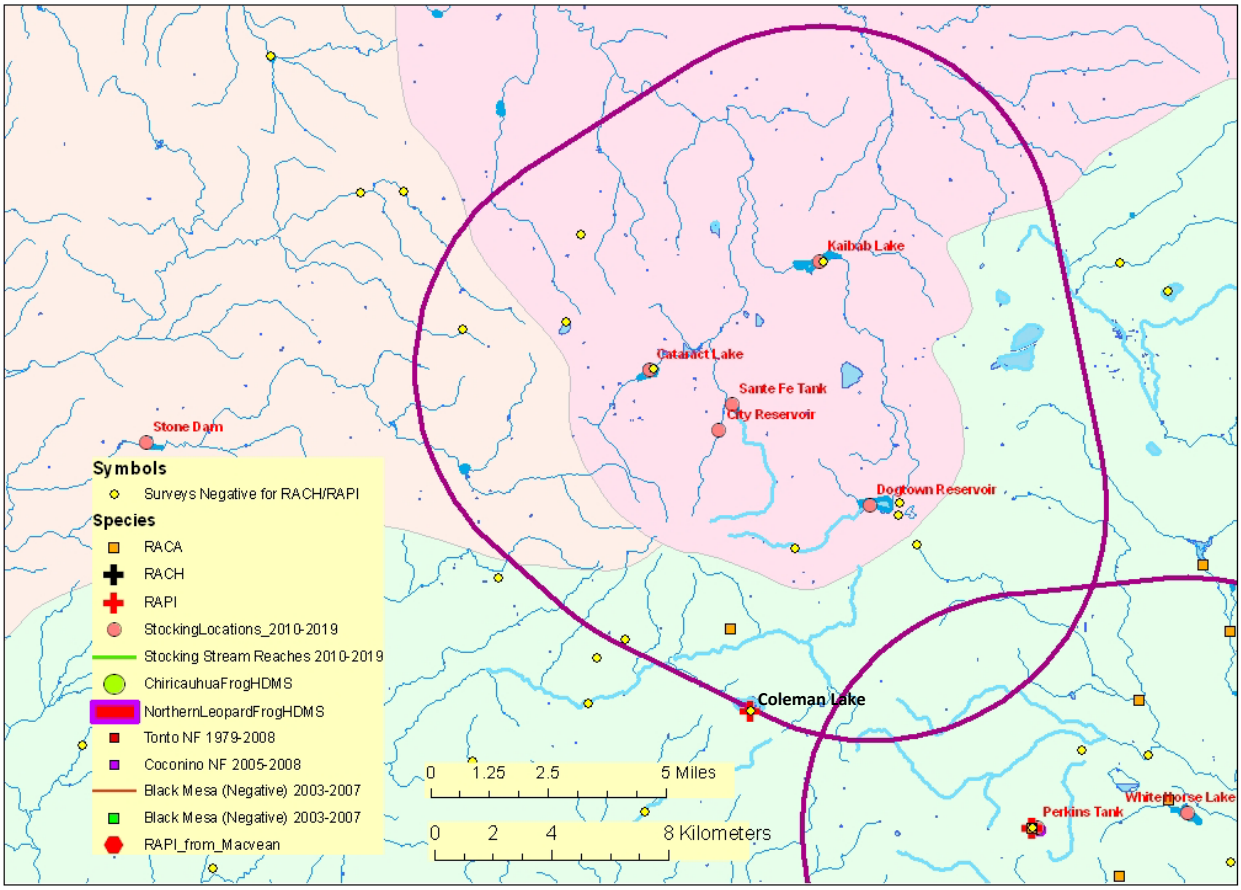

Figure 3. Map of Havasu Creek buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Kaibab Lake

Site Description

The dam at Kaibab Lake was constructed in 1953, impounding the approximately 65 acre lake, which is located two miles northeast of the town of Williams in Northern Arizona on the Kaibab National Forest. Kaibab Lake sits at an elevation of approximately 6,795 feet, and is an impoundment on Dogtown Wash; it receives flow from Dogtown Reservoir located 6.7 miles upstream. Kaibab Lake run-off would flow 3 miles downstream from the reservoir into Cataract Creek. An aqueduct runs from the dam at Kaibab Lake 1.4 miles to an unnamed pond as a municipal water supply for the City of Williams.

Fishing occurs year-round; however, road access is limited to the period from May to October, or as weather permits. The roads to the lake are paved, but are sometimes closed in winter due to snow. There are 70 campsites with fire rings and picnic tables, with a fee for camping. Vault toilets and water faucets are scattered throughout the campground; however, water is not available during the winter months. There is a paved boat-launch area; power boats are limited to single electric motors or single gasoline engines of 10 horse power or less. A wheelchair accessible composting toilet, open only during summer season, is adjacent to the boat ramp. A wheelchair accessible fishing pier is nearby.

Management of Water Body

Kaibab Lake is managed primarily as a high intensity cold water put-and-take rainbow trout fishery (Table 5). Catchable and sub-catchable rainbow trout are stocked multiple times during the spring, summer, and fall. The lake is also managed secondarily as a warm water fishery that supports largemouth bass, channel catfish, and bluegill. Of these warm water species only channel catfish are currently stocked during spring and summer months. Catchable channel catfish are stocked multiple times during the spring and summer. Kaibab Lake is an intensive use rainbow trout fishery with over 19,717 angler hours of use between May 24 and October 21, 2003; rainbow trout were the most commonly caught species at 72% of fish species caught by anglers during the survey, and channel catfish harvest was at 100% of the total caught by anglers during the survey (Table 6). Kaibab Lake is currently cleared for the stocking of rainbow trout, channel catfish, and largemouth bass.

Table 5. Kaibab Lake AGFD stocking history 1955 to 2009.

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Bluegill	1994	1994	1	6,000
Brook trout	1978	1979	2	10,000
Brown trout	1978	1995	21	131,702
Channel catfish	1984	2008	19	27,000
Largemouth bass	1992	1999	10	10,898
Rainbow trout	1955	2009	411	1,158,226
Total			462	1,342,226

Table 6. Kaibab Lake 2003 Creel Census, Catch and Harvest by Species.

Species	Num. caught	% of catch	Num. Harvested	% Released
rainbow trout	4,980	72	4,500	10
black crappie	1,895	27.4	1,837	3
channel catfish	21	0.3	21	0
bluegill	21	0.3	21	0

Proposed Action

The Department proposes to stock rainbow trout, brown trout, channel catfish, largemouth bass, bluegill, and redear sunfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times from March to November annually; numbers of rainbow trout stocked may be from 0 to 45,000 annually.

Catchable and sub-catchable brown trout will be stocked multiple times from September to November each year; numbers of brown trout stocked may be from 0 to 20,000 annually.

Catchable channel catfish will be stocked multiple times each year from April to July; numbers of catchable channel catfish stocked may be from 0 to 5,000 annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity

Kaibab Lake spills as a result of runoff events, with the majority of these events occurring in the spring during high runoff years. In most years the City draws from Kaibab Lake in rotation with Dogtown and Santa Fe. This reduces the number of times that Kaibab spills. Outflow from Kaibab Lake would flow over the spillway on the west side of the lake down Dogtown Wash 3.23 miles into Cataract Canyon. Kaibab Lake spills on the average of three out of every 10 years (C. Benedict, pers. comm.). For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Fish Movement

During precipitation events significant enough to cause Dogtown Wash to flow, fish can potentially move upstream out of Kaibab Lake into Dogtown Wash and upstream 6.7 miles to the dam at Dogtown Reservoir. During these high flows, fish could also potentially travel down

Dogtown Wash and into Cataract Canyon. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Community Description
In 1987, the fish assemblage at Kaibab Lake was dominated by green sunfish (Table 7). Kaibab Lake currently contains largemouth bass, bluegill, black crappie, channel catfish, green sunfish, and rainbow trout. In 2008 there was an aquatic community of rainbow trout, channel catfish (only 1 collected), black crappie, largemouth bass, and bluegill; no green sunfish were collected during the survey (Table 8).

Table 7. 1987 Kaibab Lake gill net survey.

Year	Green Sunfish	Bluegill	Channel Catfish	Brown Trout	Rainbow Trout
1987	732	544	3	5	3

Table 8. 2008 Kaibab Lake electrofishing data; total effort 3,623 seconds (60.38 minutes).

Species	Num.	Catch/Min	% total	Mean TL (mm)	Min-Max TL (mm)
rainbow trout	124	2.05	28.70	231.91	161-290
channel catfish	1	0.02	0.23	620	620
black crappie	112	1.85	25.93	173.67	24-204
largemouth bass	195	3.23	45.14	202.94	57-365
bluegill	15	0.25	3.36	60.53	22-177
TOTALS	447	7.40	-	-	-

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to Humpback chub are covered in the Havasu Creek Sub-Watershed analysis at the end of this section because it is found downstream from all of these proposed sites.

Northern Leopard Frog

Local Analysis: Although Kaibab Lake and the Havasu Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Kaibab Lake is low. The likelihood of frogs being exposed to fish stocked in other sites within the Havasu Creek buffered stocking complex is also low. Kaibab Lake was surveyed once in 1992 and there are no historical northern leopard frog records from Kaibab Lake. There have been 19 surveys at 12 sites within the buffered stocking complex between 1991 and 1998 (Figure 3; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were observed at 1 of these sites, Coleman Lake in 1980 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Coleman Lake was surveyed during 3 visits after 1994; northern leopard frogs were not observed during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is not likely that northern leopard frogs occupy the buffered stocking complex.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached dam is low, because there are no historical records for frogs in the drainages into which the fish would disperse (See also Fish Movement above) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Santa Fe Reservoir

Site Description

Located on the southern edge of the City of Williams off of 4th street and used as a water supply for the City of Williams, Santa Fe Reservoir sits at an elevation of 6,850 feet. The water level at Santa Fe Reservoir can fluctuate based on water use. The reservoir is an impoundment on Cataract Creek which collects snowmelt from Bill Williams Mountain and on average covers 3 surface acres, or 11 surface acres maximum when fully watered. Santa Fe Reservoir is a popular recreation area for the summer visitors and the citizens of Williams. The reservoir is located on private property. There is a primitive parking area and a small 1-lane gravel boat launch. Powerboat use on the lake is allowed, but is restricted to a single electric motor.

Management of Water Body

Santa Fe Reservoir is managed primarily as a high intensity cold water put-and-take rainbow trout fishery and a put-grow-and-take brown trout fishery, and secondarily as a put and take channel catfish fishery, and a self sustaining warm water fishery (Table 9). The lake is intensively used with an estimated 5,238 angler hours between May and October of 2003; rainbow trout were the most commonly caught species at 80% of fish species caught by anglers during the survey, and channel catfish harvest was 100% of the total caught by anglers during the survey (Table 10). Santa Fe Reservoir is currently cleared for the stocking of rainbow trout, brown trout, channel catfish, and redear sunfish.

Table 9. Santa Fe Reservoir AGFD stocking history 1941 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1941	1949	2	8,200
Brown trout	1965	2008	21	61,078
Channel catfish	1956	2009	19	14,151
Fathead minnow	1987	1987	1	2,000
Largemouth bass	1949	1960	4	2,235
Rainbow trout	1963	2009	300	306,098
Redear sunfish	1949	1989	2	1,830
Total			346	393,033

Table 10. Santa Fe Reservoir Catch and Harvest by Species (2003).

Species	Number caught	% of catch	Num. harvested	% released
rainbow trout	1301	80	1268	3
brown trout	228	14	228	0
channel catfish	97	6	97	0

Proposed Action

The Department proposes to stock rainbow trout, brown trout, channel catfish, largemouth bass, bluegill, and redear sunfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times annually during the spring, summer and fall; numbers of rainbow trout stocked may be from 0 to 16,500 annually.

Catchable and sub-catchable brown trout will be stocked multiple times during the fall annually; numbers of brown trout stocked may be from 0 to 7,000 annually.

Catchable channel catfish will be stocked multiple times during the spring and summer annually; numbers of catchable channel catfish stocked may be from 0 to 1,500 annually.

Largemouth bass (fingerlings, sub-catchables, and catchables), channel catfish (fingerlings, sub-catchables), redear sunfish (fingerlings, sub-catchables) and bluegill (fingerlings, sub-catchables) may be stocked as needed at any time during the year to augment existing populations, or

recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity
Santa Fe Reservoir spills during runoff events, with the majority of the spill occurring during spring runoff in 3 out of 10 years. In most years the City draws from Santa Fe Reservoir in rotation with Dogtown Reservoir and Kaibab Lake. This reduces the number of times that the Santa Fe Reservoir spills. In the event of flooding, outflow from Santa Fe Reservoir will travel over the spillway and into Cataract Canyon. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Fish Movement
Fish could potentially move up stream out of Santa Fe Reservoir during precipitation events significant enough to cause Cataract Creek to run. Fish could potentially travel upstream to the headwaters of Cataract Creek where movement would be terminated. During these high flows, fish could potentially escape Santa Fe Reservoir into Cataract Canyon. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Community Description
Santa Fe Reservoir currently contains channel catfish, bluegill sunfish, rainbow trout, brown trout, black crappie, yellow perch, and green sunfish (angler reports). The Department is actively stocking channel catfish, rainbow trout, and brown trout. The remaining species are of a self-sustaining and primarily illegally introduced warm water fish community.

Consultation Species or Critical Habitat
Humpback chub is covered in the Havasu Creek Sub-Watershed analysis at the end of this section because it is found downstream from all of these proposed sites.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Leopard Frog
Local Analysis: Although Santa Fe Reservoir and the Havasu Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard

frogs could be exposed to fish stocked in Santa Fe Reservoir is low. The likelihood of frogs being exposed to fish stocked in other sites within the Havasu Creek buffered stocking complex is also low. There are no historical northern leopard frog records for Santa Fe Reservoir. There have been 19 surveys at 12 sites within the buffered stocking complex between 1991 and 1998 (Figure 3; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were observed at 1 of these sites, Coleman Lake in 1980 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Coleman Lake was surveyed during 3 visits after 1994; northern leopard frogs were not observed during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is not likely that northern leopard frogs occupy the buffered stocking complex.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached dam is low, because there are no historical records for frogs in the drainages into which the fish would disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

City Reservoir

Site Description

Located on the southern edge of the City of Williams off 6th street in Buckskinner Park, City Reservoir sits at an elevation of 6,750 feet. The water level at City Reservoir can fluctuate based on water use, because it is used as a water supply for the City of Williams. In most years the City draws from City Reservior Lake in rotation with Dogtown Reservoir and Kaibab Lake.. This reduces the number of times that City Reservoir spills. The reservoir collects snowmelt from Bill Williams Mountain and on average covers 6 surface acres, with an 8 surface acre maximum when full. The reservoir sits at the base of Bill Williams Mountain on a side tributary of Cataract Creek. This small reservoir is a popular recreation area for the summer visitors and the citizens of Williams. City Reservoir has a picnic area with group sites located near the lake.

Management of Water Body

City Reservoir is managed primarily as an intensive use cold water put-and-take rainbow trout fishery and a put grow and take brown trout fishery (Table 11), and secondarily as a warm water put-and-take channel catfish fishery during spring/summer. The Department has not previously stocked largemouth bass, bluegill or redear sunfish.

The lake is intensively used with an estimated 3,189 angler hours between May and October of 2003; rainbow trout were the most commonly caught species at 82% of fish species caught by anglers during the survey, and channel catfish catch was at 18% of the total caught by anglers during the survey (Table 12). Harvest rates were 100% for channel catfish and 99% for rainbow trout; 87% of the channel catfish stocked into City Reservoir were harvested between May and October 2003.

Table 11. City Reservoir AGFD stocking history 1976 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1989	1993	4	4,001
Channel catfish	1990	2009	12	7,053
Rainbow trout	1980	2009	80	74,183
Smallmouth bass	1986	1990	6	3,552
Brook trout	1976	1976	1	6,500
Fathead minnow	1989	1989	1	5,000
Total			104	100,289

Table 12. City Reservoir catch and harvest by species (2003).

Species	Num. Caught	% of catch	Num. Harvested	% Released
rainbow trout	986	82	980	1
channel catfish	217	18	217	0

Proposed Action

The proposed action is to stock rainbow trout, brown trout, channel catfish, largemouth bass, redear sunfish, and bluegill sunfish for the period covered by this consultation.

Catchable, and sub-catchable rainbow trout will be stocked multiple times annually during the spring, summer, and fall; numbers of rainbow trout stocked may be from 0 to 13,000 annually.

Catchable and sub-catchable brown trout will be stocked multiple times in the fall annually; numbers of brown trout stocked may be from 0 to 7,000 annually.

Catchable channel catfish will be stocked multiple times each year during the spring and summer; numbers of catchable channel catfish stocked may be from 0 to 3,900 annually.

Redear sunfish would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Largemouth bass (fingerlings, sub-catchables, catchables), redear sunfish (fingerlings, sub-catchables), and bluegill (fingerlings, sub-catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery. Numbers of fish stocked

for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity
In the event of flooding, outflow from City Reservoir will travel 0.4 miles to the first of a pair of reservoirs known as the Saginaw Reservoirs, at 0.30 acres and 1.12 acres respectively. City Reservoir spills during runoff events with the majority of the spill events occurring during spring runoff, in 3 out of 10 years (C. Benedict, pers. comm.). The City draws water from City Reservoir which reduces the number of times City Reservoir spills. From the first Saginaw Reservoir it is 0.05 miles to the second Reservoir. Outflow from the second reservoir continues 0.19 miles to Cataract Creek in Cataract Canyon. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Fish Movement
Any upstream movement of fish out of City Reservoir would terminate at the headwaters on Bill Williams Mountain. In the event of flooding, fish from City Reservoir can potentially travel downstream 0.4 miles to the first Saginaw Reservoir. If the first of the two reservoirs receives enough water to fill and spill into the second reservoir, fish could potentially move between the two. From the first Saginaw Reservoir it is 0.05 miles to the second reservoir. If the second reservoir receives enough water to spill outflow from the second reservoir continues 0.19 miles to Cataract Creek in Cataract Canyon. Fish could potentially make their way into Cataract Canyon. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Community Description
In 1986 and 1987, the fish assemblage in City Reservoir was dominated by green sunfish (Table 13). City Reservoir currently contains smallmouth bass (last detected 2002), green sunfish, black crappie, channel catfish, and rainbow trout. Green sunfish and black crappie were illegally introduced into the reservoir. Channel catfish are not thought to reproduce in City Reservoir. The Department does not receive reports of anglers catching small catfish.

Table 13. City Reservoir electrofishing survey 1986-1987.

Year	Green Sunfish	Bluegill	Black Crappie	Smallmouth Bass	Rainbow Trout
1986	33	29	18	0	3
1987 Spring	251	59	21	51	0
1987 Fall	296	108	8	18	0

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to Humpback chub are covered in the Havasu Creek Sub-Watershed analysis at the end of this section because it is found downstream from all of these proposed sites.

Northern Leopard Frog
Local Analysis: Although City Reservoir and the Havasu Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in City Reservoir is low. There are no historical northern leopard frog records for City Reservoir. There have been 19 surveys at 12 sites within the buffered stocking complex between 1991 and 1998 (Figure 3; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were observed at 1 of these sites, Coleman Lake in 1980 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Coleman Lake was surveyed during 3 visits after 1994; northern leopard frogs were not observed during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is not likely that northern leopard frogs occupy the buffered stocking complex.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached dam is low, because there are no historical records for frogs in the drainages into which the fish would disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Dogtown Reservoir
Site Description
Built in 1934, Dogtown Reservoir is an 82 acre lake located approximately 5 miles southeast of the town of Williams in northern Arizona on the Kaibab National Forest. The lake is an impoundment on ephemeral Dogtown Wash located 6.7 miles upstream of Kaibab Lake.

The reservoir is open seasonally to fishing from May to October, or as weather permits. The roads are paved and graveled for passenger vehicle use; however, they are usually closed by snow during winter months. The reservoir's recreational area hosts 51 campsites with picnic

tables and fire rings, and one group site, with a fee for camping. Vault toilets and water faucets are scattered throughout the campground. Powerboats are allowed on the lake but are restricted to a single electric motor of 1 horsepower or less. There is a concrete boat launch ramp. The lake is currently managed for rainbow trout and brown trout, and is a popular summertime camping and fishing destination for anglers and recreationists.

Management of Water Body
Primary management is for a high intensity use, cold water put-and-take rainbow trout fishery and a put-grow-and-take brown trout fishery. Secondary fishery is for a self sustaining warm water fishery (Table 14).

Table 14. Dogtown Reservoir AGFD stocking history 1961 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1994	1996	3	18,000
Brook trout	1978	1983	6	35,065
Brown trout	1975	2008	41	218,242
Channel catfish	1961	1994	13	26,361
Cutthroat trout	1985	1989	7	41,082
Fathead minnow	1987	1987	1	10,000
Largemouth bass	1961	1995	8	16,867
Rainbow trout	1965	2009	205	805,606
Redear sunfish	1990	1990	1	12
Total			285	1,161,195

Proposed Action
The proposed action is to stock rainbow trout, brown trout, channel catfish, largemouth bass, bluegill sunfish, and redear sunfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times annually during the spring, summer, and fall; numbers of rainbow trout stocked may be from 0 to 71,000 annually.

Catchable and sub-catchable brown trout will be stocked multiple times in the fall annually; numbers of brown trout stocked may be from 0 to 24,000 annually.

Catchable channel catfish will be stocked each year from April to July; numbers of catchable channel catfish stocked may be from 0 to 3,000 annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables) may be stocked as needed at any time during the year to, augment existing populations, or recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity
In the event Dogtown Reservoir spills outflow will travel down ephemeral Dogtown Wash ~6.7 miles into Kaibab Lake. Kaibab Lake travels down Dogtown Wash 3.23 miles into Cataract Canyon. Dogtown Reservoir spills on the average of 2 out of 10 years, with Kaibab Lake spilling on average 3 out of 10 years (C. Benedict, pers. comm.). An aqueduct runs southeast from Dogtown Dam 6.32 miles to an unnamed pond as a municipal water supply for the city of Williams. There is no outflow from this pond. The City draws water from Dogtown Reservoir, which reduces the number of spills. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis.

Fish Movement
During precipitation events significant enough to cause Dogtown Reservoir to spill, fish could potentially travel downstream into Kaibab Lake and then into Cataract Creek. For downstream analysis of Cataract Creek and Canyon see Havasu Creek Sub-Watershed analysis. Similarly during wet cycles when the upstream drainage is watered, fish could potentially move upstream into the headwaters above the reservoir where movement is terminated.

Community Description
Dogtown Reservoir currently contains detectable numbers of rainbow trout, brown trout, bluegill, and black crappie. The Department did not stock bluegill or crappie. (Please see Table 14.)

Consultation Species or Critical Habitat
Humpback chub is covered in the Havasu Creek Sub-Watershed analysis at the end of this section because it is found downstream from all of these proposed sites.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in

Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Leopard Frog

Local Analysis: Although Dogtown Reservoir and the Havasu Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Dogtown Reservoir is low. The likelihood of frogs being exposed to fish stocked in other sites within the Havasu Creek buffered stocking complex is also low. Dogtown Reservoir was surveyed 3 times from 1991-1993 and there are no historical northern leopard frog records. There have been 19 surveys at 12 sites within the buffered stocking complex between 1991 and 1998 (Figure 3; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were observed at 1 of these sites, Coleman Lake in 1980 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Coleman Lake was surveyed during 3 visits after 1994; northern leopard frogs were not observed during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is not likely that northern leopard frogs occupy the buffered stocking complex.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached dam is low, because there are no historical records for frogs in the drainages into which the fish would disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl and Critical Habitat

This stocking location is within Mexican Spotted Owl (MSO) critical habitat (CH). There is little vegetation along most of the shoreline of the stocking location, all of which can be accessed by foot.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Mexican spotted owl will not be addressed at the broader complex analysis scale.

HAVASU CREEK SUB-WATERSHED ANALYSIS

The Havasu Creek Sub-watershed Complex consists of 6 reservoirs proposed for stocking. All fish stocking activities occur within the Cataract Creek Sub-Watershed. Cataract Lake, Kaibab Lake, Santa Fe Reservoir, City Reservoir, and Dogtown Reservoir are located on the headwaters of Cataract Creek near the town of Williams. Russell Tank is located on the headwaters of Red Horse Wash, which flows in to Cataract Creek. Cataract Creek flows into Havasu Creek before entering the Colorado River more than 135 miles downstream. Ownership of land within this complex includes Federal, Tribal, State, and private.

Water Distribution/Connectivity

The Cataract Creek Sub-Watershed drains a portion of the Colorado Plateau south of the Grand Canyon, encompassing 325 square miles. Cataract Creek is the major tributary to Havasu Creek. Other washes in the drainage are ephemeral. Cataract Creek is ephemeral upstream of Havasu Creek, but becomes perennial at Havasu Springs on the Havasupai Indian Reservation in the Grand Canyon, approximately 9 miles upstream of the Colorado River. Cataract Lake, Kaibab Lake, Santa Fe Reservoir, City Reservoir, and Dogtown Reservoir are located on the headwaters of Cataract Creek near the town of Williams. From these stocking sites, it is 135 miles to the Colorado River. Russell Tank is located on the headwaters of Red Horse Wash, which flows in to Cataract Creek and finally into Havasu Creek before entering the Colorado River more than 120 miles downstream. The Confluence of the Little Colorado River and the Colorado River is 95.5 miles upstream of the Confluence of Havasu Creek and the Colorado River.

Fish Movement

It is unlikely that many if any fish survive the flood events necessary to connect the Cataract Creek headwaters to Havasu Creek. Cataract Creek is ephemeral upstream of Havasu Creek, but becomes perennial at Havasu Creek on the Havasupai Indian Reservation in the Grand Canyon. Fish from stocking locations near the headwaters of Cataract Creek would have to travel downstream and survive intermittent drainages and pass through the numerous in-channel stock tanks to reach Cataract Canyon. They would then have to survive the over 105 mile long ephemeral Cataract Creek through Cataract Canyon. Cataract Canyon is a high gradient desert wash that experiences floods, characterized by high velocity sediment-laden water through primarily boulder substrates. Surviving fish that reach the perennial stretch below Havasu Springs then would need to navigate the 4 major waterfalls to reach the lowest most 6 km of Havasu Creek where fisheries data is available near the Colorado River (Table 15). Those four falls are Fiftyfoot Falls, Navajo Falls (which has an approximate 75 foot drop), Havasu Falls (which has about a 100 foot drop) and Mooney Falls (which has a 196 foot drop).

Community Description

There have been occasional captures of nonnative fish in Havasu Creek, a tributary that flows into the Colorado River approximately 96 miles downstream from the Little Colorado River (LCR) confluence. Table 15 provides a summary of known collections from the lower 3.7 miles, on National Park Service lands. There is no available fish survey data other than anecdotal information on what is in Havasu Creek above this area on the Hualapai Reservation, and fish assemblage information within that segment of creek is unknown. It is unknown whether or not the non-native species listed in Table 15 originated from the watershed above or from the Colorado River where they maintain existing populations, since there are no significant impediments to upstream movement in the first 3.7 miles of Havasu Creek upstream from its confluence with the Colorado River. A complete description of the fishery in the Colorado River in Grand Canyon and the lower part of the Little Colorado River is provided in the Lower Little Colorado River Complex Analysis.

Table 15. Grand Canyon Monitoring and Research Center Havasu Creek fish survey collection data from 1978 to 2003. Surveys were conducted in the lower 6 km of Havasu Creek.

Number of Fish Captures 1978-2003 at RKM (river kilometer mark) in Havasu Creek							
Native Species	**0-1 km**	**1-2 km**	**2-3 km**	**3-4 km**	**4-5 km**	**5-6 km**	**Total**
Humpback Chub	65	0	0	0	0	0	65
Flannelmouth Sucker	963	0	0	0	3	0	966
Bluehead Sucker	926	99	127	75	87	10	1324
Speckled Dace	979	21	13	15	30	62	1120
Total	2933	120	140	90	120	72	3475
Non-Native Species							
Fathead Minnow	37	0	0	0	0	0	37
*Channel Catfish	1	0	0	0	0	0	1
Common Carp	6	0	0	0	0	0	6
*Rainbow Trout	116	0	1	0	0	0	117
*Brown Trout	2	0	0	0	0	0	2
Brook Trout	2	0	0	0	0	0	2
Striped Bass	7	0	0	0	0	0	7
Un-determined Fish	1	0	0	0	0	0	1
Yellow Bullhead	1	0	0	0	0	0	1
Plains Killifish	3	0	0	0	0	0	3
Total	176	0	1	0	0	0	177

*Species proposed to be stocked in the upstream watershed of Havasu Creek.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses

(resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Humpback Chub & Critical Habitat

Between 1978 and 2003, surveys of the lower 6 km of Havasu Creek upstream from its confluence with the Colorado River detected Humpback chub only in the 0-1km reach upstream from the confluence as well as in the main stem Colorado River both upstream and downstream for Havasu Creek confluence.

Critical habitat is designated in the Colorado River from Nautiloid Canyon to Granite Park in the Grand Canyon. Critical Habitat is designated in the Little Colorado River from river mile 8 downstream to the confluence with the Colorado River. Known constituent elements include water, physical habitat, and biological environment as required for each particular life stage for each species. No critical habitat is designated in Havasu Creek.

Potential impacts

All of the waters proposed for stocking in the upper section of the Cataract Creek Sub-Watershed are potentially connected to the Colorado River and lower Havasu Creek where humpback chub occur. It is unlikely that many if any fish survive the flood events necessary to connect the Cataract Creek headwaters to Havasu Creek. Cataract Creek is ephemeral upstream of Havasu Springs, but becomes perennial on the Havasupai Indian Reservation in the Grand Canyon at those springs. Fish from stocking locations near the headwaters of Cataract Creek would have to travel downstream and survive intermittent drainages and pass through the numerous in-channel stock tanks, including Redlands Dam a large stock tank to reach Cataract Canyon. They would then have to survive the over 105 mile long ephemeral Cataract Creek through Cataract Canyon. Cataract Canyon is a high gradient desert wash that experiences floods, characterized by high velocity sediment-laden water through primarily boulder substrates. Surviving fish that reach the perennial stretch below Havasu Springs then would need to navigate the 4 major waterfalls to reach the lowest most 6 km of Havasu Creek where humpback chub are located.

All of the sport fish species proposed by the Department for stocking have been stocked and/or have existed in the Cataract Creek Sub-Watershed for many years; rainbow trout, brown trout, channel catfish, largemouth bass, bluegill, and redear sunfish. One species, redear sunfish, has been stocked five times at three of the lakes (Table 2; Table 9; Table 14). Of the stocked species listed, only 1 channel catfish, 116 rainbow trout, and 2 brown trout were collected in the lower

section of Havasu Creek between 1978 and 2003 (Table 15). Green sunfish, black crappie, and yellow bullhead have also persisted in several of the reservoirs in this complex, but there origin cannot be determined (Table 3; Table 4; Table 6; Table 7; Table 13). The absence of green sunfish and black crappie in the Lower Havasu Creek data is evidence that migration of fish from the reservoirs in this complex is limited or non-existent and the habitat in Havasu Creek may not be suitable for their short or long-term persistence. Green sunfish are believed to be well adapted to riverine conditions that exist in Lower Havasu Creek because of their seemingly wide-spread distribution throughout other desert stream systems in Arizona, including other travertine dominated systems (i.e. Fossil Creek). If fish movement from the reservoirs in this complex existed, it is expected that green sunfish would appear in the Lower Havasu Creek data. All but one of the nonnative species in the Lower Havasu Creek were only captured in Havasu Creek within 0-1 km upstream of its confluence with the Colorado River (rainbow trout was collected in the 2-3 km reach upstream from the confluence; Table 15. Grand Canyon Monitoring and Research Center Havasu Creek fish survey collection data from 1978 to 2003. Surveys were conducted in the lower 6 km of Havasu Creek.Table 15). Based on the density and abundance of nonnative fish collected in the 0-1km survey reach of Havasu Creek compared to the upper end of the survey reach (1-6 km above the conf.) (where only 1 rainbow trout was collected), there is strong evidence to suggest that these non-natives are more likely to originate from the Colorado River mainstem than from upstream sources in the Cataract Creek Sub-Watershed. In particular, the source of any channel catfish found in the lower reach of Havasu Creek (of which only 1 individual has ever been documented) is more likely to be from the channel catfish population that exists downstream of the Havasu Creek confluence in the mainstem Colorado River (see discussion of Colorado River fish populations in the Lower Little Colorado River analysis).

It is also unlikely, for the same reasons mentioned above, that any largemouth bass, bluegill, or redear sunfish can persist in Havasu Creek or the Colorado River, in the unlikely event that they are successfully transported from the Cataract Creek Complex. The historical survey data for these areas showing a paucity of their occurrence supports this assertion, but doesn’t totally eliminate the potential for their transport into lower Havasu Creek.

Critical habitat

For the reasons mentioned above, it is extremely unlikely that stocked species would be exposed to humpback chub critical habitat primary constituent elements state that food supply, predation, and competition - are important elements of the biological environment. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced nonnative fish species in many areas. Impacts to critical habitat due to the addition of non-native fish to the existing non native community from the proposed action (exposure is deemed very unlikely as detailed above) would not be distinguishable from the

existing community which was present at the time of critical habitat designation. However, if any of the stocked fish were to join the existing non-native assemblage, they would incrementally affect this constituent element.

PARKER TO YUMA SUB-WATERSHED

Drainage area

The lower Colorado River extends from Lees Ferry, which is below Glen Canyon Dam, to the Sea of Cortez (Figure 4). The drainage area includes much of Arizona and parts of California, Nevada, New Mexico and Utah. This watershed area begins immediately below Parker Dam, forming Lake Havasu and extends to the southern international boundary with Mexico.

Range of elevations

Elevations range from 482 feet at Lake Havasu City to 141 feet at Yuma.

The only major tributary entering this reach is the Gila River, which only has sustained flow in the very lowest reach from agricultural drainage. However, the Gila River is capable of high flows during flood events arising in the upper watershed. Major wash systems enter the Colorado along this reach and flow after significant rainfall events.

LOWER COLORADO-YUMA COMPLEX

La Paz County Park Pond and Backwater

Site Description

La Paz County Park pond and backwater are comprised of one 0.6-acre isolated pond adjacent to the Colorado River and one 1.4-acre backwater directly connected to the Colorado River at Parker Strip, located at La Paz County Park (Figure 5), approximately 6 river miles downstream of Parker Dam. These waters are located in a county park RV resort at the upper part of the Parker to Yuma sub-watershed and are open to public fishing year round. The backwater contains a boat ramp that provides access to the river. These waters are also used for fishing clinics and derbies (Figure 6). There are typically two fishing clinics or derbies per year held at this site, involving over 800 young anglers.

Management of Water Body

This site, both pond and backwater, has been stocked for many years with both warm and cold water fish by the “Take A Kid Fishing” Community Partnership (W. Shontz, pers. comm). Since 2002 it has been stocked once a year, usually in February, by the Department with rainbow trout to facilitate two fishing clinics (Table 16) that are held a couple of days apart following the stocking. For approximately five years prior to that the U.S. Fish and Wildlife Service (USFWS) provided trout for these clinics. The backwater is netted off from the river prior to stocking and the net is not removed until well after the event. Nearly all of the fish are removed by fishing before the net is removed. There is no outlet from the isolated pond to the river, so no net is required to retain the fish in the pond.

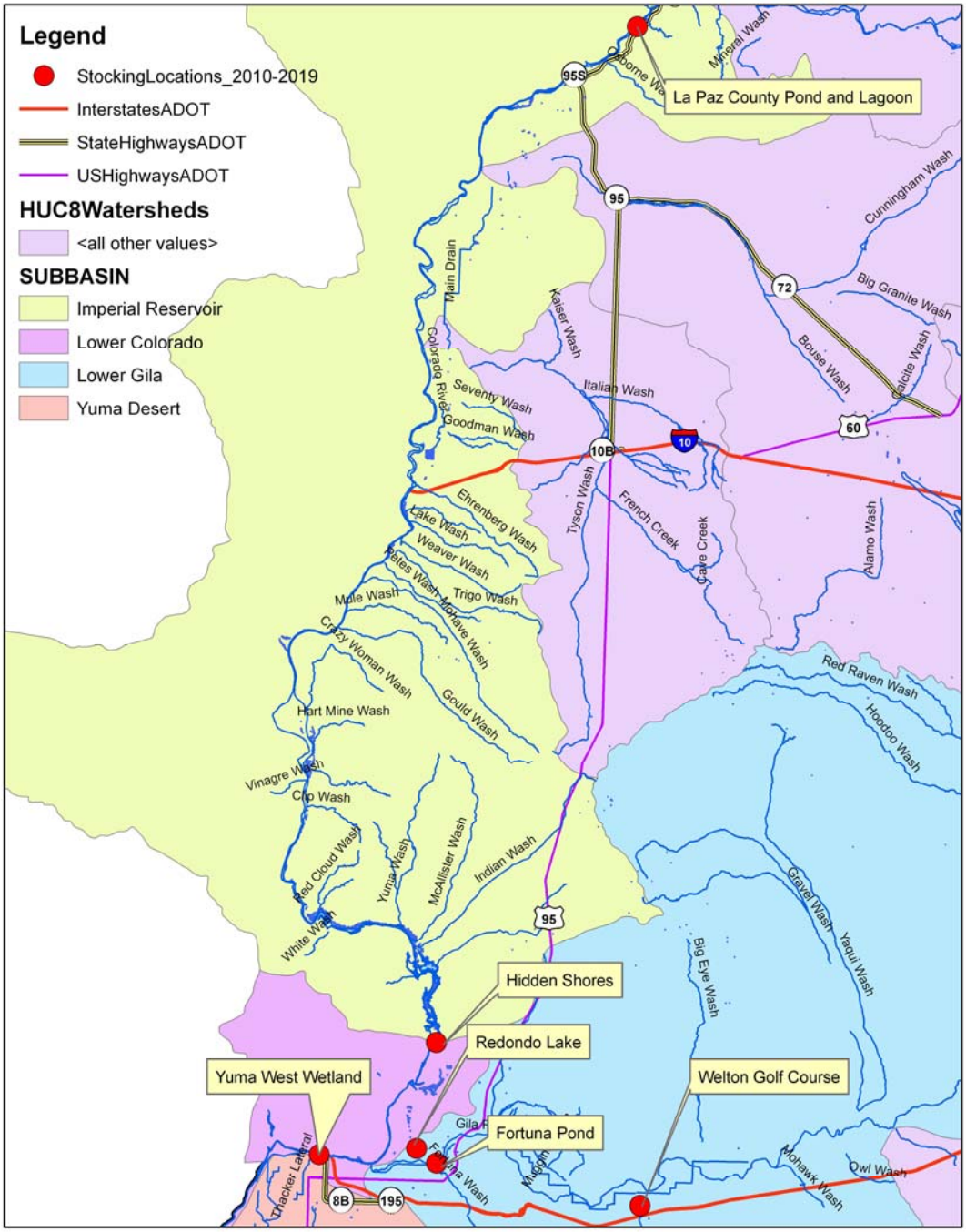

Figure 4. Lower Colorado River watershed overview map.

Figure 5. Aerial photo of La Paz County Park Lagoon and Pond.

Figure 6. Oblique photo of La Paz County Park lagoon photo 1.

Table 16. La Paz County Park Pond, backwater and adjacent Colorado River stocking history summary 1948 to 2009.

Species (Location)	First Year	Last Year	Num. of Stockings	Num. Stocked
Rainbow trout (La Paz Park ponds)	2002	2009	8	29,377
Rainbow trout (Parker Strip)	1959	2003	8	110,564
Largemouth bass (Parker Strip)	1948	1949	2	40,000
Bluegill (Parker Strip)	1949	1949	1	500
Redear sunfish (Parker Strip)	1978	1978	1	17,325
Bullfrog tadpoles	1978	1978	1	1000
Total			19	198,766

Note: stockings of razorback suckers are not included in the above table, as stocking records combine the Parker and Palo Verde Divisions of the Colorado River.

This site will be managed as a short-term put-and-take fishery to facilitate fishing clinics. The management objective for this site is to stock both the pond and backwater to facilitate approximately 2 fishing clinics/derbies per year with appropriate numbers of fish to maintain catch rates if or when angling participation increases over the next 10 years.

Proposed Action

The Department proposes to stock rainbow trout, bluegill sunfish and channel catfish for the duration covered by this consultation.

The intent is to stock rainbow trout twice annually with at least one of those stockings occurring in February; however, if it is not is not feasible to stock rainbow trout due to cost or availability, channel catfish or bluegill may be used instead. The proposed action is to stock a total of 500 – 3,000 fish annually (generally 500 - 1,500 fish per stocking) which may be comprised of catchable rainbow trout, catchable channel catfish, or catchable bluegill in the pond and a total of 1,000 - 6,000 fish annually (generally 1,000 – 3,000 fish per stocking) which may be comprised of catchable rainbow trout, channel catfish, or bluegill in the backwater, between January and March, to facilitate the fishing clinics or derbies.

Water Distribution/Connectivity

The pond is above the elevation of the Colorado River and is maintained via a small pipe and pump. There is no outflow to the river and the pond does not overflow. The pond is considered to be a closed system.

The backwater is directly connected to the Colorado River. Water can move in and out of the backwater from the river. Water in the river flows downstream and could ultimately end up in one of several irrigation canals (e.g. Palo Verde or All American) or Mexico.

Fish Movement
Fish in the pond cannot escape because it is a closed system.

Any fish remaining in the backwater after the heavy fishing pressure from a clinic could move into the Colorado River once the net is removed. These fish could then move upstream to Parker Dam where further upstream movement would be blocked by the dam. Stocked fish, or their progeny, that ended up in the Colorado River could also conceivably move downstream and get into Mexico, the Gila River, or one of the many irrigation canals.

Community Description
The fish community in Parker Strip is dominated by non-native species. Minckley (1979) reported that the fish community was likely similar to that below Headgate Rock Dam with largemouth bass, bluegill, green sunfish, redear sunfish, black crappie, channel catfish, yellow bullhead, carp, and red shiner being present. Fisheries surveys by the Department on the adjacent Parker Strip have been conducted sporadically since 1982. Six fall electrofishing surveys were conducted in the years 1982, 1986, 1998, 2000, 2007 and 2009 (Brown 2009). Species collected in these surveys included largemouth bass, smallmouth bass, bluegill, redear sunfish, green sunfish, black crappie, channel catfish, flathead catfish, striped bass, carp, yellow bullhead, rainbow trout (a single individual in 1986), razorback sucker (seven individuals in 2007) and threadfin shad. Excluding carp and threadfin shad, which were not always collected, black bass comprised 54, 59, 37, 93 and 72 percent of the total numbers collected in each year, respectively. The 93% value for the 2000 survey is inflated relative to the other years because sunfish (bluegill, redear, and green sunfish) were apparently not collected and enumerated during the sampling in 2000 (Brown 2009). However, sunfish were collected in other years. Catch per unit effort (CPUE) for largemouth and smallmouth bass was 11.2 and 12.2, respectively, for a combined CPUE of 23.4 in the most recent survey (Brown 2009). This further demonstrates that there is a large population of these species in the Parker Strip.

Catfish and striped bass are typically underrepresented with electrofishing methodology, and both channel and flathead catfish and striped bass are undoubtedly much more numerous than indicated by the survey data.

Rainbow trout were stocked into the Parker Strip eight times between 1959 and 2003, with a total of 110,564 fish stocked. Most of these fish (101,250) were stocked in 1987 as part of an effort to control caddisflies. The other seven stockings were smaller, with 5,000 trout stocked in 1986 (Jacobson 1988). The ability for rainbow trout to over-summer in the mainstem lower Colorado River below Parker Dam is limited due to high temperatures (25-30°C) that occur by midsummer (Minckley 1979). However, there is a small chance that some trout may survive for at least one summer. The 1986 stocking was made on May 21, 1986 (Jacobson 1988) and the one record for rainbow trout from the electrofishing surveys was in the fall of that year (Brown 2009). The large stockings of rainbow trout in 1987 were made between January and April, with another in December of that year, and no rainbow trout were taken that fall. The difference in survival may be in the size of the trout stocked. The 1986 stocking may have been of larger sized fish, as the trout recaptured was 270 mm (Brown 2009), and the 1987 stockings were averaging between 170 mm and 70 mm (Jacobson 1988).

There is a long history of stocking razorback suckers into the Parker Strip. However, there was a hiatus between 2001 and 2005 in which no razorback suckers were stocked. Stocking of razorback suckers resumed in 2006, and bonytail stocking was initiated in 2007 (Schooley et al. 2008).

Consultation Species and Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Listed species occurring within the vicinity of this site would include; razorback sucker and critical habitat and bonytail chub. Yuma clapper rail is discussed in the complex analysis.

Bonytail

Wild populations of bonytail in the lower Colorado River below Parker Dam are considered extirpated. Critical habitat was designated in 1985 and included the reach of the lower Colorado River where the wild population was considered extant: from Hoover Dam to Davis Dam, including Lake Mohave to its full pool elevation and the mainstem lower Colorado River from the northern boundary of the Havasu National Wildlife Refuge to Parker Dam including Lake Havasu to its full pool elevation.

Bonytail are currently stocked into Lake Mohave by the U.S. Fish and Wildlife Service and into Lake Havasu and the lower Colorado River below Parker Dam by the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). Extensive stocking in Lake Mohave and Lake Havasu has not resulted in significant population gains in those reservoirs (Pacey and Marsh 2008), although portions of Lake Havasu at the lower end of the lake show greater numbers of bonytails persisting than the upper portion.

A total of 1,208 bonytail were stocked into the Parker Strip at River Island State Park in December 2007 (LCR MSCP 2009a) and 535 in 2008 (LCR MSCP 2009b). This site is about three miles upstream of La Paz County Park. Six bonytail were recaptured in 2007 during electrofishing surveys (Schooley et al. 2008). Stockings of bonytail and subsequent monitoring are expected to continue in this reach for the foreseeable future in an attempt to establish a population. Survival rate for the stocked bonytails is unknown; and few were recaptured post-stocking. Additional surveys throughout the Parker Strip are planned for future years and will assist in defining survival and habitat use. Designated critical habitat for bonytail ends at Parker Dam, so the proposed action at this site will have no impact on bonytail critical habitat because stocked species cannot move above Parker Dam.

Potential Impacts

Pacey and Marsh (1998) reviewed the literature on resource use between native and non-native fishes, including the bonytail and the species proposed for stocking into La Paz County Park. Their conclusion, after review of the literature, was that non-native cold and warm water fish generally use the same habitats and resources as bonytail. The extent of the overlap depends on the specific species habitat preferences (and the availability of those habitat types), diet, and behavior. Predation on all life stages of bonytail by non-native fish species is documented in the literature (Pacey and Marsh 1998; USFWS 2002a). Bluegill and channel catfish (USFWS 2002a) are specifically identified. While there is no specific mention of rainbow trout as predators on small bonytail, rainbow trout do prey on small razorback suckers (Mueller 1993).

Bonytail stocked into the Parker Strip are about 300 mm (LCR MSCP 2009a) and are currently stocked at River Island State Park upstream of La Paz County Park during the winter. Although not specifically identified as to capture location, six bonytails were recaptured in 2008 after stocking. Downstream movements are likely, and the La Paz County Park backwater may be an attractive location for bonytail in a river reach with few available backwaters.

Bonytail are often considered fish of higher velocity waters; however, they are mostly found in the slower waters (eddies and pools) adjacent to higher velocity waters (USFWS 2002a). Backwaters, particularly with rip-rap or cobble shorelines are important habitats (Mueller et al. 2003) where fish hide during the day. Bonytail are active at night, coming into open water to forage. Young bonytail use backwaters and shallow, low velocity habitats (USBR 2005) and

prefer areas with heavy cover from rocks or vegetation. Bonytail do very well in ponds, which corroborates information on their use of backwaters in the wild.

Exposure of stocked rainbow trout, channel catfish, or bluegill may result in competition for space and resources with the stocked bonytail. Exposure could occur with bonytail that may be in the backwater when sport fish are stocked or with bonytail in other portions of the Parker Strip once the block net is removed and stocked fish can exit the backwater.

The stocked bonytail are within the size range of the catchable (8-12 inches) fish stocked into the backwater. Immediate predation by the stocked fish on bonytail is not likely due to similar sizes at stocking; however, any stocked warm water fish that survive and remain in the backwater may be able to prey on subsequently stocked bonytail that access the backwater. Stocked channel catfish that leave the backwater once the block net is removed and grow to larger sizes in the river may have exposure to recently stocked bonytail.

There should be no potential impacts to bonytail from the proposed stocking of the isolated pond because it is a closed system. There is a slight possibility that channel catfish or bluegill could be stocked when rainbow trout are not available, but because it is a closed system, there is no impact.

As discussed above, there could be the potential for direct competition of resources if any bonytail are present in the backwater at the time of stocking. Very few fish are expected to remain following the fishing clinic; however, those fish could get into the Colorado River following removal of the net. This could result in competition and possible predation of native fish. The amount of channel catfish or bluegill that might be added to the river system, should they be used, would not be expected to have a meaningful or measurable effect on the existing populations of those species in this system. Rainbow trout that might enter the river would not be expected to survive more than a few months due to predation and high water temperatures in the summer.

Razorback Sucker and Critical Habitat

Razorback suckers are found in the Colorado River Lower Basin from Lake Mead to Imperial Dam. Critical habitat is designated in the Colorado River and its 100-year flood plain, from Parker Dam to Imperial Dam, including Imperial Reservoir to the full pool elevation or 100-year flood plain, whichever is greater. Razorback suckers can access and be present in the La Paz County Park backwater at the time of sport fish stocking.

Razorback suckers have been stocked into the Parker Strip in the past, and are currently stocked by the LCR MSCP into the Parker Strip (Table 17). This activity is expected to continue for the foreseeable future. Monitoring of the stocked fish also occurs under the LCR MSCP (Schooley et al. 2008).

Table 17. Razorback sucker stockings in the Parker Strip 2006-2009 (LCR MSCP 2009a).

Location	**Date (month/year)**	**Num.**
Buckskin Mountain Park	9/06	1655
Buckskin Mountain Park	2/07	1051
River Island Park	11/06	2529
River Island Park	1/07	1924
River Island Park	3/07	570
River Island Park	9/07	901
River Island Park	9/07	2657
River Island Park	2/08	3024
River Island Park	1/09	4454
River Island Park	3/09	1303

The stocking site is within the boundaries of designated critical habitat for the razorback sucker. This reach of critical habitat was determined to be important for delisting of the species, which equates to recovery (USFWS 1994). The Parker Strip portion of the designated reach was considered particularly important at the time of designation due to the presence of both wild-born and hatchery raised juvenile razorback suckers in the CRIT irrigation canals between 1974 and 1993 (Marsh and Minckley 1989; USFWS 1993). Stockings of small razorback suckers into the Parker Strip in 1986 were a likely source for the hatchery-raised juveniles found (Schooley and Marsh 2007).

Potential Impacts

There should be no potential impacts to the razorback sucker from the proposed stocking of the isolated pond because it is a closed system. The primary intent of the proposed action is to stock 1,000-3,000 rainbow trout in the backwater once a year in February. There is a slight possibility that channel catfish or bluegill could be stocked when rainbow trout are not available, but because it is a closed system, there is no impact.

As discussed above, there is a potential for direct competition of resources if any razorback suckers are present in the backwater at the time of stocking and for predation if larval razorback suckers are present. However, it is not known whether razorback suckers successfully spawn, whether the larvae hatch or what the likelihood would be for larvae to be found in or near this backwater. Very few stocked fish are expected to remain following the fishing clinic; however, those fish remaining could get into the Colorado River following removal of the net, or razorback sucker larvae could enter the backwater through the fine mesh of the net. This could result in competition with and possible predation on razorback sucker larvae. The number of channel catfish or bluegill that might be added to the river system when those species are used in

place of rainbow trout would not be expected to have a meaningful or measurable effect on the existing populations of those species in this riverine system. Rainbow trout that might enter the river would not be expected to survive more than a few months due to predation by other existing non-native fishes and high summer water temperatures.

Pacey and Marsh (1998) reviewed the literature on resource use between native and non-native fishes, including the razorback sucker and the species proposed for stocking into La Paz County Park. Their conclusion was that non-native cold and warm water fish generally use the same habitats and resources as razorback suckers. The extent of the overlap depends on the specific species habitat preferences and the availability of those habitat types, diet, and behavior. Predation on all life stages of razorback suckers by non-native fish species is documented in the literature (Pacey and Marsh 1998; USFWS 2002b). Bluegill and channel catfish (USFWS 2002b) are specifically identified. Rainbow trout have also been documented to feed on larval razorback suckers in the wild (Mueller 1993).

Razorback suckers stocked into the Parker Strip are over 300 mm (LCR MSCP 2009a) and are currently stocked at River Island State Park or Buckskin Mountain Park upstream of La Paz County Park, mostly in the winter and early spring but with some fall stockings. Fish move away from the stocking sites and were observed and recaptured in the La Paz County Park backwater (Schooley et al. 2008). It would not be unexpected to find razorback suckers in the available backwaters. All life-stages of razorback suckers are known to heavily use backwaters (Bradford and Gurtin 2000; Mueller 2006; USFWS 2002b). Cover is important, particularly for young fish (Mueller 2006; Albrecht et al. 2008) and may be in the form of rock piles, vegetation, or turbidity.

Exposure of stocked rainbow trout, channel catfish, or bluegill may result in competition for space and resources with the stocked bonytail that are in the backwater when sport fish are stocked and in other portions of the Parker Strip once the block net is removed and stocked fish can exit the backwater.

The stocked razorback suckers are generally over 300 mm, which is within the size range of the catchable (8-12 inches) fish stocked into the backwater. Immediate predation by the stocked fish on razorback suckers is not likely due to similar sizes at stocking; however, any stocked warm water fish that survive and remain in the backwater may be able to prey on subsequently stocked razorback suckers that access the backwater. Stocked channel catfish that leave the backwater once the block net is removed and grow to larger sizes in the river may have exposure to recently stocked razorback suckers.

Razorback suckers take three to four years to sexually mature, with males becoming mature as early as one year of age (Mueller 2006). Generally, razorback suckers stocked at 300 mm are not mature and are unlikely to spawn during their first year. Females stocked at more than 300 mm

and at large for more than a year may reach the size to allow spawning (over 400 mm). Spawning takes place during winter and early spring on the lower Colorado River, generally January through April. Spawning areas in rivers include gravel bars and wash fans, and in backwaters on gravel and cobble substrates. Larval razorback suckers use quiet water areas as nurseries, and the La Paz County Park backwater is one of the few available in the reach. Larval razorback suckers are at risk of predation from non-native fish species and if potential predators are stocked into the backwater during the spawning season, there is opportunity for predation on larval razorback suckers by the stocked fish.

Critical Habitat

This site is within designated critical habitat for the razorback sucker. The presence of robust populations of non-native fish in this critical habitat reach was acknowledged in the designation (USFWS 1993). The stocking of sport fish into the backwater could affect the biological environment constituent element of designated critical habitat. However, the additive effect of the stockings should not substantially change the biological environment that existed at the time of the designation or that is currently present.

Hidden Shores Golf Course Ponds

Site Description

These two small ponds (0.1 acre and 0.2 acre) are located about 100 yards southeast of Imperial Dam on a golf course in an RV park/resort (Figure 7). These ponds are located toward the bottom of the Parker to Yuma sub-watershed. The land is owned by BLM but leased as a recreation area/concession. These ponds were constructed as water hazards on a golf course and are used to store irrigation water that is pumped from the Colorado River for the golf course. The ponds are very shallow and periodically go dry. No connectivity (outflow or overflow) to the Colorado River has ever been known.

Figure 7. Close-up aerial photo of Hidden Shores golf course ponds.

Management of Water Body

In recent years, these ponds have been managed as a short term put-and-take fishery to facilitate one fishing clinic per year. They have typically been stocked once a year in February with rainbow trout (Table 18).

Table 18. Stocking history at Hidden Shores Golf Course Ponds.

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Rainbow trout	2002	2009	8	Approx. 3,000
Total			8	Approx. 3,000

The management objective for this site is to continue to facilitate the fishing clinic that has been conducted over the past few years, and potentially facilitate an additional fishing clinic in the future to meet increasing demand (Figure 8). The site will continue to be managed as a short term, intensive use, put-and-take fishery to facilitate up to two fishing clinics per year. Both cold and warm water species may be used to facilitate these clinics.

Figure 8. Oblique photo of the larger of the Hidden Shores golf course ponds.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass and bluegill sunfish for the period covered by this consultation.

The Department proposes to stock 500 - 2,000 rainbow trout twice annually (for a total maximum of 4,000 fish per year). At least one of the stockings would occur in spring, likely February, and the other could occur anytime during the year. The intent is to stock rainbow trout; however, if that is not feasible due to cost, availability, or water quality constraints (water temperature), catchable channel catfish, catchable largemouth bass and/or catchable bluegill may be stocked instead; numbers would be the same as those proposed for rainbow trout, and would not exceed a total of 4,000 fish per year of any combination.

Water Distribution/Connectivity

These ponds are maintained and filled via a pump. Water from these ponds is then use to irrigate the golf course. The ponds are not known to overflow or have any outflow to the Colorado River. The ponds have also been observed to go dry periodically. Because of this, these ponds are considered to be closed systems.

Fish Movement

Fish cannot move or escape from these ponds because they are closed systems.

Community Description
Rainbow trout are present for a short time after the stocking events/clinics. Bluegill, hybrid sunfish and carp have also periodically been observed in the ponds. However, no fish species are known to persist for any length of time since the ponds go dry periodically and the stocked fish are subject to intense predation by osprey and herons.

Consultation Species and Critical Habitat
Listed species that may occur in the vicinity of these ponds could include; razorback sucker and bonytail chub. Designated critical habitat for the razorback sucker occurs above Imperial Dam.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Please see the Lower Colorado–Yuma Complex analysis, below, for a discussion of Yuma clapper rail.

Bonytail Chub
Bonytail have been stocked into the Imperial Division only into isolated ponds at Imperial National Wildlife Refuge (LCR MSCP 2009a). Bonytail are stocked further upstream in the river and could move down into the vicinity of Imperial Dam. However, due to extremely low survivability of stocked bonytail in the Lower Colorado River (Schooley et al. 2008) there will most likely be a hiatus in stocking bonytail into the lower Colorado River, below Palo Verde Dam. That could further reduce the number of bonytail in this part of the river over the next 10 years. Bonytail have not been documented in the Colorado River below Imperial Dam in recent history. There is no designated critical habitat at this site. The nearest critical habitat for bonytail is above Parker Dam. No potential impacts to bonytail are anticipated because this is a closed system.

Razorback Sucker
Razorback suckers have been stocked into the Imperial Division into isolated ponds at Imperial National Wildlife Refuge (LCR MSCP 2009a) and into the Imperial Division as recently as 2007 (Schooley and Marsh 2008). There were some stockings in the late 1990s for research purposes (Bradford and Gurtin 2000) and there may be some of these fish also remaining in the vicinity.

Razorback suckers are also stocked further upstream in the river and some may move down into the vicinity of Imperial Dam. Due to the extremely low survivability of stocked razorback suckers in the Lower Colorado River (Schooley et al. 2008), there will most likely be a hiatus in stocking razorback suckers below Palo Verde Dam. That could further reduce the number of razorback suckers in this part of the river over the next 10 years. Razorback suckers have not been documented in the Colorado River below Imperial Dam in recent history. There is no designated critical habitat for the razorback sucker below Imperial Dam. No potential impacts to razorback suckers are anticipated because this is a closed system.

Yuma West Wetlands

Site Description

The Yuma West Wetlands pond was constructed in 2003 in an urban park (Figure 9) owned and operated by the City of Yuma. It is approximately 1.3 acres in size and is located at the bottom of the watershed, approximately 1 mile downstream of the Interstate 8 Bridge over the Colorado River. The pond is inside the levees of the Colorado River and could conceivably be connected to the river as a result of an extraordinary flood event. However, the area where the pond is located was not inundated during the 1983 flood, the largest flow event in over 65 years, at which time approximately 42,000 cfs was flowing through this area (R. Phelps, pers. comm.). Subsequent analysis also indicates that it would take approximately a 100-year flood event to threaten inundation of this area (J. Nichol, pers. comm.).

This pond is located in an urban park and receives heavy fishing pressure. Due to its location within the City of Yuma, it provides an excellent opportunity for families to experience an outdoor activity with minimal associated costs. Facilities include parking lots, walking paths, restrooms, ramadas, picnic areas, a boat ramp to the Colorado River, playgrounds and interpretive areas.

Management of Water Body

This is a relatively new pond (less than 6 years old) and it has only been stocked a few times to create a fishery and facilitate fishing clinics/derbies. The demand and fishing pressure at this pond is very high, and current resources do not meet the demand.

Yuma West Wetlands was not stocked by the Department until 2009. Prior stockings were conducted by the City of Yuma and Optimists Club of Yuma, for fishing derbies (Table 19).

Figure 9. Close-up aerial photo of pond at the Yuma West Wetlands Park

Table 19. Yuma West Wetlands stocking history.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	2005	2007	2	50 in 2005 # not specified in 2007
Channel catfish	2004	2009	8	2600
Largemouth bass	2005	2009	2	650*
Rainbow Trout	2009	2010	3	2309
Total			14	1350 +

The water was not stocked by the Arizona Game and Fish Department until 2009.
**number of bass stocked in 2005 not specified; 650 bass were stocked May 2009 by AGFD.*

The management objective for this pond is to manage it as a put-grow-and take warm water fishery and an intensive use put-and-take trout fishery (there is a minimum harvest size length of 13 inches at Yuma West Wetlands for largemouth bass; however largemouth bass are considered catchable at 8 inches). The warm water fishery would consist of bluegill, largemouth bass, and channel catfish. A cold water sport fishery for rainbow trout is typically maintained

seasonally, from November to March each year. The proposed stockings will also be used to facilitate fishing clinics/derbies.

Proposed Action

The Department proposes to stock rainbow trout, largemouth bass, channel catfish and bluegill sunfish for the period covered by this consultation.

The Department proposes to stock catchable largemouth bass, channel catfish, bluegill sunfish, and rainbow trout up to 8 times a year with up to 2,000 fish per stocking (for a maximum of 16,000 fish per year) in any combination of those species..

Water Distribution/Connectivity

Water to maintain this pond is pumped out of the Yuma Main irrigation canal which is supplied with Colorado River water. The water level is closely managed and varies very little. There is no overflow or outlet from this pond to the river. Since it would take approximately a 100-year flood event to threaten inundation or to connect this pond with the Colorado River, it is considered a closed system.

Fish Movement

Fish cannot move or escape from this pond because it is a closed system with no possibility for fish escape

Community Description

The only fish known to occur in the pond are those that have been stocked; largemouth bass, bluegill, channel catfish and rainbow trout.

Consultation Species and Critical Habitat

No listed fish species are known occur in the pond or this stretch of the Colorado River. Flycatchers and cuckoos potentially migrate through this area and clapper rails are found in various locations along the lower Colorado River.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Please see the Lower Colorado–Yuma Complex analysis, for a discussion of Yuma clapper rail.

Figure 10. Oblique photo of the pond at Yuma West Wetlands Park.

Bonytail Chub

Bonytail have been stocked into the Imperial Division only into isolated ponds at Imperial National Wildlife Refuge (LCR MSCP 2009a). Bonytail are stocked further upstream in the river and could move down into the vicinity of Imperial Dam. However, due to extremely low survivability of stocked bonytail in the Lower Colorado River (Schooley et al. 2008) there will most likely be a hiatus in stocking bonytail into the lower Colorado River, below Palo Verde Dam. That could further reduce the number of bonytail in the Imperial Division (above Imperial Dam) over the next 10 years. Bonytail chubs have not been documented in the Colorado River below Imperial Dam in recent history.

There is no critical habitat at this site. The nearest critical habitat for bonytail is above Parker Dam. No potential impacts to bonytail are anticipated because this is a closed system.

Razorback Sucker

Razorback suckers have been stocked into the Imperial Division of the Colorado River and into isolated ponds at Imperial National Wildlife Refuge in recent years (Schooley and Marsh 2008; LCR MSCP 2009a). Razorback suckers were also stocked in the Imperial Division for research purposes in the late 1990s (Bradford and Gurtin 2000). In addition to these more localized stockings, razorback suckers are also stocked further upstream in the Colorado River and could

move down into the vicinity of Imperial Dam. However, due to the extremely low survivability of stocked razorback suckers in the Lower Colorado River (Schooley et al. 2008) there will most likely be a hiatus in stocking razorback suckers below Palo Verde Dam. That would reduce the potential number of razorback suckers in the Colorado River between Imperial Dam and Palo Verde Dam over the next 10 years. Razorback suckers have not been documented below Imperial Dam in recent history, despite regular fish surveys.

There is no critical habitat at this site. The nearest critical habitat for razorback suckers is above Imperial Dam. No potential impacts to razorback suckers are anticipated because this is a closed system.

LOWER COLORADO-YUMA COMPLEX ANALYSIS

The three sites proposed for stocking within this complex were previously described, and include La Paz County pond and backwater, Hidden Shores, and Yuma West Wetland. Potential impacts to bird species at the complex level for them are discussed below. Hidden Shores, Yuma West Wetland and La Paz County pond are closed systems with no opportunity to affect razorback sucker and bonytail chub; La Paz County backwater has potential for overlap with consultation fish species, and impacts from those were discussed at the site level. There is no additional discussion for them at the complex level because of the limited potential dispersal of stocked fish beyond the Parker reach of the Colorado River. Impacts to Yuma clapper rail are discussed below.

Consultation Species or Critical Habitat

Yuma Clapper Rail

The nearest documented occurrence from La Paz County Park for the Yuma clapper rail was documented over 5 miles from the Park/Lagoon along the Colorado River.

The nearest documented occurrence from Hidden Shores Golf Course for the Yuma clapper rail was documented in 2000 along the Colorado River approximately over 1 mile from the pond.

Yuma clapper rail is found several miles along the Colorado River from Yuma West Wetlands Ponds.

There is no suitable habitat at any of the proposed sites or adjacent to the sites on the Colorado River.

Potential Impacts

There are no potential impacts to Yuma clapper rails from stocking or subsequent angler use of these areas. There is no exposure to Yuma clapper rails since they are not present at or adjacent to the pond.

Chapter 6 Little Colorado River Watershed

This chapter is broken up into three separate documents due to file size. The Upper Little Colorado River Sub-Watershed, The Middle Little Colorado River Sub-Watershed and the Lower Little Colorado River Sub-Watershed.

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Chapter 6 LITTLE COLORADO RIVER WATERSHED

Physical geographic description

The Little Colorado River is the major drainage within the basin and has perennial flows only in areas near the headwaters and below Silver Creek. There are approximately 1,300 springs within the basin (USGS 2006a).

Elevation increases from north to south with the highest point at San Francisco Peaks north of Flagstaff on Humphreys Peak. The White Mountains along the SE boundary of the basin rise to over 11,000 feet at Mt. Baldy. The lowest point is at 1300 feet, as the LCR exits the basin.

A number of named and unnamed tributaries contribute to the LCR, including larger perennial sources: Nurioso Creek, LCR West Fork, LCR East Fork, LCR South Fork, Silver Creek, Chevelon Creek and Clear Creek.

UPPER LITTLE COLORADO RIVER SUB-WATERSHED

LITTLE COLORADO RIVER ABOVE LYMAN COMPLEX

The Little Colorado River above Lyman Lake Complex is made up of 6 stocking sites. Additionally, it is a continuation of the discussion and analysis of the potential effects of the West Fork Little Colorado River Complex proposed stocking actions because those eight sites all drain into the Little Colorado River (LCR) above Lyman Lake (Figure 1). Effects of potential stocking actions to aquatic species located downstream of Lyman Lake would be discussed later in this chapter, as additional complexes and watersheds that contribute to the LCR below Lyman Lake are added to the discussion.

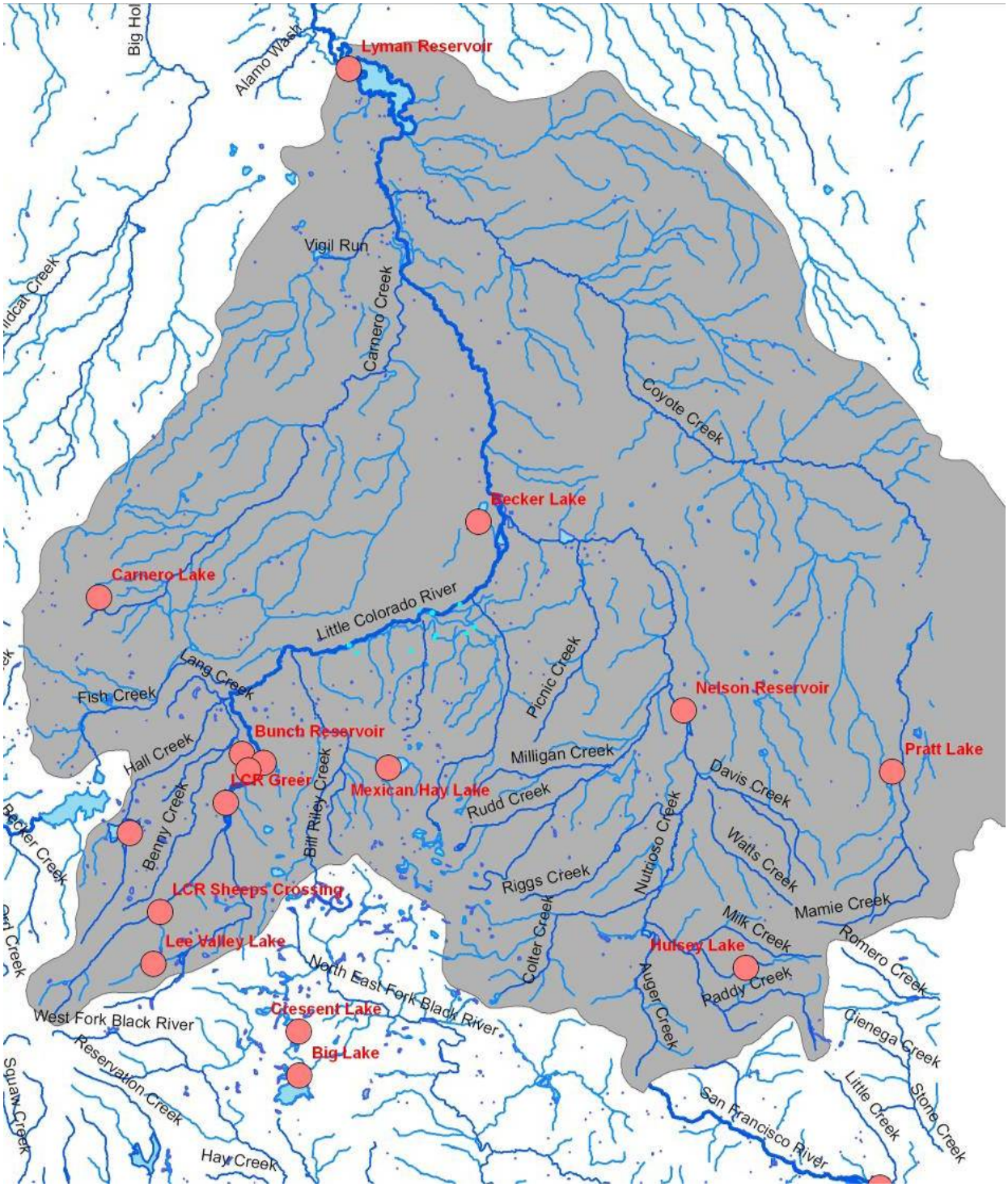


Figure 1. Overview map of the Little Colorado River headwaters watershed above Lyman Lake.

Pratt Lake

Site Description

Pratt Lake is a natural lake, 12 acres in size, located northeast of the town of Nutrioso. Pratt Lake is considered a closed system with no outlet, and exists in a natural sinkhole about ¼ mile west of Coyote Creek. The portion of Coyote Creek closest to Pratt Lake goes dry regularly (M. Lopez pers. obs.). Pratt Lake is geographically close to Hulsey Lake and Nelson Reservoir, but has no hydrologic connection to these waters. The closest drainage, Coyote Creek, drains into the LCR just upstream of Lyman Lake, the lowest stocked water in this complex. Pratt Lake is located within the Apache Sitgreaves National Forest.

There is no outlet on this natural sinkhole and no mechanism to control water levels or to deliver water to anyone downstream; the lake also never spills. The lake catches just enough precipitation to offset evaporation. Pratt Lake is often not suitable to support trout and is stocked opportunistically when conditions and water levels are optimal.

Management of Water Body

Pratt Lake is managed as a primitive put-grow-and-take coldwater fishery. This fishery is not well promoted because of the difficult access via a rough primitive dirt road, and infrequent stocking. Anglers can access Pratt Lake typically May through October, with the winter months presenting extremely difficult road conditions. There are no direction signs, designated parking, boat ramps, or other facilities at Pratt Lake.

Pratt Lake's level is too low and too weedy during years of low winter precipitation to stock trout. However, the proposed action is worded to give us the ability to stock every year if the conditions allow. The lake was stocked nearly every year during the wet cycle in the 1980s and early 1990s when conditions were suitable (Table 1). The proposed action would allow the flexibility of a similar management approach if the precipitation and lake conditions allow within the period covered by this consultation.

Table 1. Stocking history in Pratt Lake

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1983	1995	11	47,101
Rainbow trout	1979	2009	11	48,819
Total			22	95,920

The Integrated Fisheries Management Plan for the LCR Watershed identifies a management emphasis at Pratt Lake as basic yield, put-grow-and-take sport fish with a desired species assemblage of rainbow trout and brown trout. However, we are proposing to stock only rainbow trout in the period covered by this consultation.

There have been no creel surveys conducted on site at Pratt Lake; however, a mail-out survey reported 254 AUDs in 2001 (Pringle 2004). This is likely a low estimate of the use that could

occur at Pratt Lake, as this survey occurred during a period when the lake conditions were often unsuitable and when it was only sporadically stocked.

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Sub-catchable and/or catchable rainbow trout may be stocked multiple times from April through June annually, if conditions are suitable; numbers of trout may be from 0 to 10,000 sub-catchables and/or 0 to 2,000 catchables annually.

Water Distribution / Connectivity
There is no outlet on this natural sinkhole and no mechanism to control water levels or to deliver water to anyone downstream. The lake has never been known to spill. It is considered a closed system and the lake catches just enough precipitation to offset evaporation. There is no hydrologic connection to Coyote Creek or the LCR, thus nowhere for stocked trout to escape to. Pratt Lake is included in this complex because of its proximity to Hulsey Lake and Nelson Reservoir, but has no hydrologic connection to these or any other waters.

The closest drainage, Coyote Creek, drains into the LCR just upstream of Lyman Lake, the lowest stocked water in this complex. The portion of Coyote Creek closest to Pratt Lake goes dry regularly.

An artificial fish barrier on Coyote Creek is located approximately 2/3 mile upstream of the area closest to the tank, with a recovery population of Apache trout located upstream of the fish barrier in the only perennial water in Coyote Creek. Approximately 38.7 miles of Coyote Creek from the Pratt Lake area downstream to the LCR is normally dry and fishless, flowing only in response to a heavy snowmelt runoff (Novy and Lopez 1991a). But there is no hydrologic connection to Coyote Creek or the LCR, making the lake a closed system.

Fish Movement
There is no inlet or outlet from Pratt Lake. The lake exists in a natural sinkhole and catches just enough precipitation to offset evaporation in good precipitation years. There is no hydrologic connection to Coyote Creek or the LCR, thus nowhere for stocked trout to escape to.

Community Description
Pratt Lake contains rainbow trout when stocked, fathead minnow, and likely tiger salamander. There is no information supporting the presence of tiger salamander in Pratt Lake other than nearly all permanent stock tanks and small lakes at this elevation in pinion-juniper habitat contain tiger salamander larvae at one time or another. Stocked trout may persist in the lake if water levels are suitable, but there is no evidence that they reproduce within the lake. Table 2 provides a summary of surveys of Pratt Lake. Fathead minnows are established and reproduce naturally, although they are not reflected in any survey data (M. Lopez pers. comm.).

Table 2. Survey history for Pratt Lake

Date	Survey Type	Species	Num. Collected	Size Range
May 1987	Experimental gillnet	Brown trout	24	210-406
April 1985	Angling	Rainbow trout	6	297-439
April 2009	Experimental gillnet	No fish	0	-

Coyote Creek in the vicinity of the lake and downstream to the LCR is fishless, because it regularly goes dry. No surveys have been conducted in these reaches of Coyote Creek to document the dry conditions or absence of fish, because that part of the drainage is known to be dry and fisheries surveys are conducted in areas that support at least perennial pools.

A recovery population of Apache trout is located in the only permanent water in upper Coyote Creek, but are isolated by a constructed fish barrier located about 2/3 mile upstream of the Pratt Lake area. This area was surveyed in 1990, 1995, and 2001 through 2003 (Table *3*).

Table 3. Results of Coyote Creek fish surveys.

Year	Species	Num. Collected	Average size (mm TL)	Average weight (g)	Size Range
1990	Apache trout	110	109	17	71-241
1995	Apache trout	47	107	21	30-221
2001	Apache trout	5	178	63	160-195
2002	Apache trout	20	145	44	82-240
2003	Apache trout	1	145	37	145-145

Data from 1990 (Novy and Lopez 1991a; 38 sites), 1995, 2001,2002, and 2003 (T. Robinson pers.comm. using 3 pass depletion sampling on 50-meter stations with a backpack electroshocker).

The tank is within the historic range for both Chiricahua and Northern leopard frogs; however, the closest occurrences of these species, at or near Nelson Reservoir/Nutrioso Creek are old records and over 6.5 miles away over land.

The closest known current populations of Chiricahua leopard frogs are 15.5 miles away at Sierra Blanca Lake, 18.2 miles away at Three Forks, 20.2 miles away at lower Coleman Creek, and 21.5 miles away at Concho Bill Springs. The closest know population of Northern leopard frogs is 29.6 miles away at the LCR below Lyman Lake dam (Dan Groebner, per. comm.).

Consultation Species or Critical Habitat

No listed aquatic species have been documented in or near Pratt Lake. The closest listed aquatic species is the Apache trout within Coyote Creek, but there is no hydrologic connection and no way for stocked rainbow trout to escape into Coyote Creek naturally and no way for Apache

trout to disperse into Pratt Lake. Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur (Figure 2).

Chiricahua leopard frog

Local Analysis: Although Pratt Lake and the LCR above Lyman buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Pratt Lake is low because there are no historical records for Chiricahua leopard frogs at Pratt Lake and it is a closed system. The likelihood of frogs being exposed to fish stocked in other sites within the LCR above Lyman buffered stocking complex is also low. There are historical records for Chiricahua leopard frogs from 3 sites in the buffered complex; Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). In addition, Chiricahua leopard frogs were released at Trinity Reservoir in 1996 by the Department as part of ongoing recovery activities (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Chiricahua leopard frogs were not observed during subsequent surveys at Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was adequately surveyed for frogs after the 1996 release and no frogs were observed after the 1997 field season (D. Groebner and Sredl pers.comm.). In addition, the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish make the habitat less suitable for leopard frogs.Therefore, it is likely that Chiricahua leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from stocking sites in the LCR above Lyman buffered stocking complex is low. The northernmost part of the LCR above Lyman buffered stocking complex is just outside of the range of the Chiricahua leopard frog, therefore further downstream in the LCR is outside of the range of the Chiricahua leopard frog. There are records for Chiricahua leopard frogs just south of the LCR above Lyman buffered stocking complex, but these sites are in different watersheds and it is not feasible for stocked fish in the LCR above Lyman buffered stocking complex to reach these areas and the likelihood of frogs traveling the overland distance to the headwater of the tributaries to the LCR is low. These Chiricahua leopard frog sites will be assessed in different complex documents.

Northern Leopard Frog

Local Analysis: Although Pratt Lake and the LCR above Lyman are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to fish stocked in Pratt Lake is low because there are no historical records for northern leopard frogs at Pratt Lake and it is a closed system. However, the likelihood of frogs being exposed to fish stocked in other sites within the LCR above Lyman buffered stocking complex is high. There are records from 2007-2009 just downstream of Lyman Lake, which is within the LCR above Lyman buffered stocking complex (Drost, pers. comm.). There are historical records for northern leopard frogs from 9 sites within the buffered stocking complex; Benny Creek (1979), Iris Spring (1979), LCR (Foot of Lyman Dam) (1935), LCR (Johnson Ranch) (1938), LCR (4.35 MI W of Eager) (1979), Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), Sheep Springs (1942), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974, 1979). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2,AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (1992 and 1995), Iris Spring (1992, 1995, and 1997), LCR (Foot of Lyman Dam) (1997), LCR (Johnson Ranch) (1997), Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), Sheep Springs (1995), or Unnamed Creek (1 mi. S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed and it is likely that northern leopard frogs no longer occupy the sites mentioned above, the recent observations by Charles Drost show that northern leopard frogs currently occupy the area below Lyman Lake dam (Drost, pers. comm.). In addition, this is the last known extant population of northern leopard frogs in the upper LCR drainage and it is thought to be declining (Drost, pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the LCR above Lyman buffered stocking complex is low. There are records from 2007-2009 for northern leopard frogs just below Lyman Lake within the LCR above Lyman buffered stocking complex and the likelihood that these frogs would be exposed to stocked fish in the buffered stocking complex is high (Drost, pers. comm.). However, there is only 1 other record downstream in the LCR at Salado Springs for northern leopard frogs (1939), but frogs were not observed at this site in 1997 and it is likely that northern leopard frogs no longer occupy this area or further downstream in the LCR or its tributaries (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.).

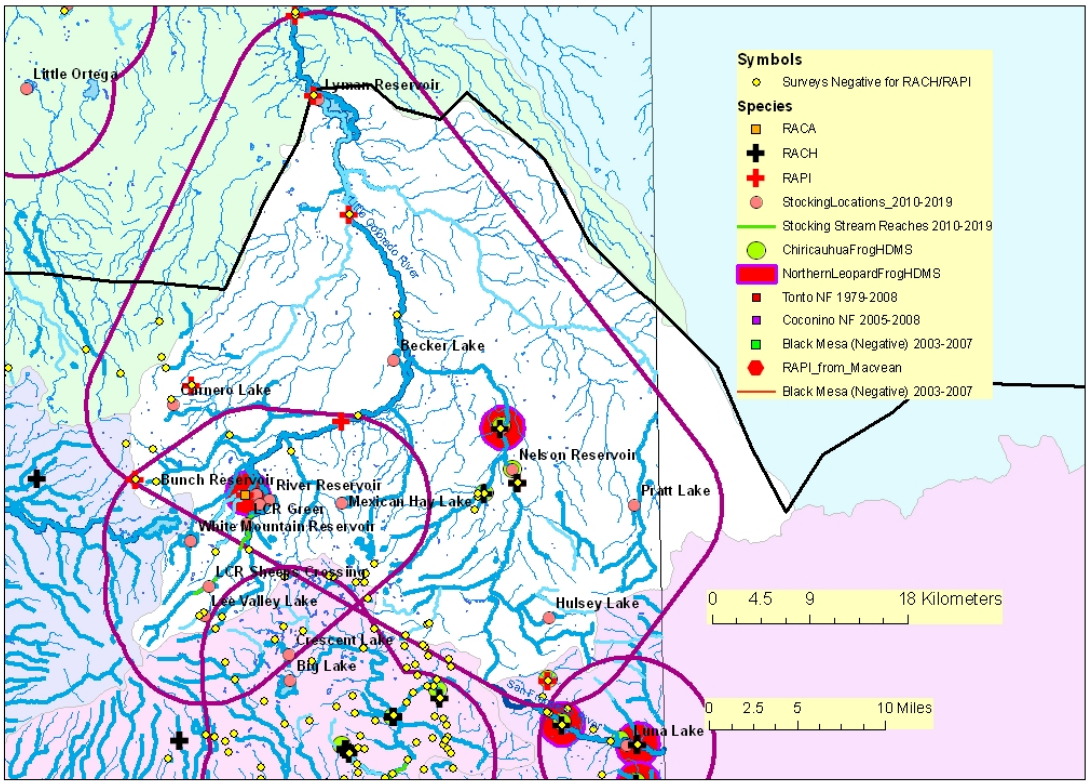


Figure 2. Map of LCR above Lyman buffered stocking complex for leopard frog analysis:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Hulsey Lake

Site Description

Hulsey Lake is a 5-acre lake impounding Hulsey Creek at 8580 feet elevation. It is located on the Apache Sitgreaves National Forest approximately 7 miles south of Alpine. The dam was originally constructed in 1887 and rebuilt in 1975. Hulsey Lake is a shallow reservoir with a maximum depth of about 12 feet. The lake is fed by a relatively small watershed, less than two square miles, but the lake fills and spills every year during snowmelt runoff in the spring. The lake only spills in the spring; however, it does not experience dramatic lake level fluctuations because no irrigation releases occur at this lake.

Hulsey Lake is accessed by an all weather road, Forest Road 56. The only facilities at the lake are a parking area at the top of the hill with a restroom. A short hike down the hill is required to get to the lakeshore. No boat ramps or fishing piers are present. The lake is normally accessible from March through November. The lake ices over in the winter, but does not receive much ice fishing use because of very low numbers of trout during the winter.

Hulsey Lake is very weedy, with strong summer blue-green algae blooms, and experiences occasional summer kills and frequent winter kills. Hulsey Lake likely winter kills much more often than is documented in the table below; however, the lake is not often surveyed to verify this assumption. Jim Novy, Fish Program Manager for this region from 1977 through 2001, stated that the lake winter killed often, therefore was not surveyed regularly. Plus, the early survey history at Hulsey Lake, discussed below, shows few or no fish present during spring surveys in 1978-1983, and again recently in 2009. The water quality at Hulsey Lake deteriorates usually by mid to late June with rapid growth of aquatic macrophytes and algae blooms, limiting the stocking season to mid-April through early June. Table 6 lists the history of known fish kills at Hulsey Lake.

Management of Water Body

Hulsey Lake is managed as an intensive use put-and-take coldwater fishery. It is stocked with catchable rainbow trout multiple times from April through early June of each year. The lake supports good catch rates in May and June when stocked, and decreasing in July, poor catch rates from August through early April. Creel surveys in 1998 showed catch rates of 1.43 and 1.04 fish per hour in May and June, respectively, 0.35 fish per hour in July, 0.0 to 0.15 fish per hour from August through April (Table 4). Despite the poor catch rates from late summer through winter, angler use remains fairly high for this small lake through October. The data suggest that a high percentage of the trout stocked are harvested in the spring and early summer, and the remaining trout succumb to winter kills and occasional summer kills. Creel surveys were conducted with limited opportunity for high-confidence intervals in the results. During creel surveys the trout which were creeled were measured, and there were no trout of larger sizes that would have indicated winter carryover (M. Lopez pers. comm.). To get better confidence and power in the

data and more accurate harvest estimates, creel surveys would have had to be implemented more than the 2 survey days per week.

Table 4. History of angler creel surveys at Hulsey Lake and return to creel of stocked trout.

Year	Sample period	Total anglers	Estimated harvest	Trout stocked	Percent harvested
1981	May-Nov	2434	2381	2000	119%
1998	Apr-Dec	11,192	9033	8100	112%

Table 5 shows the fishing success and harvest in 1998 by month, illustrating high catch rates in May and June, moderate in July, and poor for the rest of the year, even in the fall, showing that most of the trout are caught out by the end of July.

Table 5. Angler creel summary in 1998 for Hulsey Lake.

Month	Catch/hr	Harvest/hr	Total anglers	Total Harvest
APR	0	0	115	0
MAY	1.43	0.59	1321	1390
JUN	1.04	0.64	5098	5879
JUL	0.35	0.31	2354	1707
AUG	0.02	0	923	0
SEP	0.12	0.12	480	31
OCT	0.15	0.05	783	24
NOV	0	0	115	0
DEC	0	0	0	0
TOTAL	0.84	0.48	11,192	9033

Table 6. Documented fish kills in Hulsey Lake.

Date	Comments	Num. dead fish observed
6/8/1977	Summer kill related to weed growth and high pH	30
4/1983	Winter kill documented	
8/5/1983	Summer kill related to algae bloom die-off	50
9/4-8/1986	Summer kill related to algae bloom die-off, low oxygen	300-350
6/21-23/1992	Summer kill related to algae bloom and high pH	250
4/2/1993	Winter kill documented, oxygen measured at 1 ppm	6
8/4/1995	Summer kill	178
8/12/2003	Summer kill related to algae bloom die-off and low oxygen	270

Date	Comments	Num. dead fish observed
5/24-28/2008	Summer kill related to low oxygen levels	276

Early netting surveys conducted prior to stocking show little or no trout remained in the lake in early spring prior to stocking, likely from being caught out the prior fishing season, or because of fish kills (Table 7). Because of this survey history, it is assumed few trout carryover from the prior year.

Table 7. Fish Survey Netting History for Hulsey Lake.

Year	Sample period	Survey gear	Num. of fish caught	Size (mm TL)
1978	March	Trap net (1)	1 rainbow trout	320
1981	April	Trap net (4)	0	-
1983	April	Exp. Gillnet (1)	0	-
2009	April	Exp. Gillnet (2)	0	-

Based on the angler use (return to creel documented as at or near 100% in 91-98 surveys) and harvest, plus the winter kill loss and occasional summer kill loss, very few stocked trout are left in the lake when it spills in the spring during snowmelt runoff. Because there is no maintained road to the lakeshore, the lake is not accessible to stock until the hillside between the parking lot and the lake has dried out enough to support a full hatchery truck. By this time, the spill is reduced to a matter of a few inches, making it extremely difficult for a catchable size trout to escape over the spillway. There is a short stocking window in the early summer, after the hillside dries out and before the pH gets very high in the lake, and it is usually not possible to restock until the following spring/early summer because of lingering high pH levels through the fall.

The Integrated Fisheries Management Plan for the LCR (LCR) Watershed (Young et al. 2001) identifies the management emphasis for Hulsey Lake as intensive use sport fish, with a desired fish assemblage of rainbow trout. Hulsey Lake has been historically stocked mainly with rainbow trout from 1960-present, and with infrequent stockings of brown trout in 1978-1992, and brook trout in 1981-1985 (Table 8).

Table 8. Stocking History in Hulsey Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1981	1985	4	5,800
Brown trout	1978	1992	11	12,080
Rainbow trout	1960	2009	138	219,060
Total			153	236,940

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked from April through July annually; numbers of trout stocked may be from 0 to 10,000 fish annually.

Water Distribution / Connectivity
Hulsey Creek drains the southwestern edge of Escudilla Mountain and flows into Hulsey Lake. Hulsey Creek has a poor survey history, with the only survey on record being upstream of the lake. This portion of Hulsey Creek was extremely low flow when surveyed, and no fish were found; it often dries entirely during low precipitation years.

Hulsey Lake fills and spills every year during snowmelt runoff in the spring, but does not spill most of the year. When it does spill, it flows down lower Hulsey Creek for 2.1 miles into Milk Creek, then down Milk Creek for 0.3 miles to the confluence with Nutrioso Creek just upstream of the Town of Nutrioso. Lower Hulsey Creek is intermittent and only flows during snowmelt runoff when the lake is spilling. Lower Hulsey Creek has a steep gradient with dense woody debris from numerous blow-downs in the thick mixed conifer forest. Milk Creek appears to have a low but permanent flow, and is fishless as determined by Department surveys in 1976, 1995, and 1996 (Table 9).

From the confluence of Milk Creek, Nutrioso Creek flows downstream through the Town of Nutrioso for 11.1 miles to Nelson Reservoir. This flow is perennial going into the Town of Nutrioso; however, numerous water diversions exist through the town and the creek does not always flow continuously into Nelson Reservoir during the summer irrigation season, with occasional drying into isolated pools.

There are two other major tributaries entering Nutrioso Creek between the confluence with Milk Creek and Nelson Reservoir. Auger Creek and Colter Creek enter at 1.9 miles and 3.5 miles, respectively, downstream of the Milk Creek confluence. Both of these tributaries have permanent flow; however, a number of water diversions often keep this permanent flow from reaching Nutrioso Creek during the summer irrigation season.

The reach of upper Nutrioso Creek upstream of the confluence of Milk Creek also flows perennially. A perennial tributary, Paddy Creek, also enters this reach of Nutrioso Creek.

Hulsey Lake, Hulsey Creek, Milk Creek, upper Nutrioso Creek, Auger Creek, Colter Creek, and Nelson Reservoir are all connected during snowmelt runoff during the spring. However, at base flows, Hulsey Lake does not spill, Hulsey Creek is dry and permanent flow in Nutrioso Creek, Auger Creek, and Colter Creek often are not connected with each other or to Nelson Reservoir because of numerous water diversions around the Town of Nutrioso. The diverted water is used

to irrigate fields throughout the old floodplain from the Town of Nutrioso down to the Forest boundary just above Nelson Reservoir. Nutrioso Creek is incised/downcut from the lower end of Nutrioso almost down to Nelson Reservoir, up to 10 feet below the old floodplain in some places.

Fish Movement

During base flow times at Hulsey Lake, fish would not have the opportunity to move in or out of the lake and Hulsey Creek is dry with no connection. When it spills, because there is no maintained road to the lakeshore, the lake is not accessible to stock until the hillside between the parking lot and the lake has dried out enough to support a full hatchery truck. By this time, the spill is reduced to a matter of a few inches, making it extremely difficult if not impossible for a catchable size trout to escape over the spillway. In addition, the spill occurs only in spring for a short duration and often at a minimal depth of ½ inch or less entering into the Milk Creek (for 2.4 miles, then into Nutrioso Creek). The stream above the lake flows more frequently than that below, but dries in the mid summer months and does not support fish. Further, Lower Hulsey Creek has a steep gradient with dense woody debris from numerous blow-downs in the thick mixed conifer forest. Milk Creek appears to have a low but permanent flow, and remains fishless.

A stocked trout could escape downstream of the reservoir, but would have to survive frequent winter kills, a steep gradient, dense woody debris and encounter a spring spill that was large enough to allow a full size trout to pass over the spillway. During the spring spill, Hulsey Creek is running continuously into Milk Creek, and then into Nutrioso Creek. Once in Nutrioso Creek, an escaped trout could move upstream into perennial trout habitat, or downstream towards the Town of Nutrioso, and potentially downstream towards Nelson Reservoir. The potential to move out of the reservoir exists, but is likely rare.

Community Description

Hulsey Lake contains rainbow trout when stocked, fathead minnow, and crayfish, and experiences occasional summer fish kills and frequent winter kills (see Table 6 and Table 7). Upper Hulsey Creek above the lake is fishless, based on a survey conducted by the Department throughout 1.86 miles of stream in June 1998. The 2.1 miles of Hulsey Creek below the lake is considered fishless because of its intermittent nature and inability to support a fish population long-term. No formal fisheries surveys have been conducted because Hulsey Creek goes dry.

Table 9. Summary of Milk Creek Fish Surveys.

Date Surveyed	Effort	Num. of fish collected
September 1976	Electrofishing - Four 100-meter stations	0
July 1995	Electrofishing - Ten 50-meter stations, 3 pass depletion	0

Date Surveyed	Effort	Num. of fish collected
November 1996	Visual - Entire stream	0

Nutrioso Creek at the confluence of Milk Creek contains wild rainbow trout hybrids and some speckled dace (Marsh and Young 1988). Spinedace were found a short distance downstream around the town of Nutrioso in 1988 (Marsh and Young 1988), but mixed in with wild rainbow trout in that same area around the Town of Nutrioso. Marsh and Young (1988) identified these trout as hybrid rainbow X Arizona (Apache) trout, indicating wild trout populations in upper Nutrioso Creek. Extensive surveys in 1994 also found numbers of wild hybrid trout in the upper reaches of Nutrioso Creek (Lopez et al. 2001). These wild trout are not found downstream of Auger Creek, as the habitat downstream of Nutrioso is predominately low gradient, exposed, and of fine sediment, suitable for spinedace, speckled dace, and suckers. The habitat upstream of Nutrioso is primarily high gradient, shaded, and of gravel/cobble substrates, suitable primarily for trout. Recent surveys in May 2009 again confirmed the presence of wild rainbow X Apache trout hybrids in Nutrioso Creek between the confluences of Milk Creek and Paddy Creek. A total of 68 trout were collected in 200 meters of stream, ranging in size from 69 mm to 220 mm total length (TL). These results were similar to the 1994 surveys when 90 rainbow hybrids were collected in six 50-meter stations, ranging in size from 37 mm to 215 mm TL (Lopez et al. 2001). One brook trout was also found in this headwater reach of Nutrioso Creek in the 1994 surveys, but is considered to be an escapee from either Hulsey Lake or Nelson Reservoir, because of the size of the fish (230 mm) and the fact that no other brook trout has been documented in the headwaters of Nutrioso Creek, upstream of the Town of Nutrioso, so it is unlikely there is a wild population. This brook trout was most likely an escapee from Nelson Reservoir and not Hulsey Lake, since brook trout were being stocked regularly in Nelson through 1994. The last brook trout stocked into Hulsey Lake was in 1985 and would have died of old age prior to this record, assuming it could have persisted through the high angler use and harvest, winter kill, and occasional summer kill in Hulsey Lake.

A wild population of trout is also present in Paddy Creek, a tributary to Nutrioso Creek just upstream of Hulsey Creek, and was thought to be native trout hybrids. Loudenslauger et al. (1986) reported the trout in Paddy Creek to be Apache and rainbow hybrids, but no pure Apache trout. However, Dowling and Childs (1992) reported Paddy Creek to be primarily of cutthroat trout origin. Regardless, pure Apache trout have not been documented to remain in the Nutrioso Creek drainage, but presence of hybrids indicates that they used to inhabit the creek. Intensive electrofishing surveys (3 pass depletion) of twelve 50-meter stations in Paddy Creek in August 1994 found 353 hybrid Apache-rainbow trout, ranging in size from 35 mm to 278 mm TL.

Auger Creek is perennial but fishless, determined by electrofishing surveys (3 pass depletion of 5 survey sites) of the stream in August 1994.

Colter Creek is perennial and supports a wild population of rainbow hybrid trout; likely Apache-rainbow hybrids, but genetic analyses on these fish have not been done. Intensive electrofishing surveys (3 pass depletion) in 1994 found 273 trout throughout thirty-nine 50-meter stations, ranging in size from 36 mm to 235 mm TL. Twenty-six speckled dace were also found in the lower reach of Colter Creek.

Spinedace have been documented from the town of Nutrioso downstream to just above Nelson Reservoir (Lopez et al. 2001; Sweetser et al. 2002), along with native speckled dace and bluehead sucker (Table 10). Little Colorado sucker are not present in Nutrioso Creek. Several Little Colorado suckers reported by Marsh and Young in 1988 may have been misidentifications. Over 6000 suckers have been surveyed in the Nutrioso Creek drainage since 1988 and all of them have been identified as bluehead suckers. Fathead minnow and crayfish are abundant in this reach of Nutrioso Creek, and green sunfish are occasionally collected. The 1997-2000 surveys were conducted in the spring and fall with a backpack electroshock with results detailed in the 2001 Nutrioso Creek Fish Management Report, AGFD Technical Report 01-01 (Lopez et al, 2001). The 2005 survey was conducted in May with a backpack electroshocker, with results detailed in a trip report (McKell 2005e). The 2006 surveys were conducted in April-June with a backpack electroshocker and 1/8” mesh seines, with results described in two trip reports (Carter et al 2006a, 2006b). The 2007and 2008 surveys were conducted in July of each year with 1/8” mesh seines, with results described in the 2007 Nutrioso Survey Report (Weiss 2007c) and 2008 Nutrioso and Rudd Creeks Survey Report (Weiss and Lopez 2008). The 2009 survey was conducted in May-June with a backpack electroshocker and 1/8” mesh seines (Mike Lopez, per. comm.).

Table 10. Fish survey summary from 1996-present for Nutrioso Creek from Nelson Reservoir upstream to the town of Nutrioso.

Species	**Native fish**			**Non native fish**			**Total**
	Spinedace	Bluehead sucker	Speckled dace	Rainbow trout	Fathead minnows	Green sunfish	
Spring 1997	146	411	69	0	86	0	712
Fall 1997	59	229	14	0	139	0	441
Spring 1998	3	20	10	0	22	0	55
Spring 1999	4	38	11	0	144	0	197
Fall 1999	50	36	40	0	273	0	399
Spring 2000	147	358	74	5	2390	3	2,977
2005	7	7	48	0	145	0	207

Species	**Native fish**			**Non native fish**			**Total**
	Spinedace	Bluehead sucker	Speckled dace	Rainbow trout	Fathead minnows	Green sunfish	
2006	895	109	234	0	1,374+	0	2,612+
2007	60	4	39	0	1090	0	1,193
2008	57	38	46	0	432	2	575
2009	19	0	15	0	766	2	802

Trout likely do not persist within Nutrioso Creek between the Auger Creek confluence and Nelson Reservoir, as only six have been captured in the numerous surveys; five in 2000 and one in 1993. The six trout were of hatchery origin. Five rainbow trout were collected in one pool approximately 0.25 mile upstream of Nelson Reservoir in 2000 and all had tetracycline marks (Sweetser et al. 2002) as required in the consultation recommendations for Nelson Reservoir. The grouping in one pool in close proximity to Nelson Reservoir also suggests they were from stocked fish in Nelson and not from Hulsey Lake. One brook trout was captured in Nutrioso Creek at the gauging station in 1993, not far upstream of Nelson Reservoir. This brook trout was likely an escapee from Nelson Reservoir, as was the 1 brook trout documented in the headwaters mentioned earlier, since there are no wild populations of brook trout documented upstream of Nelson Reservoir and brook trout were stocked into Nelson Reservoir almost every year from 1980 through 1994. Hulsey Lake was last stocked in 1985.

Little Colorado spinedace and bluehead sucker may be as close as 1 mile downstream in Nutrioso Creek from the confluence with Milk Creek, as reported by Marsh and Young in 1988. This area has not been surveyed since 1988. Little Colorado spinedace still occur within the first several miles upstream of Nelson Reservoir (Lopez et al. 2001; Sweetser et al. 2002) and were recently confirmed in surveys conducted in 2009.

There is no evidence that stocked rainbow trout reproduce in Hulsey Lake, nor in Hulsey Creek. The headwaters of Nutrioso Creek upstream of the Town of Nutrioso are suitable trout habitat, and survey data indicate that trout are reproducing there. Survey data also indicate that wild trout populations are also reproducing in Paddy Creek and Colter Creek. Apache trout were historically native to these streams; however they likely hybridized with non native rainbow and cutthroat trout stocked into Paddy Creek during 1933-1947 and into Colter Creek during 1933-1948. Hybridization may have also occurred with any stocked trout that escaped Hulsey Lake and/or Nelson Reservoir.

No trout likely reproduce in Nutrioso Creek between the Town of Nutrioso and Nelson Reservoir. This reach of stream is low gradient, dominated by fine substrates of sand/silt, and

gets fairly warm early in the spawning season. Trout also do not reproduce in Nelson Reservoir (M. Lopez pers. comm.).

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Little Colorado Spinedace occupy Nutrioso Creek and Mexican spotted owl critical habitat is discussed below.

Chiricahua Leopard Frog
Local Analysis: Although Hulsey Lake and the LCR above Lyman buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Pratt Lake is low because there are no historical records for Chiricahua leopard frogs at Hulsey Lake and if fish were able to disperse from the lake, it is not likely that they would persist. The likelihood of frogs being exposed to fish stocked in other sites within the LCR above Lyman buffered stocking complex is also low. There are historical records for Chiricahua leopard frogs from 3 sites in the buffered complex; Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974). In addition, Chiricahua leopard frogs were released at Trinity Reservoir in 1996 by the Department as part of ongoing recovery activities (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered

stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was adequately surveyed for frogs after the 1996 release and no frogs were observed after the 1997 field season (D. Groebner and M.Sredl pers.comm.). In addition the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish make the habitat less suitable for leopard frogs. Therefore, it is likely that Chiricahua leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from stocking sites in the LCR above Lyman buffered stocking complex is low. The northernmost part of the LCR above Lyman buffered stocking complex is just outside of the range of the Chiricahua leopard frog, therefore further downstream in the LCR is outside of the range of the Chiricahua leopard frog. There are records for Chiricahua leopard frogs just south of the LCR above Lyman buffered stocking complex, but these sites are in different watersheds and it is not feasible for stocked fish in the LCR above Lyman buffered stocking complex to reach these areas and the likelihood of frogs traveling the overland distance to the headwater of the tributaries to the LCR is low. These Chiricahua leopard frog sites will be assessed in different complex documents.

Northern Leopard Frog

Local Analysis: Although Hulsey Lake and the LCR above Lyman buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to fish stocked in Hulsey Lake is low because there are no historical records for northern leopard frogs at Hulsey Lake and if fish were able to disperse from the lake, it is not likely that they would persist. However, the likelihood of frogs being exposed to fish stocked in other sites within the LCR above Lyman buffered stocking complex is high. There are records for northern leopard frogs from 2007-2009 just downstream of Lyman Lake, which is within the LCR above Lyman buffered stocking complex (Drost, pers. comm.). There are historical records for northern leopard frogs from 9 sites in the buffered complex; Benny Creek (1979), Iris Spring (1979), LCR (Foot of Lyman Dam) (1935), LCR (Johnson Ranch) (1938), LCR (4.35 MIW of Eager) (1979), Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), Sheep Springs (1942), and Unnamed Creek (1 mile S of Alpine Divide Campground) (1974, 1979). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (1992 and 1995), Iris Spring (1992, 1995, and 1997), LCR (Foot of Lyman Dam) (1997), LCR (Johnson Ranch) (1997), Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), Sheep Springs (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed and it is likely northern leopard frogs no longer occupy the sites mentioned

above, the recent observations by Charles Drost show that northern leopard frogs currently occupy the area below Lyman Lake dam (Drost, pers. comm.). In addition, this is the last known extant population of northern leopard frogs in the upper LCR drainage and it is thought to be declining (Drost, pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the LCR above Lyman buffered stocking complex is low. There are records from 2007-2009 for northern leopard frogs just below Lyman Lake within the LCR above Lyman buffered stocking complex and the likelihood that these frogs would be exposed to stocked sport fish in the buffered stocking complex is high (Drost, pers. comm.). However, there is only 1 other record downstream in the LCR at Salado Springs for northern leopard frogs (1939), but frogs were not observed at this site in 1997 and it is likely that northern leopard frogs no longer occupy this area or further downstream in the LCR or its tributaries (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Little Colorado Spinedace and Critical Habitat

Spinedace occupied habitat occurs in Nutrioso Creek from the Town of Nutrioso downstream to Nelson Reservoir (Lopez et al. 2001; Sweetser et al. 2002). Occupied habitat may be as close as 4.3 miles downstream of Hulsey Lake via Hulsey Creek, Milk Creek and upper Nutrioso Creek. Designated critical habitat for spinedace is located on Nutrioso Creek beginning just below Nelson Reservoir Dam and continuing downstream for approximately 5 miles to the Apache-Sitgreaves Forest boundary.

Potential Impacts

The proposed stocking activity could potentially impact Little Colorado spinedace if any stocked trout were able to escape during a flooding event. These interactions could occur as predation on adults and juvenile spinedace, or competition for space. Since rainbow trout are stocked as catchables, they would not likely compete for food with spinedace (refer to the interactions discussion in Chapter 4). Stocked trout also do not reproduce in the lake or in Nutrioso Creek in the habitat where spinedace occur, thus, no progeny of stocked trout would be expected to occur that might compete for food.

The proposed action would not be anticipated to directly impact Little Colorado spinedace designated critical habitat, which occurs downstream of Nelson Reservoir. Constituent elements were identified as clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate. Several types of activities were identified that would be considered an impact to critical habitat. These included any activity that would deplete the flow, lessen the minimum flow, or significantly alter the natural flow regime; any activity that would extensively alter the channel morphology; or any activity that would extensively alter the water chemistry. An escaped stocked trout would not contribute to any of these activities, directly or indirectly. Some

data show that rainbow trout can escape from Nelson Reservoir (which would be the more likely source for trout in downstream areas) and could have the potential to impact spinedace. In the numerous surveys conducted in Nutrioso Creek upstream of Nelson Reservoir, only six hatchery rainbow trout have ever been documented in 2 decades of numerous surveys. These rainbow trout are considered to have come from Nelson Reservoir as upstream emigrants (M. Lopez pers. comm.).

In addition, crayfish are extremely numerous in the reaches where spinedace occur and likely present a significant threat. Portions of Nutrioso Creek dry up during low precipitation years, especially with water diversions occurring in and around the Town of Nutrioso, impacting habitat quality and availability to spinedace in Nutrioso Creek.

Mexican Spotted Owl and Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Nelson Reservoir

Site Description

Nelson Reservoir dam was built on Nutrioso Creek, a tributary to the LCR, in 1892 at an elevation of 7412 feet. Nelson Reservoir is a 90 surface acre reservoir when full, with a maximum depth of 24.6 feet and an average depth of 8.3 feet. The reservoir is located on the Apache-Sitgreaves National Forest approximately 8 miles southeast of Springerville. The lake spills only during good snowpack runoff in the spring, but often does not spill in drier years. The lake maintains a fairly consistent water level because the Department owns the water rights, and has since 1966, and no water is released through the outlet in the dam.

Nelson Reservoir is accessed year round by a paved road (highway 180/191). Two boat ramps are present; however, the ramp near the dam is usually the only one used because the ramp at the upper end is in very shallow water. Three fishing platforms are also present on Nelson Reservoir on the east side near the highway. Restrooms are present at each boat ramp. A bird watching platform is present at the upper end of the lake.

Shore anglers congregate mostly at the dam and on the east side of the lake along the highway. The fishing platforms are also located on the east side. Few anglers fish from the west shore because of the limited access. Anglers must cross below the spillway and hike around to reach the west side. Anglers also do not congregate at the upper end of the lake because it is so shallow and full of macrophytes. The Department's weed harvester is also used annually on Nelson Reservoir to thin the thick aquatic weeds in the upper end of the lake. The lake ices over for short periods in the winter but receives very little ice fishing use because the ice is normally too thin to safely support people.

Management of Water Body

Nelson Reservoir is currently managed as an intensive use put-and-take coldwater rainbow trout fishery. Precautions identified in the previous consutation (USFWS 2001) include stocking to begin each year as soon as practical following spring runoff and outflow from reservoir ceases. Stocking would also be ceased if/when habitat conditions (temperature, pH) deteriorate. In addition, all stocked fish would continue to be tagged and creel census monitoring would continue. These trout are caught quickly, reducing the number of trout in the lake, with fairly poor catch rates for the rest of the year. Bag limits are lifted through the winter, but this likely does not have much impact on trout numbers as they are already low by the time those regulations take effect. By the time the next spring runoff and spill occurs, there are few trout left in the lake. Return to creel is up to 80% with the highest catch rates immediately after stocking.

From 1958 to 1994 Nelson Reservoir was managed as a put-grow-and-take fishery with various combinations of brook trout, brown trout, cutthroat trout, and rainbow trout stocked on a regular basis. Trout stocked as fingerlings grew to catchable size in the lake and were harvested by fishermen a year later. Early in the last decade, a secondary warm water fishery was created by the illegal introductions of black crappie, green sunfish, and largemouth bass. Only the crappie and sunfish became established in the reservoir.

In 1995 a formal Section 7 Endangered Species Act (ESA) Consultation with the USFWS over the stocking of Nelson Reservoir resulted in a likely to adversely affect determination for the threatened Little Colorado spinedace, which occurs in Nutrioso Creek both above and below Nelson Reservoir. Trout stocking and management of Nelson were modified in 1996 as a result of the consultation to minimize the potential for adverse effects to Little Colorado spinedace. Modifications dictated by the consultation included the following:

1. Adjust stocking schedule as necessary to avoid stocking until water level is below the spillway and expected to remain so until the end of the stocking season. Unexpected spills may interrupt prescheduled stockings.

2. Stock only hatchery-reared catchable size rainbow trout that have been tagged with coded wire tags.

3. Stock trout to coincide with the summer fishing season, the approximate period being Memorial Day to Labor Day.

4. Conduct stream surveys, upstream and downstream of the reservoir, to determine whether tagged rainbow trout are moving to the connecting stream. If tagged trout are collected from areas occupied by spinedace, stomachs are to be taken and attempts made to determine if spinedace are being consumed by the tagged trout. Surveys of the reservoir fish population, to determine survival and carryover of stocked trout, is encouraged.

5. Provide the Arizona Ecological Services Office with results of monitoring activities listed in number 4 annually.

Intensive monitoring conducted in Nutrioso Creek from 1996 through 2000 determined that these management modifications on Nelson Reservoir were working to greatly reduce potential impacts on Little Colorado spinedace (Novy et al. 2001; Sweetser et al. 2002). Few stocked trout had escaped the reservoir, and only during high spill events (Lopez et al. 2001; Sweetser et al. 2002), and stomach analysis of those trout found no fish remains (Robinson et al. 2000).

In 1998, a regulation change was made at Nelson Reservoir and Nutrioso Creek to attempt to further minimize adverse effects to Little Colorado spinedace resulting from the Nelson Reservoir stocking program. Unlimited rainbow and brown trout harvest was allowed from September 1 to May 1 in Nutrioso Creek from its confluence with the LCR upstream to Highway 180 in the Town of Nutrioso, including Nelson Reservoir. This regulation was developed to change the management direction from sport fish to native fish within designated critical habitat, and to encourage harvest of trout out of the reservoir just prior to the spring spill events, to minimize the chance of escape, and to remove trout from the creek if trout do escape.

Consultation was re-initiated in 2001 to consider the monitoring results on the effectiveness of the management modifications. This resulted in new management guidelines that were generally similar, but slightly modified, to those developed in 1995.

2001 recommendations included:

1. Continue the current put-and-take rainbow trout stocking program. Stock approximately 20,000 fish in late spring/early summer when the lake level is below the spillway and when seasonal restrictive bag limits are in place.

2. Evaluate the stocking program at five year intervals through creel census and fish population surveys.

3. Monitor fish populations in Nutrioso Creek with backpack electrofishing equipment at five year intervals at 18 permanently established 50-meter stations downstream of Nelson Reservoir, and 12 permanently established 50-meter stations located upstream of the reservoir between Nelson Reservoir and the Town of Nutrioso.

4. If an unusual spill event occurs in early summer (June or July) following restocking, electrofish the entire length of critical habitat downstream of Nelson Reservoir and remove all trout and other non native predators sampled.

5. Eliminate the regulation that removes bag limits seasonally at Nelson Reservoir and Nutrioso Creek. It accomplishes nothing biologically and is confusing to anglers. It also further restricts the limited stocking window at Nelson because initiation of stocking cannot begin prior to May 1. This would become critical should another drought year occur like in 1996.

From 1996-2009, a total of approximately 262,958 catchable size rainbow trout were stocked into Nelson Reservoir. Stocking took place in May and June each year, following the cessation of spring runoff and spill, except for 1996 when low water levels and drought conditions allowed stocking to take place in April, in 2002-2004 and 2006-2007 when the reservoir did not spill. Seasonal elevation in pH levels associated with growth of aquatic vegetation generally precluded stocking past mid-June, to allow trout enough time to acclimate and avoid associated mortality. Fish were marked at the hatchery of origin, Page Springs, with coded wire tags in 1996, 1997, and 1998. Tetracycline was used to mark trout stocked into Nelson Reservoir after 1998 when permission was secured from the Fish and Wildlife Service to eliminate the coded wire tag requirement. Table 11 provides a summary of all stockings in Nelson reservoir.

Table 11. Stocking history in Nelson Reservoir.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1977	1994	27	545,641
Brown trout	1978	1992	11	83,170
Channel catfish	1975	1975	1	10,000
Cutthroat trout	1987	1993	14	283,757
Rainbow trout	1958	2009	184	3,810,414

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bullfrog Tadpole	1968	1969	2	9,450
Total			239	4,742,432

Angler creel surveys were conducted at Nelson Reservoir in each year from 1996-2000 (Novy et al 2001), and also in 2001 (17,406 angler use days) and 2005. A mail-out survey conducted for 2001 reported a use of 21,618 AUDs (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed identifies the management emphasis for Nelson Reservoir as intensive use sport-fish, with a desired fish assemblage of rainbow trout and bluehead sucker.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked from April through July annually following the cessation of the spring spill; numbers of trout stocked may be from 0 to 20,000 fish annually.

Water Distribution / Connectivity

Nelson Reservoir is fed by upper Nutrioso Creek, which stretches 13.3 miles upstream from the reservoir to the very headwaters. Nutrioso Creek flows from its origin near the Alpine Divide for 0.6 miles to the confluence with Paddy Creek. Paddy Creek is a perennial tributary that provides most of the flow from that point down in Nutrioso Creek. Nutrioso Creek continues downstream for 1.6 miles to the confluence with Milk Creek. Milk Creek appears to have a low but permanent flow, and is fishless as determined by Department surveys in 1976, 1995, and 1996. Hulsey Creek is an intermittent tributary off Milk Creek, with Hulsey Lake located on the creek approximately 2.1 miles upstream of Milk Creek. There is no irrigation or other type of water releases from Nelson Reservoir.

From the confluence of Milk Creek, Nutrioso Creek flows downstream through the Town of Nutrioso for 11.1 miles to Nelson Reservoir. This flow is perennial going into the Town of Nutrioso; however, numerous water diversions exist through the town and the creek does not always flow continuously into Nelson Reservoir during the summer irrigation season, with occasional drying to isolated pools.

There are two other major tributaries entering Nutrioso Creek between the confluence with Milk Creek and Nelson Reservoir; Auger Creek and Colter Creek enter at 1.9 miles and 3.5 miles, respectively, downstream of the Milk Creek confluence. Both of these tributaries have permanent flow; however, a number of water diversions often keep this permanent flow from reaching Nutrioso Creek during the summer irrigation season.

Paddy Creek, Milk Creek, upper Nutrioso Creek, Auger Creek, Colter Creek, and Nelson Reservoir are all connected during snowmelt runoff during the spring. However, at base flows, Hulsey Lake does not spill, Hulsey Creek is dry, and permanent flows in Nutrioso Creek, Auger Creek, and Colter Creek often are not connected with each other or to Nelson Reservoir because of numerous water diversions around the Town of Nutrioso. The diverted water is used to irrigate fields throughout the old floodplain from the Town of Nutrioso down to the Forest boundary just above Nelson Reservoir. Nutrioso Creek is incised/downcut from the lower end of Nutrioso almost down to Nelson Reservoir, up to 10 feet below the old floodplain in some places.

Nelson Reservoir spills during spring snowmelt runoff when there is a sufficient snowpack to fill the reservoir. The lake has spilled 5 times in the last 10 years, as shown in Table 12.

Table 12. Spill history of Nelson Reservoir from 2001-2008.

Year	**Spill description**
2000	Spilled 106 days
2001	Spilled “spring” to 5/23
2002	No spill
2003	No spill
2004	No spill
2005	Spilled 3/16 to 5/20
2006	No spill
2007	No spill
2008	Spilled 1/28 to 5/1
2009	Spilled 1/13 to 5/6

When the reservoir does spill, it flows downstream for 13.0 miles to the confluence with the LCR. A major tributary, Rudd Creek, enters at 1.2 miles downstream of the Nelson Reservoir dam. A culvert barrier is located on Rudd Creek 3.1 miles upstream of its confluence with Nutrioso Creek. During spring snowmelt runoff, Rudd Creek flows continuously into Nutrioso and on down to the LCR. Nutrioso Creek for 1.2 miles downstream of Nelson Dam maintains surface flow both when the reservoir spills and when it does not spill; post-spill surface flows are maintained by seepage through the earthen dam.

During base flows when the reservoir is not spilling, much of Nutrioso Creek within designated critical habitat, approximately 5 miles from the dam downstream to the Forest boundary, has perennial water, but it usually dries up downstream of this on private property. The very lower

portion of Rudd Creek often dries up as well during the dry season. During extreme drought years, such as 2002, Nutrioso Creek below the reservoir was reduced to isolated pools.

The LCR is perennial at the confluence with Nutrioso Creek and all the way upstream to River Reservoir near Greer and above. Downstream of Nutrioso Creek the confluence of the LCR is perennial all the way to Lyman Lake near St. Johns.

Fish Movement

There is documentation that stocked rainbow trout have escaped upstream and downstream from Nelson Reservoir. It is more difficult for stocked trout to move upstream than downstream. Initially, Nutrioso Creek enters the lake through a shallow marsh mostly without a defined channel. This marshy area is much thicker in the last decade after the Forest fenced off that area to elk and cattle, resulting in a dense area of willows, reeds and grasses. Once in the defined channel of Nutrioso Creek, a fish could move upstream during high flows mostly unobstructed to the Town of Nutrioso, where there are a number of low elevation surface water diversions that are likely not fish barriers. At higher flows escaped trout could potentially swim up into perennial Colter Creek, perennial Auger Creek, or up into the headwaters of Nutrioso Creek. At base flows, a trout could not escape upstream from the reservoir because of the undefined channel in the shallow marsh, but mostly because the lower portion of the creek coming into the reservoir is often dry due to water diversion upstream during the summer months. At base flows, a trout could also not get into Colter Creek, Auger Creek, or upper Nutrioso above the Town of Nutrioso because summertime water diversions take most of the base flows.

Rainbow trout from Nelson Reservoir were documented a short distance above the reservoir in 2000, with 5 marked trout in one pool. A brook trout collected in the headwaters of Nutrioso Creek in 1994 was also likely from Nelson Reservoir. No other stocked trout have been documented in upper Nutrioso Creek above the reservoir during many surveys.

Stocked trout can only move downstream into lower Nutrioso Creek when the lake spills, and likely only when it spills significantly because of the shallow depth of water over the spillway. Trout do not reproduce so there are no small trout, larvae or eggs that would be transported over the spillway. Because the stocked trout are catchable or larger sized rainbow trout there would have to be an increase in depth, greater than what is usual for the lake, for escapement to occur. An escaped rainbow trout could swim all the way down to the LCR during high flows if it escapes Nelson Reservoir. Once in the LCR, a fish could swim upstream through Springerville, but may be slowed down by a number of large water diversions, although these are likely not complete fish barriers during high flows. However, the stocked trout would not get past River Reservoir dam. Moving downstream in the LCR, a fish could theoretically travel to Lyman Lake, although the habitat in the LCR downstream of Springerville becomes unsuitable for trout in most years. Lyman Lake last spilled in the early 1990s, and only barely; thus Lyman Lake is

likely a fish barrier to downstream movement of fish in that part of the LCR, except for irrigation releases into the LCR below Lyman. Irrigation releases are also made to a canal that does not re-connect to the river channel. The frequency, volume or timing of the two types of releases is not known. After leaving the downstream end of Nelson Reservoir, stocked trout could also swim up into Rudd Creek, but only until they reach a culvert barrier, which is at least a 6 foot drop.

At Base flows, the lower portion of Nutrioso Creek dries up and is not connected to the LCR. Flow between pools in the perennial section is typically very low and often ceases altogether during dry years. Isolated pools may persist during very dry years, making it difficult for a catchable size trout to move upstream or downstream. Fish could move into lower Rudd Creek at high flows, but would not be able to get past the culvert barrier 3.1 miles upstream of the confluence with Nutrioso Creek.

Community Description
Nelson Reservoir contains rainbow trout, green sunfish, black crappie, fathead minnow, bluehead sucker, and crayfish (Table 13).

Green sunfish, black crappie, channel catfish, and largemouth bass were illegally stocked in the mid-1990s following a change in the management of Nelson Reservoir; however, only green sunfish and black crappie are established.

Table 13. Survey history for Nelson Reservoir, using experimental gillnets.

Date	Species	Num. Collected	Size Range (mm TL)
April 2005	Rainbow trout	19	360-427
	Black crappie	3	276-315
March 2003	Green sunfish	2	149-181
	Rainbow trout	1	355
	Black crappie	1	240
March 2002	Green sunfish	4	133-155
	Rainbow trout	14	300-347
April 2001	Green sunfish	6	130-160
	Rainbow trout	1	413
	Bluehead sucker	1	150
	Black crappie	1	142
April 2000	Green sunfish	90	118-206
	Rainbow trout	18	335-445
	Bluehead sucker	5	201-254
	Black crappie	30	211-337
May 1999	Rainbow trout	6	288-430
	Bluehead sucker	10	193-246
	Black crappie	7	291-306
April 1998	Channel catfish	1	463

Date	Species	Num. Collected	Size Range (mm TL)
	Green sunfish	3	127-145
	Rainbow trout	4	355-390
	Bluehead sucker	1	215
	Black crappie	7	267-297
May 1997	Green sunfish	4	159-201
	Largemouth bass	1	382
	Rainbow trout	3	374-440
	Bluehead sucker	12	187-234
	Black crappie	24	247-272

Nutrioso Creek above and below the reservoir contains Little Colorado spinedace, speckled dace, bluehead sucker, fathead minnow, numerous crayfish, and occasional green sunfish and rainbow trout, according to surveys conducted in the last ten years. Brown trout, cutthroat trout, and brook trout have been collected in Nutrioso Creek in the early-mid 1990s when they were still stocked in the reservoir (Lopez et al., 2001). Table 14 provides a summary of fish surveys from Nutrioso Creek above Nelson Reservoir from 1997 to present. The 1997-2000 surveys were conducted in the spring and fall with a backpack electroshock with results detailed in the 2001 Nutrioso Creek Fish Management Report, AGFD Technical Report 01-01 (Lopez et al, 2001). The 2005 survey was conducted in May with a backpack electroshocker, with results detailed in a trip report (McKell 2005e). The 2006 surveys were conducted in April-June with a backpack electroshocker and 1/8” mesh seines, with results described in two trip reports (Carter et al 2006a) and (Carter et al 2006b). The 2007and 2008 surveys were conducted in July of each year with 1/8” mesh seines, with results described in the 2007 Nutrioso Survey Report (Weiss 2007c) and 2008 Nutrioso and Rudd Creeks Survey Report (Weiss and Lopez 2008). The 2009 survey was conducted in May-June with a backpack electroshocker and 1/8” mesh seines (Mike Lopez, per. comm.).

Table 14. Fish survey summary from 1997-present for Nutrioso Creek from Nelson Reservoir upstream to the town of Nutrioso.

Species	Native fish			Non native fish			Total
	Little Colorado spinedace	Bluehead sucker	Speckled dace	Rainbow trout	Fathead minnow	Green sunfish	
Spring 1997	146	411	69	0	86	0	712
Fall 1997	59	229	14	0	139	0	441
Spring 1998	3	20	10	0	22	0	55
Spring	4	38	11	0	144	0	197

Species	Native fish			Non native fish			Total
	Little Colorado spinedace	Bluehead sucker	Speckled dace	Rainbow trout	Fathead minnow	Green sunfish	
1999							
Fall 1999	50	36	40	0	273	0	399
Spring 2000	147	358	74	5	2390	3	2,977
2005	7	7	48	0	145	0	207
2006	895	109	234	0	1,374+	0	2,612+
2007	60	4	39	0	1090	0	1,193
2008	57	38	46	0	432	2	575
2009	19	0	15	0	766	2	802

The aquatic community in Nutrioso Creek downstream of Nelson Reservoir consists of speckled dace, bluehead sucker, Little Colorado spinedace, fathead minnow, green sunfish, rainbow trout, and crayfish according to surveys conducted by the Department (Table 15).

Table 15. Fish survey summary from 1996-present of Nutrioso Creek downstream of Nelson Reservoir.

(Table 14 provides survey gear types used and referenced reports.)

Species	Native fish			Non native fish			Total
	Little Colorado spinedace	Bluehead sucker	Speckled dace	Rainbow trout	Fathead minnow	Green sunfish	
Fall 1996	176	200	304	0	368	4	1,052
Spring 1997	3	41	30	0	208	0	282
Fall 1997	9	25	19	1	242	3	299
Spring 1998	2	44	114	0	616	3	779
Fall 1998	3	76	47	0	1,300	3	1,429
Spring 1999	111	present	present	0	present	1	N/A
Fall 1999	61	289	601	0	2,053	3	3,007
Spring 2000	162	543	1,467	0	11,137	22	13,331
2005	0	1	26	10	958	60	1,055
2006	0	0	89	1	3,888	52	4,030
2008	0	0	106	2	344	2	454
2009	1	2	165	9	3,783	6	3,966

Rainbow trout accounted for just 28 of the 39,854 fish (0.07%) sampled in Nutrioso Creek over 9 years of intensive monitoring since the implementation of new management approaches to reduce escapement of trout from Nelson Reservoir in 1996 (Lopez et al. 2001; Sweetser et al. 2002). Since 1996, only 5 tagged trout were captured upstream of Nelson, in a single pool in May 2000, and are considered escapees from Nelson Reservoir. In that same time, 23 trout were captured downstream of Nelson. Only 1 of these downstream trout was collected in the first 5 years of intensive survey and 22 were collected in the last 4 years of surveying, due to the more frequent occurrence of high spill events. None of the rainbow trout sampled from Nutrioso Creek were found to contain spinedace in stomach analyses (Robinson et al. 2000), although 3 out of 28 trout contained fathead minnows (Table 17). Sweetser et al. (2002) examined stomach contents of 54 rainbow trout, 24 brown trout, and 4 brook trout in Nutrioso Creek, Rudd Creek, and the LCR upstream of Lyman Lake, and 6% of the rainbow trout, 33% of the brown trout, and 24% of the brook trout had fish remains in their GI tract.Twenty-four of the 28 trout collected in Nutrioso Creek were marked with coded wire tags or tetracycline markers and were considered to have escaped from Nelson Reservoir. Five of the rainbow trout collected during the most recent survey conducted in 2009 were large individuals, from 391 mm and 462 mm TL, and had tetracycline marks. The other 4 rainbow trout were smaller, with sizes ranging from 166 mm to 232 mm TL, and did not have tetracycline marks when checked in a lab setting. The smaller trout also had no fin wear, further indicating that they were not of hatchery origin. Stocked trout in Nelson Reservoir have excessive fin wear from the Page Springs Hatchery, the only hatchery stocking Nelson Reservoir since 1996. It was thought that the “wild” trout could have come from a wild population of rainbow trout that may still be persisting in Rudd Creek, since 3 of the small trout were collected very near the confluence with Rudd Creek. Another small wild trout was collected in lower Rudd Creek during surveys there in May-June 2009, and a strong wild population existed in the headwaters of Rudd Creek in 1994 (Table 16).

Electrofishing surveys conducted in upper Rudd Creek in reaches 5-8 in July-August 2003 found only 2 rainbow trout throughout 19 50-meter stations (3 pass depletion), in a year following an extreme dry year in 2002 when much of upper Rudd Creek dried up. A recent electrofishing survey in upper Rudd Creek in May-June 2009 found only 5 brook trout and no rainbow trout in two 200 meters stations in the headwaters (1 pass), indicating that the wild population of rainbow trout in upper Rudd Creek may no longer exist. If wild rainbow trout still persist in upper Rudd Creek, they may not be numerous enough to explain the numbers of wild trout found downstream in Nutrioso Creek and lower Rudd Creek. Another explanation is that large trout that had escaped from Nelson Reservoir were able to reproduce in lower Nutrioso Creek, something that had not been considered possible or observed since extensive monitoring began in 1996. Additional monitoring is needed to verify successful trout spawning in lower Nutrioso Creek. Other fish documented in lower Rudd Creek in 2009 included Little Colorado spinedace, speckled dace, and bluehead sucker, all of which were located downstream of the culvert barrier.

Surveys conducted at Nelson Reservoir and Nutrioso Creek since 1996 indicate that changes in fish management at Nelson to comply with Section 7 ESA consultation requirements relating to stocking have generally achieved the objectives. Rainbow trout stocked into Nelson have had minimal escapement overall, and impacts to the threatened Little Colorado spinedace, which occupies Nutrioso Creek above and below Nelson Reservoir, is likely minimal. Escapement of rainbow trout into Nutrioso Creek was extremely limited during the first five years since new management practices were implemented (Lopez et al. 2001; Sweetser et al. 2002), but were higher in the last 4 years of survey due to the greater occurrence of spills due to high flow events. Although the occurrence of escaped trout has been greater in recent years, the relative occurrence has been low. Angler harvest of trout stocked into Nelson has been high and most trout were removed over the course of the summer and fall following stocking in the spring. Seasonal trends in catch rates and surveys of the reservoir's fish population both indicated that most trout had been caught prior to spring overflows, which occur almost annually at Nelson.

Table 16. Fish collected in Rudd Creek in 1994 by 3 pass depletion electrofishing at 40 survey sites, beginning at the confluence of Nutrioso Creek and progressing upstream.

Reach number	**Species collected**	**Num. of fish collected**
1	Little Colorado spinedace Bluehead sucker Speckled dace	36 11 49
2	Little Colorado spinedace Bluehead sucker Speckled dace	104 45 206
3	Little Colorado spinedace Bluehead sucker Speckled dace	161 61 298
4	Speckled dace	11
5	Rainbow trout Brook trout	73 32
6	Rainbow trout Brook trout	17 35
7	No fish	0
8	Rainbow trout Brook trout	1 2

Table 17. Summary of trout captured (and stomach contents) in Nutrioso Creek, from 1996 through 2009.

Date	**Species**	**Size (mm TL)**	**Stomach content**
1996	No trout		

Date	Species	Size (mm TL)	Stomach content
8/19/1997	Rainbow trout	306	Invertebrates
1998	No trout		
1999	No trout		
5/2000	Rainbow trout	198	No fish
	Rainbow trout	201	No fish
	Rainbow trout	214	No fish
	Rainbow trout	224	No fish
	Rainbow trout	228	No fish
5/16/2005	Rainbow trout	413	1 crayfish
	Rainbow trout	392	1 fathead minnow (48 mm)
	Rainbow trout	343	Aquatic insects, 8 snails, 1 ant, 1 fathead minnow (39 mm), 4 notonectids
	Rainbow trout	390	Empty
5/18/2005	Rainbow trout	412	16 damselfly larvae, 1 amphipod
	Rainbow trout	378	Empty
5/19/2005	Rainbow trout	380	Beetles, notonectids, corixids, bees, snail
	Rainbow trout	375	3 beetle larvae, ant
	Rainbow trout	406	1 fathead minnow (32 mm), 58 ants, 9 notonectids, 5 corixids, beetles, 24 snails
	Rainbow trout	346	Notonectids, damselfly nymph
4/18/2006	Rainbow trout	380	Invertebrates
2007	No trout		
7/21/2008	Rainbow trout	525	1 crayfish, 5 corixids
	Rainbow trout	350	Empty
5/19/2009	Rainbow trout	211	Chironomid larvae, 2 mayfly larvae
	Rainbow trout	462	1 rock, 5 crayfish
5/20/2009	Rainbow trout	222	6 corixids, sticks, 1 caddisfly larvae
	Rainbow trout	166	1 crayfish, sticks, 2 corixids
5/27/2009	Rainbow trout	232	30 corixids, 1 blackfly larvae, 1 scud, 1 mayfly larvae, crayfish pieces
6/8/2009	Rainbow trout	452	6 crayfish, some aquatic invertebrates, sticks
	Rainbow trout	423	5 crayfish
	Rainbow trout	419	6 crayfish
6/9/2009	Rainbow trout	391	50 corixids, 1 crayfish claw
Lower Rudd	Rainbow trout	184	10 corixids, 2 crayfish

Date	Species	Size (mm TL)	Stomach content
Creek 6/9/2009			

There is no evidence trout reproduce in Nelson Reservoir, but they do persist through the summer and winter months. However, most are caught out before the reservoir spills in the spring. Based on survey data from years of monitoring, trout may move upstream into upper Nutrioso Creek, but no evidence exists that they reproduce or persist in the reach from the lake upstream to the Town of Nutrioso. Trout may persist and reproduce if they are able to reach the headwaters of Nutrioso Creek, above the Town of Nutrioso. New evidence shows that trout may persist and reproduce in lower Nutrioso Creek, below the reservoir, but in fairly low numbers and very infrequently. Reproduction of trout in lower Nutrioso Creek has not been verified and the origin of 4 small, unmarked rainbow trout remains unexplained. However, the potential that escaped trout have reproduced and recruited progeny into lower Nutrioso Creek must be considered.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua Leopard Frog

Local Analysis: Although Nelson Reservoir and the LCR above Lyman buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Nelson Reservoir is low because it is likely that frogs no longer occupy Nelson Reservoir. The likelihood of frogs being exposed to fish stocked in other sites within the LCR above Lyman buffered stocking complex is also low. There is an historical record for Chiricahua leopard frogs at Nelson Reservoir (SE Corner) from

1971, although frogs have not been observed during subsequent surveys at the reservoir (1987, 1992, 1993, and 1995). There are historical records for Chiricahua leopard frogs from 2 other sites in the buffered complex; Nutrioso Creek (Correjo Crossing - 1979), and Unnamed Creek (1 MI S of Alpine Divide Campground - 1974). In addition, Chiricahua leopard frogs were released at Trinity Reservoir in 1996 by the Department as part of ongoing recovery activities (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was surveyed adequately for frogs after the 1996 release and no frogs were observed after the 1997 field season (D. Groebner and M.Sredl pers.comm.). In addition, the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish makes the habitat less suitable for leopard frogs. Therefore it is likely that Chiricahua leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from stocking sites in the LCR above Lyman buffered stocking complex could have an impact on Chiricahua leopard frogs is low. The northernmost part of the LCR above Lyman buffered stocking complex is just outside of the range of the Chiricahua leopard frog, therefore further downstream in the LCR is outside of the range of the Chiricahua leopard frog. There are records for Chiricahua leopard frogs just south of the LCR above Lyman buffered stocking complex, but these sites are in different watersheds and it is not feasible for stocked fish in the LCR above Lyman buffered stocking complex to reach these areas. The likelihood of frogs traveling the overland distance to the headwater of the tributaries to the LCR is low. These Chiricahua leopard frog localities will be assessed in different complex documents.

Northern Leopard Frog

Local Analysis: Nelson Reservoir and the LCR above Lyman buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Nelson Reservoir or elsewhere in the buffered stocking complex is high. There are records for northern leopard frogs from 2007-2009 just downstream of Lyman Lake, which is within the LCR above Lyman buffered stocking complex (Drost, pers. comm.). There is a historical record for northern leopard frogs at Nelson Reservoir (SE Corner) from 1971; although frogs have not been observed during subsequent surveys at the reservoir (1987, 1992, 1993, and 1995), it is possible for frogs within the buffered stocking complex to be exposed to dispersing stocked fish. There are historical records for northern leopard frogs from 8 other sites in the buffered stocking complex; Benny Creek (1979), Iris Spring (1979), LCR (Foot

of Lyman Dam) (1935), LCR (Johnson Ranch) (1938), LCR (4.35 MI W of Eager) (1979), Nutrioso Creek (Correjo Crossing) (1979), Sheep Springs (1942), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974, 1979). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (1992 and 1995), Iris Spring (1992, 1995, and 1997), LCR (Foot of Lyman Dam) (1997), LCR (Johnson Ranch) (1997), Nutrioso Creek (Correjo Crossing) (1995), Sheep Springs (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed and it is likely that northern leopard frogs no longer occupy the sites mentioned above, the recent observations by Charles Drost show that northern leopard frogs currently occupy the area below Lyman Lake dam (Drost, pers. comm.). In addition, this is the last known extant population of northern leopard frogs in the upper LCR drainage and it is thought to be declining (Drost, pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the LCR above Lyman buffered stocking complex is low. There are records from 2007-2009 for northern leopard frogs just below Lyman Lake within the LCR above Lyman buffered stocking complex and the likelihood that these frogs would be exposed to stocked sport fish in the buffered stocking complex is high (Drost, pers. comm.). However, there is only 1 other record downstream in the LCR at Salado Springs for northern leopard frogs (1939), but frogs were not observed at this site in 1997 and it is likely that northern leopard frogs no longer occupy this area or further downstream in the LCR or its tributaries (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.).

Little Colorado Spinedace and Critical Habitat

Little Colorado spinedace occur in Nutrioso Creek above and below Nelson Reservoir. Spinedace have been documented above the reservoir in nearly every survey from 1988-2009. Spinedace below the reservoir had not been found from 2002-2008, but were rediscovered recently in 2009.

Potential Impacts

The proposed stocking activity at Nelson Reservoir would be anticipated to have direct and/or indirect impacts on Little Colorado spinedace due to occurrences of Little Colorado spinedace upstream and downstream of the reservoir, since no barriers exist to limit upstream movement and the dam only prevents downstream movement when it is not spilling. However, monitoring has shown that very few stocked rainbow trout escape the reservoir, and only during very high spill events. In addition, several diversions exist on upper Nutrioso Creek, limiting the potential for upstream movement of trout to suitable habitat in extreme upper Nutrioso.

Stipulations from the last Section 7 consultation in 2001 directed that Nelson Reservoir could only be stocked after the lake stopped spilling in the spring and only with marked catchable rainbow trout; that creel surveys are done every 5 years; and that fish surveys for escaped rainbow trout be done if the lake spills during the stocking season. Implementation of these management practices and removal of trout during surveys was thought to reduce impact/exposure.

Critical Habitat

Spinedace critical habitat continues to support variable populations of spinedace (USFWS 2001, 2008e) and when critical habitat areas for spinedace were designated, these areas were reported as "…presently support(ing) healthy self-perpetuating populations of the Little Colorado spinedace" (USFWS 1987). Since that time, habitat degradation, introduction of non native fishes, and scarcity of water have resulted in low numbers of spinedace in East Clear Creek and Leonard Canyon. The act of stocking catchable rainbow trout upstream and downstream of critical habitat is reversible and does not diminish or preclude the role of that habitat for the survival and recovery of the spinedace. In years of high precipitation or during periods of high runoff, trout have the opportunity to move out of the stocked area into spinedace habitat. Similarly, spinedace may move into trout areas. In either case, some spinedace could be consumed by rainbow trout or other non native species.

Critical habitat that is potentially affected by this action includes the five miles of Nutrioso Creek below Nelson Reservoir dam to the Apache-Sitgreaves National Forest boundary. The paragraphs below were taken from the USFWS 2001 BO for stocking of Nelson Reservoir:

> Blinn et al. (1993) conducted experiments in Nutrioso creek enclosures. Wild rainbow trout and spinedace (all from Nutrioso Creek) were placed in 6.6 to 9.8 ft (2 by 3 meter) enclosures and fish interactions monitored. Although spinedace disappeared from enclosures with and without trout, significantly more spinedace were lost from enclosures that contained wild rainbow trout (Blinn et al. 1993). Even though macroinvertebrates were abundant in the enclosed areas, trout consumed spinedace. However, Robinson et al. (2000) examined stomach contents of 54 rainbow trout captured from Rudd, Nutrioso Creek, and the LCR and detected no predation on spinedace. Blinn et al. (1993) also noted trout presence modified spinedace behavior. In the presence of trout, spinedace moved into open water, possibly making them more vulnerable to a wide variety of predators (Blinn and Runck 1990; Blinn et al. 1993). Robinson et al. (2000, 2003) also documented changes in spinedace habitat use when in the presence of rainbow trout, and the shifts appeared to be dependent on the density of rainbow trout present.

Blinn et al. (1993) documented an inverse relationship between trout and spinedace abundance and distribution throughout Nutrioso Creek. This pattern is also noted with the consistent presence of spinedace in Dines Tank and the absence of rainbow trout. The uppermost area of Nutrioso Creek contained a healthy population of trout, the area downstream had a few trout and spinedace, while the area still farther downstream had only spinedace (Blinn and Runck 1990). In addition to predation, competition between spinedace and rainbow trout may occur. Robinson et al. (2000, 2003) documented both species selecting for the same habitats (pools with undercut banks) in both field and lab observations. With downsteam flow being limited during the summer months, competition for space could occur[1].

Spills from the reservoirs are more likely to transport large numbers of fathead minnows, as evidence by the previous sampling reports (Lopez et al. 2001; Benedict 2000; Robinson et al. 2000). While native fishes are adapted to flood events, small bodied fish like the fathead minnow are readily transported downstream into spinedace habitat (Minckley and Meffe 1987). Fatheads mainly feed on detritus and algae on soft bottoms (Minckley 1973). High numbers of fathead minnows would continue to have a negative effect on Little Colorado spinedace through competition for food and habitat, and by predation on larval fishes. While it is recognized that other variables such as water temperatures, stream gradient, etc. may affect abundance and distribution of all fish species, it is possible that the spinedace population may not be able to maintain or increase their numbers in the presence of non native fishes. In addition, introduced crayfish likely pose yet another threat to spinedace, since they both prey on and cause spinedace to modify their habitat use (Robinson et al. 2000, 2003). Providing habitat free of non native fish may be crucial to spinedace recovery.

Nelson Reservoir does spill, and trout can overwinter. In addition, spinedace can move into the reservoir. However, escapement of rainbow trout from Nelson Reservoir into Nutrioso Creek was extremely limited in 1996-2000 and was higher in 2005-2009, but still considered to be low. Just 24 tagged trout originating from Nelson Reservoir out of 262,958 stocked from May 1996 through 2008 was recaptured in Nutrioso Creek, 5 found upstream of the reservoir and 19 downstream. Four unmarked trout were also collected below the reservoir and remain unexplained, but could potentially be progeny from recently escaped stocked trout. Additional

[1] Competition for food was reported to be low between full size trout and spinedace (Robinson et al 2000), likely because of the difference in body size between the 2 species. Diet overlap between similar sized spinedace and trout may be greater, however, only catchable size trout are stocked into Nelson Reservoir. Potential reproduction by escaped trout below the reservoir may produce progeny that could compete for food with spinedace; however, this natural recruitment has not been verified.

work will be needed to verify possible reproduction. Overall, the number of escaped rainbow trout from Nelson Reservoir since the implementation of new management approaches in 1996 has been low. Twenty-eight rainbow trout, including both marked and unmarked fish, have been collected out of 39,854 total fish from 1996 to 2009, just 0.07% of the total collected. Angler harvest of trout stocked into Nelson is expected to remain high with most trout being removed over the course of the summer and fall following stocking. Seasonal trends in catch rates and surveys of the reservoir's fish population both indicated that most trout had been caught prior to spring overflows in previous years, and is expected to continue in the future (USFWS 2001).

Southwestern Willow Flycatcher

The stocking site does not occur within the designated critical habitat for the Southwestern willow flycatcher. The nearest occurrence was documented at the north end of the lake in 1994 and is considered a historic record as no birds have been documented near the lake since.

Potential Impacts

There may be some limited amount of habitat degradation and some amount of disturbance to nesting flycatchers from anglers using or creating new trails to access the stocking site.

Becker Lake

Site Description

Becker Lake is a 107 surface acre reservoir created in an abandoned oxbow of the LCR on the southern edge of the Town of Springerville. Originally created in 1880, a dam was constructed at a later date, increasing the size of the lake to its current dimensions. The lake is off the main channel and is filled by diverting water from the LCR. The Department owns the property and water rights associated with Becker Lake. The lake was purchased from private ownership in 1973 and turned into a public fishery, and is currently managed as part of the Becker Wildlife Area.

Management of Water Body

Primary fishery is a cold water put-grow-and-take rainbow trout fishery, with emphasis on growing Blue Ribbon/trophy trout. This is a year round fishery with peak use in spring and fall. Sub-catchable and catchable rainbow trout are stocked several times in the spring. This water also hosts special events and fishing clinics periodically throughout the year, although it is not stocked specifically for these clinics. Table 18 provides a summary of stocking history for Becker Lake.

Secondary fishery is a cold water featured species fishery for Apache trout and Arctic grayling. Catchable Apache trout and sub-catchable grayling would be stocked occasionally, only if there was a surplus of these species in the hatchery and another place was needed to stock them, or if the Department wanted to develop broodstock for these species. The secondary fishery proposed

in this document is intended in part to give the Department flexibility in developing a broodstock of Apache trout and/or Arctic grayling within the lake from which to take eggs if needed.

Most angler use in Becker Lake is by boat, with shore fishermen concentrated on the north and west shoreline. The lake freezes over only for a short period during the winter, but receives no ice fishing use because of the thin ice. Anglers can fish open water at Becker Lake 11-12 months of the year.

Rainbow trout are currently stocked in Becker Lake at relatively low levels to support a put-grow-and-take fishery, with a low bag limit to produce blue ribbon size trout. Table 19 shows the reduction from high stocking levels in 2004 and 2005 to the current stocking levels in 2006 and 2007 with the regulation change. Current stocking levels include 2,000-6,000 sub-catchable and 2,000-10,000 catchable size rainbow trout. Trout are not known to spawn in the reservoir because water flowing into the lake through the ditch from September through April does not provide appropriate timing for a spawn in that flowing water, plus the dirt substrates in the ditch are unsuitable for spawning.

Table 18. Stocking history in Becker Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Apache trout	1974	2000	14	17,328
Brook trout	1985	1985	1	10,000
Brown trout	1978	1988	14	121,672
Cutthroat trout	1979	1993	11	236,903
Fathead minnow	1979	1980	2	750
Largemouth bass	1937	1937	1	510
Rainbow trout	1973	2009	154	2,572,601
Total			197	2,959,764

Table 19. Detailed stocking history at Becker Lake from 2003 through 2008, showing the reduction in numbers stocked with more restrictive regulations.

Year	Species stocked	Fingerlings	Sub-catchables	Catchables
2003	Rainbow trout	130,525	15,310	5098
2004	Rainbow trout	112,761	3654	6840
2005	Rainbow trout		4000	5000
2006	Rainbow trout			9915
2007	Rainbow trout		6000	5000
2008	Rainbow trout		3000	2000

Apache trout were previously approved for Becker Lake and were stocked regularly from 1993 to 2002; however, this species did not return well to creel, making up only 6.5% of the total catch in 1993, 8.2% in 1995, 12.6% in 1996, and 7.4% in 1999, based on angler creel surveys.

Becker Lake is accessed year round by paved road (Highway 180/191). The lake has restrooms, a dirt parking lot, fishing pier, and a proposed boat courtesy dock. One boat launch is located at the parking lot. The entrance road accesses the north side of the lake only, with the rest of the lake accessed by boat or hiking the shoreline.

The Integrated Fisheries Management Plan for the LCR Watershed identifies the management emphasis for Becker Lake as Blue Ribbon and Intensive Use sport fish, with a desired species assemblage of rainbow trout, Apache trout and Little Colorado sucker (Young et al. 2001). The proposed species rainbow trout and Apache trout are consistent with this management plan. However, Arctic grayling was not identified as a desired species because the need for a grayling broodstock had not been identified at the time the plan was developed. Adding Arctic grayling would not impair the ability to meet the main management objectives, since the numbers would be fairly low and the fish do not grow large and would not compete for food resources in the lake at an unacceptable level.

Proposed Action

The Department proposes to stock rainbow trout, Apache trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked from March to May annually; numbers of rainbow trout stocked may be from 0 to 16,000 trout annually.

Catchable Apache trout would be stocked from March to May annually; numbers of Apache trout may be from 0 to 8,000 annually.

Subcatchable Arctic grayling would be stocked from March to May annually; numbers of Arctic grayling may be from 0 to 5,000 annually.

Water Distribution / Connectivity

Becker Lake is located off the main channel of the upper LCR, just on the southern edge of the Town of Springerville. The lake is filled with water diverted from the LCR during the “fill season” from September 15 through April 15 to replace losses from the lake through evaporation and seepage, and occasional irrigation use, per the water rights held by the Department. The diversion dam for the ditch leading to Becker Lake is located on the LCR in the town of Springerville approximately 0.2 miles upstream of Airport Road. Diverted water flows through an open ditch for 1.7 miles and dumps into the southeast site of the lake. There are no other

water users taking water from this diversion ditch and there is no natural drainage or other water coming into the lake.

During the fill season, water is diverted into the lake until the lake fills, or April 15, whichever comes first. The diversion is shut as the lake level approaches the spillway, to prevent spillage. The lake level remains fairly constant through the year since the Department owns all water rights in the lake.

The Department occasionally releases water from Becker Lake into the LCR across Highway 180/191, and diverts water back out of the LCR to be used for irrigation downstream on the Wenima Wildlife Area to maintain existing state water rights. This irrigation use occurs primarily during drier years, with no irrigation releases in better precipitation years. This irrigation use has occurred 5 years out of the last 10 years. Water is released through a large diameter (14-16") outlet pipe at the dam, flows through a similar diameter pipe to a control box and valve on the west side of Highway 180/191, then back into a pipe, under the highway, then into an open ditch and on to the LCR, approximately 0.2 miles from the lake, and approximately 1.3 miles downstream of the confluence with Nutrioso Creek. The valve at the control box as managed by the Department is only opened approximately 1 inch to release water, because of the large diameter of the pipe/valve, and water is typically released for approximately 5 days at a time, and no more than 2-3 times in a dry year. During years with good precipitation the valve is never opened. After the water is released into the LCR, another diversion on the LCR approximately 1.4 miles downstream of the return ditch from Becker Lake takes water back out of the river and into a combination piped and open ditch system on the Wenima Wildlife Area. This ditch/pipe splits after the diversion and runs for approximately 2 miles each, with one ditch on each side of the river. Water is taken out of this ditch to irrigate fields on each side of the river within the Wenima Wildlife Area. The ditch does not return to the LCR and all the diverted water soaks into the fields.

For a description of water continuity within the upper LCR, see the details within the Lyman Lake analysis, below.

Fish Movement

Stocked trout have the ability to swim up into the diversion ditch while water is running into the lake during the "fill season" from September 15 to April 15; however, a rock gabion fish barrier was constructed on the ditch 0.1 mile up from the lake to prevent trout from swimming up the ditch and into the LCR. This rock gabion structure is completely effective at preventing up-ditch movement of stocked trout. This barrier is not subject to the issues that have caused failures of other rock gabion barriers on Apache trout streams. Those issues were larger fish jumping over the barrier during high flow events, and tiny fish swimming through the interstitial spaces between the rocks in the barrier. The ditch where the barrier is located is not subject to the

flooding that occurs in natural streams, since water entering the ditch is controlled at the diversion. Plus, the ditch does not have a deep jump/plunge pool at the base of the barrier that facilitates large fish jumping over, because the flow in the ditch is constantly controlled and never great enough to erode a deep jump/plunge pool below the barrier. Small trout are not present in the size that can fit through the interstitial spaces in the barrier, since fingerling trout are no longer stocked, but only sub-catchables or catchables are stocked, and trout do not reproduce in the lake or in the ditch coming into the lake because the lake and ditch are silty with no suitable substrates.

Very small fish could escape the lake and into the LCR when water is occasionally released for irrigation use downstream via the outlet in the dam and pipe/valve/ditch to the LCR. However, the valve in the control box on the pipe coming from the lake is not opened more than 1 inch, because the large diameter of the pipe allows for passage of sufficient flow at that opening. This opening would not allow subcatchable or catchable size trout to escape through the valve without some level of physical harm. The outlet through the dam is located in shallow water, which would prevent trout from being near the outlet at the times when water is released. Trout feed in the shallows during the winter, spring and fall; however, they retreat to the deep water for the hot summer months to escape the warm water at the surface or in shallow water, and do not come into the shallows during those months. For these reasons, stocked fish are not likely to escape or survive if they escaped during an irrigation release.

Community Description
Becker Lake contains rainbow trout, green sunfish, Little Colorado sucker, fathead minnow, an occasional brown trout, and crayfish (Table 20).

Table 20. 5 Year survey history at Becker Lake with experimental gillnets.

Species	**2004**	**2005**	**2006**	**2007**	**2008**
Rainbow trout	171	30	58	16	29
Green sunfish	19				
LC sucker	10		1	1	
Brown trout	1				

The LCR in the vicinity of Becker Lake contains Little Colorado spinedace, Little Colorado sucker, bluehead sucker, speckled dace, fathead minnow, numerous crayfish, brown trout, and an occasional rainbow trout. Green sunfish are found in the LCR further downstream starting around the Wenima Wildlife Area. Spinedace have been documented in the LCR from just downstream of St. Johns upstream to Airport Road in Springerville. Spinedace are assumed to be present in the LCR at the location where the dam outflow enters the river, approximately 0.2 miles from the lake. Although that exact location has not been surveyed, recent surveys in 2009

found spinedace not far downstream and upstream of that location. The upstream range of Little Colorado spinedace is at Airport Road in Springerville. This most upstream location of spinedace is 0.2 miles downstream of the diversion dam that feeds the ditch leading to Becker Lake. A different water diversion that spans the entire width of the stream is located next to the Airport Road bridge and may be somewhat of a fish barrier to smaller fish, but not to trout. Surveys in 2009 found spinedace numerous below and up to this diversion, but no spinedace upstream of the diversion (see Table 23in the LCR in the Lyman Lake analysis). This location at the Airport Road Bridge is the furthest upstream verified record of spinedace in the LCR since 1938. Thus, if this diversion does act as a fish barrier, there is no potential for spinedace to get into the ditch flowing into Becker Lake.

Brown trout have been recorded regularly in the LCR from Wenima Wildlife Area, located a short distance downstream of Springerville, up to and above River Reservoir (see Table 24 in the LCR in the Lyman Lake analysis). A healthy population of wild brown trout is present in the upper reaches of the LCR above Springerville, mostly from a section of State Trust Land and above, where they likely reproduce. Brown trout, usually larger individuals, are consistently present but not in high numbers below this section of State Trust Land, where they don't appear to reproduce.

Rainbow trout have rarely been found in occupied spinedace habitat in the LCR. Three rainbow trout have been collected over years of survey, two in 1993 (Dorum and Young 1995) and one in 1999 (T. Robinson, pers. comm.). Occasional rainbow trout have been collected upstream of occupied habitat, but are not numerous and normally not found below the section of State Trust Land upstream of the Highway 261 bridge. In 2009, 1 rainbow trout was found at the Highway 260 bridge and State Land section above the Highway 261 bridge. Wild rainbow trout are established and reproducing in the upper reaches of the LCR just below River Reservoir. Rainbow trout likely do not reproduce in the LCR downstream of the South Fork LCR confluence.

Crayfish are numerous in the LCR from Springerville downstream to Lyman Lake and downstream from there.

Consultation Species or Critical Habitat
Potential impacts to Apache trout, Chiricahua and northern leopard frogs and little Colorado Spinedace are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for

determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Apache Trout

Catchable Apache trout and sub-catchable grayling would be stocked occasionally, only if there was a surplus of these species in the hatchery and another place was needed to stock them, or if the Department wanted to develop broodstock for these species. Stocked Apache trout are not expected to escape the lake and get into the Little Colorado River due to the presence of a gabion barrier at the ditch. Apache trout do not spawn in Becker Lake.

Potential Impacts

Stocked Apache trout co-stocked with other species:

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Chiricahua Leopard Frog

Local Analysis: Although Becker Lake and the LCR above Lyman buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Becker Lake is low because there are no historical records for Chiricahua leopard frogs at Becker Lake. The likelihood that Chiricahua leopard frogs could be exposed to fish stocked in other sites within the LCR above Lyman buffered stoking complex is also low. There are historical records for Chiricahua leopard frogs from 3 sites in the buffered complex; Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing (1979), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974). In addition, Chiricahua leopard frogs were released at Trinity Reservoir in 1996 by the Department as part of ongoing recovery activities (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Chiricahua leopard frogs were not observed during subsequent surveys at Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was adequately surveyed for frogs after the 1996 release and no frogs were observed after the 1997 field season (D. Groebner and Sredl pers.comm.). In addition, the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish make the habitat less suitable for leopard frogs.Therefore, it is likely that Chiricahua leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from stocking sites in the LCR above Lyman buffered stocking complex is low. The northernmost part of the LCR above Lyman buffered stocking complex is just outside of the range of the Chiricahua leopard frog, therefore further downstream in the LCR is outside of the range of the Chiricahua leopard frog. There are records for Chiricahua leopard frogs just south of the LCR above Lyman buffered stocking complex, but these sites are in different watersheds and it is not feasible for stocked fish in the LCR above Lyman buffered stocking complex to reach these areas and the likelihood of frogs traveling the overland distance to the headwater of the tributaries to the LCR is low. These Chiricahua leopard frog localities will be assessed in different complex documents.

Northern Leopard Frog

Local Analysis: Becker Lake and the LCR above the Lyman buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Becker Lake or elsewhere in the buffered stocking complex is high. There are records for northern leopard frogs from 2007-2009 just downstream of Lyman Lake,

which is within the LCR above Lyman buffered stocking complex (Drost, pers. comm.). Although there are no historical records for northern leopard frogs at Becker Lake, it is possible for frogs within the buffered stocking complex to be exposed to dispersing stocked fish. There are historical records for northern leopard frogs from 9 sites within the buffered stocking complex; Benny Creek (1979), Iris Spring (1979), LCR (Foot of Lyman Dam) (1935), LCR (Johnson Ranch) (1938), LCR (4.35 MI W of Eager) (1979), Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), Sheep Springs (1942), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974, 1979). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (1992 and 1995), Iris Spring (1992, 1995, and 1997), LCR (Foot of Lyman Dam) (1997), LCR (Johnson Ranch) (1997), Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), Sheep Springs (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed and it is likely that northern leopard frogs no longer occupy the sites mentioned above, the recent observations by Charles Drost show that northern leopard frogs currently occupy the area below Lyman Lake dam (Drost, pers. comm.). In addition, this is the last known extant population of northern leopard frogs in the upper LCR drainage and it is thought to be declining (Drost, pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the LCR above Lyman buffered stocking complex is low. There are records from 2007-2009 for northern leopard frogs just below Lyman Lake within the LCR above Lyman buffered stocking complex and the likelihood that these frogs would be exposed to stocked sport fish in the buffered stocking complex is high (Drost, pers. comm.). However, there is only 1 other record downstream in the LCR at Salado Springs for northern leopard frogs (1939), but frogs were not observed at this site in 1997 and it is likely that northern leopard frogs no longer occupy this area or further downstream in the LCR or its tributaries (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Little Colorado Spinedace and Critical Habitat

Little Colorado spinedace do not appear to be able to enter the lake through the Department's water diversion from the LCR. Another water diversion structure located approximately 0.2 miles downstream of the Department's diversion spans the entire river and appears to be a fish barrier to upstream movement for smaller fishes. Spinedace are currently not found upstream of the lower diversion and are not present at the site of the Department's diversion The nearest documented occurrence of spinedace to Becker Lake is approximately 0.2 miles away overland, but indirectly connected to the lake.

Designated critical habitat is located approximately 8 miles away upstream in Nutrioso Creek where the outflow of water from the Becker dam, via the pipe/ditch, enters the LCR approximately 1.3 miles downstream of the confluence with Nutrioso Creek. Constituent elements for all areas of critical habitat include clean, permanent flowing water with pools and a fine gravel or silt-mud substrate (FWS, 1987; Federal Register Rule to Determine LC Spinedace to be a Threatened Species with Critical Habitat).

Potential Impacts

The proposed stocking activity is unlikely to have direct impacts on the Little Colorado spinedace. Stocked trout and grayling are not able to escape from Becker Lake and impact Little Colorado spinedace that exist in the LCR. A rock gabion fish barrier was constructed on the diversion ditch, just upstream of the lake, to prevent trout stocked in Becker Lake from swimming upstream in the ditch to the LCR. In addition, when filling the reservoir, the total control of water coming in is manually controlled, and the reservoir is not allowed to spill. There is no natural drainage or watershed that drains into the lake, and the diversion ditch is the only significant source of water. The lake does not spill due to the manual control of the inflow. Some water is released directly into the LCR for irrigation downstream during the summer months of dry years; however, the location of the outlet structure and operation of the valve on the outlet pipe (see description in earlier text) would make it unlikely for a trout to escape the lake through this route.

Surveys in the LCR have found only 3 rainbow trout within spinedace occupied habitat, two in 1993 and one in 1999 (T. Robinson pers.comm.) all within the Wenima Wildlife Area, approximately 2.1 miles downstream of the outlet flow into the LCR. These trout could have come from Becker Lake during a period of operating the lake differently and allowing it to spill, or they could have come from stockings further upstream in the LCR at South Fork, the Greer lakes, or wild fish in the upper LCR. Rainbow trout were stocked annually in the South Fork LCR, very near the confluence with the mainstem LCR, up through 1993. That stocking location was discontinued after 1993. Unusually high flows during the spring of 1993 could have washed some of these stocked trout downstream from this old stocking location; such high flows are not be expected to occur on a regular basis. Rainbow trout are stocked annually in the Greer lakes, which release water for irrigation use in Springerville. Plus, a healthy population of wild rainbow trout exists in the LCR from the National Forest boundary up to River Reservoir.

The trout in 1993 could possibly also have come up from Lyman Lake. Lyman Lake is approximately 17 miles downstream of Wenima Wildlife Area. Trout were stocked up to 1996 in Lyman Lake, after which rainbow trout stocking was discontinued.

It is unlikely that a spinedace would enter the lake through the diversion ditch because they are not present at that diversion site, only downstream from it and an additional irrigation.

Critical Habitat

No impacts to critical habitat are anticipated because stocked trout and grayling are not able to escape from Becker Lake and move into designated critical habitat.

Lyman Lake

Site Description

Lyman Lake is a 1400 acre lake impounded on the LCR at an elevation of 5978 feet, approximately 15 miles south of St. Johns. The dam forming Lyman Lake was constructed in 1910 and was rebuilt in 1920 and 1949. The lake has a maximum depth of 57 feet and an average depth of 22 feet when full. The water rights are owned by Lyman Irrigation and water is released for irrigation use downstream. Lyman Lake is filled by the LCR, which is perennial from the lake upstream to the headwaters on Mt. Baldy. However, the lake is rarely full and does not often spill; the last time was 1993, and then only slightly. The size of the lake is usually much smaller than identified on maps. Although it does not spill on an annual basis, water is released directly into the LCR downstream of the lake and also into a diversion ditch. Access to the lake year-round is by paved road (Highway 180/191) and through Lyman Lake State Park, although other parts of the lake is located on State Trust, BLM, and private lands. The state park offers campsites, a store, boat launch, fish cleaning station, and swimming area. Lyman Lake is also the only lake in this area that allows water skiing because no motor restrictions are in effect.

Management of Water Body

The primary objective is to manage Lyman Lake as a naturally reproducing warm-water fishery. Although there appears to be natural reproduction of channel catfish occurring, growth is extremely slow and recruitment to catchable size may not be enough to sustain a good fishery. Channel catfish and rainbow trout have not been stocked in the last 14 years, with the last stocking in 1996 (Table 21). However, fishing has not been good since then. The secondary objective is to manage a put-and-take coldwater fishery on an opportunistic basis if conditions were suitable.

The conditions at Lyman Lake are not currently suitable for trout or a coldwater fishery. The water is perpetually turbid, mostly due to numerous carp in the lake, which has reduced primary productivity significantly. With very little primary productivity, the zooplankton, which is the main food for reservoir trout, occur at very low levels. Angler creel surveys in 1996 documented only a 2% return to creel of the 5,000 catchable size trout stocked into Lyman Lake, thus, the Department has not stocked rainbow trout since then. However, the lake was drained in 1990-1991 to repair the dam, which reduced the carp population. Water quality and productivity was very good for several years and supported a good trout fishery. The water quality, productivity, and suitability for coldwater fishery crashed in the mid 1990s as the carp population expanded to original levels.

Table 21. Stocking history for Lyman Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1978	1978	1	20,000
Bluegill	1935	1992	5	14,493
Brown trout	1953	1968	8	219,026
Channel catfish	1965	1996	29	1,733,973
Cutthroat trout	1952	1966	4	369,000
Fathead minnow	1978	1978	1	40,000
Largemouth bass	1935	1991	8	40,445
Northern pike	1967	1973	8	303,118
Rainbow trout	1952	1996	112	3,278,295
Redear sunfish	1979	1979	1	15,000
Bullfrog tadpole	1967	1967	1	5,000
Threadfin shad	1959	1959	1	750
Walleye	1973	1984	6	3,250,000
Yellow perch	1979	1979	1	100,000
Total			186	9,389,100

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies the management emphasis for Lyman Lake as warm water sport fishery, with a desired fish assemblage of channel catfish, largemouth bass, bluegill, walleye, black crappie, and Little Colorado sucker.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked year round, if the water quality and lake conditions are suitable; numbers of trout may be from 0 to 10,000 annually.

Water Distribution / Connectivity

The LCR draining into Lyman Lake is perennial from the lake upstream to the headwaters of the West and East Forks of the LCR, approximately 48 miles upstream on Mt. Baldy. Coyote Creek enters the LCR several miles upstream of Lyman Lake. The lower 39 miles of Coyote Creek is normally dry, with the only perennial water located upstream of a constructed fish barrier at the lower end of the perennial reach, upstream from Pratt lake. A large water diversion structure is located in the LCR approximately 17 miles upstream of Lyman Lake at the bottom end of Round Valley, just downstream of Springerville. This diversion structure is approximately 4-5 feet tall and is likely a fish barrier to upstream movement for some species. Nutrioso Creek enters the LCR approximately 1.5 miles upstream of the diversion structure, but is usually dry in its lower reaches. Nelson Reservoir dam is located on Nutrioso Creek approximately 13.0 miles upstream

of the LCR and is a barrier to upstream movement of fish. Permanent water is found within the several miles just downstream of the reservoir. Rudd Creek, a tributary of Nutrioso Creek, is located about 1.2 miles downstream of the Nelson Reservoir dam with a culvert fish barrier located 3.1 miles upstream of Nutrioso Creek.

Upstream of Nutrioso Creek, the LCR flows through the Town of Springerville, which has a number of smaller water diversion structures. A large water diversion structure is located approximately 10.1 miles upstream of the confluence with Nutrioso Creek, and is likely a fish barrier for some species. Perennial South Fork LCR flows into the mainstem LCR approximately 1.3 miles upstream of the large diversion structure. A constructed fish barrier is located on the South Fork LCR for Apache trout recovery 0.9 miles upstream of the confluence with the LCR. Upstream of the South Fork confluence is River Reservoir dam, which is a barrier to upstream movement. Between the South Fork and River Reservoir, two smaller tributaries, Fish Creek and Hall Creek, flow into the LCR. Fish Creek is often dry in its lower reaches. Hall Creek is perennial in its lower reaches, but is blocked by a private dam several miles upstream. Additional discussion on this area is provided in the West Fork LCR Complex section.

Lyman Lake rarely spills. The last spill event was in 1993 during an extreme flood event, and even then the lake barely spilled a couple inches over the spillway (according to Lyman Lake Irrigation Company board members). Prior to that small spill event, the irrigation board members could not remember how long it had been since it had spilled. Water is released for irrigation during the irrigation season April 15 to September 15 directly into the river below the dam and then is diverted downstream in St. Johns for irrigating pastures for cattle grazing. Irrigation releases are also made directly into a large irrigation ditch that starts immediately below the dam. Some permanent water does exist upstream of St. Johns that supports native fishes, but the LCR is often dry just downstream of St. Johns, as confirmed by a survey on July 10, 2009. In this area, a channel is barely noticeable and was dry at the time of that July survey because water released from Lyman for irrigation is all diverted by the time it reaches St. Johns. Thirty-one miles downstream of Lyman Dam is Zion Reservoir, which is more of a marshy area than a reservoir and is often dry. The LCR downstream of Zion Reservoir is ephemeral for the next 54.2 miles to the confluence with Silver Creek. Silver Creek is perennial in its lower reaches; however, the Woodruff Dam on Silver Creek just up from the confluence is a barrier to upstream movement of fish into Silver Creek. From the confluence with Silver Creek, the LCR is alternately ephemeral with several locations of permanent pools downstream for 51.1 miles to the confluence with Chevelon Creek. Chevelon Creek is perennial, but has a diversion dam structure located 1.7 miles upstream of the confluence that would be a barrier to fish movement upstream. The LCR is then perennial for 9.1 miles to the confluence with Clear Creek, then perennial for another dozen miles where it sinks into the sand at base flows.

During extreme summer monsoon events, the LCR may flow through much of its length directly below the reservoir to St. Johns. Irrigation releases also may support this surface flow but only during the irrigation season. Snowmelt runoff from the Zuni River and the Rio Puerco River (both of which are normally dry) and from Silver Creek, Chevelon Creek, and Clear Creek, would cause the LCR to flow continuously down to the Colorado River approximately 297 miles downstream of Lyman Lake.

Fish Movement

Fish have the opportunity to move upstream from Lyman Lake into the LCR because of the perennial flow, but also during flooding. There is no known barrier to upstream movement until the large diversion structure at the bottom end of Round Valley, just downstream of Springerville, and 17 miles upstream of Lyman Lake. This structure is 4-5 foot tall and may not prevent large trout from moving upstream during a high flow event. The next barrier to upstream movement would be another large diversion structure upstream of the Highway 261 bridge, on a section of State Trust land, 28.6 miles upstream of Lyman Lake. This structure is definitely a barrier to upstream movement for catfish, and likely for trout, but it may be possible for large trout to get past it during extreme high flow events (Mike Lopez, pers.observation). Several other low flow diversions exist on the LCR through Springerville. The River Reservoir dam is the ultimate barrier to upstream movement.

Stocked trout are not likely to go downstream over the Lyman Lake spillway because it rarely spills. However, water is released downstream for irrigation, of which most is diverted into fields above and around St. Johns. Some permanent water does exist upstream of St. Johns that supports native fishes. Flood flows could theoretically carry fish downstream to the Colorado River; however, this is a long distance through mostly intermittent habitat. Some perennial water is located for a short distance downstream of Silver Creek, a short reach just upstream of Holbrook, and about a dozen miles downstream of Chevelon Creek, which could hold a fish moving downstream. Otherwise a fish would have to make the entire journey all in one flood season. Woodruff Dam on Silver Creek, a large diversion structure on Chevelon Creek, and Clear Creek Reservoir dam on Clear Creek are all barriers to upstream movement of fish within those tributaries.

Trout have the ability to move upstream long distances and are known to be able to jump over obstacles that would prevent the movement of other fish.

Community Description

Lyman Lake contains largemouth bass, green sunfish, bluegill, channel catfish, carp, fathead minnow, walleye, crayfish and occasionally northern pike, all of which naturally reproduce in the reservoir (Table 22). Trout have not been documented in Lyman Lake since it was last stocked in

1996 and do not reproduce in the reservoir or in the river as it comes into the lake. The LCR is too warm and silty at this point, unsuitable for spawning salmonids.

Table 22. Survey history for Lyman Lake with experimental gill nets.

Date	Species	Number Collected	Size range (mm TL)
May 2008	Carp	41	310-533
	Channel catfish	19	325-505
	Green sunfish	7	70-213
	Largemouth bass	1	332
	Walleye	13	451-536
May 2003	Carp	5	213-580
	Channel catfish	30	245-449
	Green sunfish	15	130-191
	Largemouth bass	4	229-424
	walleye	1	600
April-May 2002	Carp	3	378-496
	Channel catfish	6	306-640
	Largemouth bass	2	195-445
	walleye	1	660
April 2001	Carp	7	442-477
	Channel catfish	26	215-420
	walleye	1	575
May 2000	Carp	2	422-444
	Channel catfish	46	220-428
	walleye	1	502

The LCR upstream and downstream of Lyman Lake contains Little Colorado spinedace, bluehead sucker, Little Colorado sucker, speckled dace, carp, green sunfish, fathead minnow, and numerous crayfish. Plains killifish is also present downstream of the reservoir. Herpetological surveys have documented Northern leopard frogs immediately below Lyman Lake dam, and painted turtles further downstream near Salado Springs.

In numerous years of survey, no rainbow trout has been collected in the LCR near Lyman Lake. The closest record for rainbow trout in the LCR is about 14 miles upstream at the Wenima Wildlife Area bridge where 2 were caught in 1993 (Dorum and Young 1995) and 1 in 1999 (T. Robinson, per. com). However, these may have more likely come from closer sources upstream like Becker Lake, when it was allowed to spill, River Reservoir, wild populations in the upper LCR, or from private ponds in the Springerville area.

There is one record of channel catfish in the LCR upstream of Lyman Lake where 2 fish were reported in the Springerville area in 1991 (Table 23). This record is an error; the collection actually occurred downstream of Lyman Lake at the Hwy 666/191 bridge area in St. Johns.

These fish may have been from Lyman Lake, or from Little Reservoir, which is a private off-channel reservoir connected to the LCR just upstream of this collection site, and is known to have had channel catfish when historically managed by the state.

Table 23. Summary of recent (2006-09) surveys in the LCR upstream of Lyman Lake, with closest locations to the lake listed first and farthest locations upstream listed last.

Date	Location and survey gear	Species collected	Num.
6/30/2008	Wiltbank property Backpack electroshocker, 1/8” mesh seines	Little Colorado spinedace Little Colorado sucker Speckled dace Fathead minnow Green sunfish Unidentified sucker fry	36 94 55 676 50 8
6/30/2008	Nielson property Backpack electroshocker, 1/8” mesh seines	Little Colorado spinedace Little Colorado sucker Bluehead sucker Fathead minnow Green sunfish Unid sucker fry	3 43 7 1,510 114 50
8/3/2009	Richville Valley Backpack electroshocker	Little Colorado sucker Bluehead sucker Fathead minnow Green sunfish	2 2 43 12
8/3/2009	The Corral Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow	27 9 79 7 23
7/30/2009	Wenima Wildlife Area – lower Slade Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow	75 22 108 67 48
7/30/2009	Wenima Wildlife Area – upper Slade Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Green sunfish Unidentified fry	50 12 99 55 55 2 1
7/29/2009	Wenima Wildlife Area – Fence Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace	70 20 104

Date	Location and survey gear	Species collected	Num.
		Bluehead sucker Fathead minnow Brown trout Unidentified sucker fry	57 109 3 1
7/9/2009	Wenima Wildlife Area – Bridge Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout Green sunfish Unidentified sucker fry Unidentified fry	46 8 85 16 64 2 2 2 4
7/30/2009	Wenima Wildlife Area – upper end Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout Green sunfish	22 7 94 9 29 3 101
6/11/2009	Rest Area Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout	16 30 196 25 39 1
4/18/2007	Downstream of Wastewater Treatment Backpack electroshocker	Little Colorado sucker Speckled dace Fathead minnow	1 198 102
6/10/2009	Becker Wildlife Area - #1 1/8” mesh seine	Little Colorado spinedace Speckled dace Bluehead sucker Fathead minnow	21 20 2 15
7/8/2009	Becker Wildlife Area - #1 Backpack electroshocker, 1/8” mesh seine	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Unidentified fry	55 5 139 22 87 2
7/8/2009	Becker Wildlife Area - #2 Backpack electroshocker, 1/8” mesh seine	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker	30 9 30 2

Date	Location and survey gear	Species collected	Num.
		Fathead minnow Unidentified sucker fry Unidentified fry	41 1 7
7/8/2009	Becker Wildlife Area - #3 Backpack electroshocker, 1/8” mesh seine	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow	5 3 52 5 13
3/22/2007	Becker Wildlife Area 1/8” mesh seine	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout	80 6 154 11 321 1
6/11/2009	Airport Road – below diversion Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout	50 20 142 8 123 2
6/11/2009	Airport Road-above diversion Backpack electroshocker	Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow	3 3 4 7
4/12/2007	Above Airport Road Backpack electroshocker	Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout	3 139 3 94 3
6/10/2009	Hwy 260 Bridge Backpack electroshocker	Speckled dace Bluehead sucker Fathead minnow Brown trout Rainbow trout	89 1 4 1 1
6/10/2009	Hwy 261 Bridge Backpack electroshocker	Speckled dace Bluehead sucker Fathead minnow Brown trout	109 5 18 2
6/10/2009	State Land Section 16 Backpack electroshocker	Little Colorado sucker Speckled dace Brown trout Rainbow trout	1 63 1 1
11/6/2007	State Land Section 16	Little Colorado sucker	6

Date	Location and survey gear	Species collected	Num.
	Backpack electroshocker	Speckled dace Bluehead sucker Brown trout	1,166 9 51
4/4/2006	USFS downstream of Fish Creek Backpack electroshocker	Speckled dace Brown trout Rainbow trout	9 164 19
4/4/2006	USFS between Fish Ck. and River Res. Backpack electroshocker	Brown and rainbow trout Speckled dace	225 6

Two channel catfish have also been recorded in the LCR downstream of Lyman Lake near Woodruff, in 1994. These could have come from Lyman Lake or from White Mountain Lake on Silver Creek, which flows into the LCR just upstream of Woodruff. An additional 5 channel catfish were collected in the LCR at Winslow in 2007. These fish were most likely from Clear Creek Reservoir or from lower Chevelon Creek, where channel catfish are naturally reproducing.

Table 24. Summary of recent (2007-09) surveys in the LCR downstream of Lyman Lake.

(closest locations to the lake are listed first and farthest locations downstream listed last).

Date	Location	Species collected	Num.
8/10/2009	Downstream of Salado Springs #1 Backpack electroshocker	Common carp	2
8/10/2009	Downstream of Salado Springs #2 Backpack electroshocker	Common carp	1
8/10/2009	Downstream of Salado Springs #3 Backpack electroshocker	Common carp Green sunfish Fathead minnow	1 1 3
4/10/2007	Downstream of Salado Backpack electroshocker	Fathead minnow Green sunfish Plains killifish Common carp	6 1 2 1
7/28/2009	Carl Pew property #1 Backpack electroshocker	Little Colorado spinedace Little Colorado sucker Speckled dace Fathead minnow Green sunfish Plains killifish Unid. fry	21 5 1 9 1 1 5
7/28/2009	Carl Pew property #2 1/8” mesh seine	Fathead minnow Plains killifish	5 9
7/28/2009	Carl Pew property –adobe house Backpack electroshocker, 1/8” mesh seine	Little Colorado sucker Fathead minnow Plains killifish	1 19 10
7/10/2009	Carl Pew property #4	Little Colorado spinedace	1

Date	Location	Species collected	Num.
	1/8” mesh seine	Fathead minnow Plains killifish	9 4
7/10/2009	Carl Pew property #5 1/8” mesh seine	Little Colorado spinedace Fathead minnow	2 6
7/10/2009	St. Johns-upstream of Hwy 191 Bridge 1/8” mesh seine	Fathead minnow Common carp Green sunfish	5 2 1
6/17/2009	Silver Creek confluence 1/8” mesh seine	Little Colorado sucker Fathead minnow Common carp Yellow bullhead	7 14 4 21
6/17/2009	Downstream of Woodruff 1/8” mesh seine	Fathead minnow	38
6/17/2009	Holbrook	Dry	-
5/14/2007	Holbrook Backpack electroshocker	Fathead minnow	1
4/25/2007	Holbrook 1/8” mesh seine	Fathead minnow Plains killifish	10 1
6/17/2009	Winslow – upstream of I-40 1/8” mesh seine	Little Colorado sucker Plains killifish Fathead minnow Red shiner Unid. fry	4 104 39 22 1
7/11/2007	Winslow – downstream of I-40 1/8” mesh seine	Fathead minnow Green sunfish Plains killifish Bluegill Channel catfish Red shiner	703 1 1,587 1 5 10

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua leopard frog

Local Analysis: Although Lyman Lake and the LCR above Lyman buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Lyman Lake is low. The likelihood that Chiricahua leopard frogs could be exposed to fish stocked in other sites within the LCR above Lyman buffered stoking complex is also low. There are no historical records for Chiricahua leopard frogs at Lyman Lake. There are historical records for Chiricahua leopard frogs from 3 sites within the buffered stocking complex; Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974). In addition, Chiricahua leopard frogs were released at Trinity Reservoir in 1996 by the Department as part of ongoing recovery activities (AGFD Riparian Herpetofauna Database, M. Sredl per. Comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was adequately surveyed for frogs after the 1996 release and no frogs were observed after the 1997 field season (D. Groebner and Sredl pers.comm.). In addition, the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish make the habitat less suitable for leopard frogs.Therefore, it is likely that Chiricahua leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from stocking sites in the LCR above Lyman buffered stocking complex is low. The northernmost part of the LCR above Lyman buffered stocking complex is just outside of the range of the Chiricahua leopard frog, therefore further downstream in the LCR is outside of the range of the Chiricahua leopard frog. There are records for Chiricahua leopard frogs just south of the LCR above Lyman buffered stocking complex, but these sites are in different watersheds and it is not feasible for stocked fish in the LCR above Lyman buffered stocking complex to reach these areas and the likelihood of frogs traveling the overland distance to the headwater of the tributaries to the LCR is low. These Chiricahua leopard frog localities will be assessed in different complex documents.

Northern Leopard Frog

Local Analysis: Lyman Lake and the LCR above Lyman buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Lyman Lake or elsewhere in the buffered stocking complex is high. Although there are no historical records for northern leopard frogs at Lyman Lake, there are records for northern leopard frogs from 2007-2009 immediately downstream of Lyman Lake. (Drost, pers. comm.). There are historical records for northern leopard frogs from 9 sites within the buffered stocking complex; Benny Creek (1979), Iris Spring (1979), LCR (Foot of Lyman Dam) (1935), LCR (Johnson Ranch) (1938), LCR (4.35 MI W of Eager) (1979), Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), Sheep Springs (1942), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974, 1979). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (1992 and 1995), Iris Spring (1992, 1995, and 1997), LCR (Foot of Lyman Dam) (1997), LCR (Johnson Ranch) (1997), Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), Sheep Springs (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed and it is likely that northern leopard frogs no longer occupy the sites mentioned above, the recent observations by Charles Drost show that northern leopard frogs currently occupy the area below Lyman Lake dam (Drost, pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the LCR above Lyman buffered stocking complex is low. There are records from 2007-2009 for northern leopard frogs just below Lyman Lake within the LCR above Lyman buffered stocking complex and the likelihood that these frogs would be exposed to stocked sport fish in the buffered stocking complex is high (Drost, pers. comm.). However, there is only 1 other record downstream in the LCR at Salado Springs for northern leopard frogs (1939), but frogs were not observed at this site in 1997 and it is likely that northern leopard frogs no longer occupy this area or further downstream in the LCR or its tributaries (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Little Colorado Spinedace and Critical Habitat

Little Colorado spinedace has been documented as occurring within the LCR above and below Lyman Lake as recently as 2009. Spinedace occupy the LCR from Lyman Lake upstream to the Airport Road in Springerville and the LCR from Salado Springs downstream to St. Johns. Critical and occupied habitat is found in Nutrioso Creek approximately 22 miles upstream of the Lyman Lake, and in Chevelon Creek approximately 100 miles downstream of Lyman Lake, and

in East Clear Creek, about 105 miles downstream of Lyman Lake and 45 miles up East Clear Creek past the confluence.

Potential Impacts

The proposed stocking activity could have potential direct and/or indirect impacts on the Little Colorado spinedace. Stocked rainbow trout have the ability to swim upstream into the LCR, where they would not have to travel far to reach occupied spinedace habitat immediately above the lake. Predation could occur on adult and juvenile Spinedace, larvae and eggs. Stocked trout could potentially compete for food and space (refer to the interactions discussion in Chapter 4).

There is also potential for fish to move into the LCR below the lake through irrigation releases during the summer months. Trout do not reproduce in the lake or in the LCR at that elevation.

Spinedace could disperse downstream into the lake from occupied habitat just upstream and be eaten by a stocked trout. However, multitudes of other non native sport fish, including largemouth bass, bluegill, green sunfish, black crappie, walleye, an occasional pike, and channel catfish that are self sustaining in the lake, would likely prey upon a dispersing spinedace.

The assembledge of non native sport fish in Lyman Lake reduce the potential for connectivity between spinedace populations above and below the lake. Spinedace could never get up over Lyman dam, but would have the potential of dispersing downstream through Lyman Lake if the predators were not there. However, predation by stocked trout would be low in comparison to predation potential by the many other non-stocked sport fish.

Spinedace critical habitat in Nutrioso Creek, Chevelon Creek, and East Clear Creek has little potential to be impacted by stocked fish in Lyman Lake. The creek immediately downstream of the lake is consistently wet, but it is not likely stocked fish would survive the travel past this reach through a consistently dry reach and access critical habitat in Chevelon Canyon over 100 miles away. Stocked trout are also unlikely to migrate upstream out of the reservoir, over the large water diversion barrier, and into Nutrioso Creek, past sections that are typically dry, and into Little Colorado spinedace critical habitat over 22 miles upstream from the reservoir. Rainbow trout have been recorded in Nutrioso Creek downstream of Nelson Reservoir but these fish or their progeny probably originated from upstream sources such as Nelson Reservoir. In addition, there were no Primary Constituent Elements identified when critical habitat was designated for spinedace; however, several types of activities were identified that would be considered an impact to critical habitat. These included any activity that would deplete the flow, lessen the minimum flow, or significantly alter the natural flow regime; any activity that would extensively alter the channel morphology; or any activity that would extensively alter the water chemistry. An escaped stocked trout would not contribute to any of these activities, directly or indirectly, even if they were to reach critical habitat.

Carnero Lake

Site Description

Carnero Lake is a 65 acre headwater impoundment of Carnero Creek on the Apache-Sitgreaves National Forest. The lake is located at an elevation of 9033 feet, approximately 8 miles northwest of Greer. Carnero Lake is a closed system with no hydrologic connection to this complex, LCR, or other natural system. Originally, Carnero Creek flowed towards and into the LCR a short distance upstream of Lyman Lake; however a permanent diversion on the creek below Carnero Lake diverts all flow into an irrigation ditch system and it never reaches the LCR.

Management of Water Body

Primary fishery is a cold water put-grow-and-take rainbow trout fishery in spring through fall, with focus on a blue ribbon experience when the lake does not winter kill. Sub-catchable and catchable rainbow trout are stocked several times in a short period in the spring and early summer.

The lake is very shallow, with a maximum depth of 10 feet, and grows extensive aquatic macrophytes. These conditions result in elevated pH levels for much of the summer and often into the fall, limiting the timeframe to stock the lake. The weed beds are very extensive along the shorelines, even at the road access location, making it even more difficult to stock the lake from a hatchery truck. The shallowness also makes the lake very productive, growing very large trout. For these reasons, the regulations on Carnero Lake consist of artificial lure and fly only with barbless hooks, and a 2 fish limit, to keep the fish in the lake without frequent restocking and to provide a quality fishery for the anglers willing to navigate the weeds.

The shallow features and the extensive weed growth have lead to frequent fish kills. In the recent stocking history, the lake has winter killed in 2004, 2007, and 2008. Rainbow trout do not reproduce in the reservoir.

Carnero Lake has a short history as a sport fishery. The water rights were previously entirely owned by private parties and the lake was nearly drained on a regular basis. The lake was stocked in 1979-1981, then not again until 2003-2008 when the Department acquired approximately 75% of the water rights (Table 25).

Carnero Lake is accessed by an all-weather road, Forest Road 117A, via Forest Roads 117 or 118, typically from April through November. There is a dirt parking lot on the west side of the lake. There are no boat ramps, restrooms, or developed camping/picnic facilities at the lake. Primitive camping is allowed at the lake. The lake ices over and the lake is accessible by snowmobile during the winter months. The lake receives very little ice fishing use because of the artificial lure and fly-only regulations.

Table 25. Stocking history for Carnero Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1980	1980	1	15,000
Rainbow trout	1979	2009	18	72,758
Total			19	87,758

The entrance road is the main access to the lake. Most spur roads have been closed to vehicle use to help control damage and erosion. Only one spur road exists to the spillway/headgate location, but this road is very rough and not used much by the public. Boat motors on the lake are restricted to electric motors only. Because of the extensive aquatic macrophyte growth on the lake, anglers typically use inflatable pontoon boats or canoes.

There have been no creel surveys conducted on Carnero Lake.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identified the management emphasis for Carnero Lake as Blue Ribbon sport fish, which is consistent with the proposed action.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked from April to June each year; numbers of rainbow trout stocked may be from 0 to 20,000 fish annually.

Water Distribution / Connectivity

Carnero Lake is considered a closed system. Carnero Lake's principal water sources are runoff from its small 6 mile watershed and Carnero Spring above the lake. Carnero Creek is perennial from Carnero Spring into the lake but contains no fish because of its very small size. No fish are present other than stocked species. The creek below the lake runs regularly from spill out of the lake in the spring, seepage through the earthen dam, and irrigation releases in the summer to a point approximately 2 miles east of the lake. At that point the entire flow of the small (base flow of 1 cfs) creek is diverted into a manmade drainage system used for irrigation, additional storage, and numerous stock ponds. Once diverted, this water has no connection to the LCR and there is no return flow to Carnero Creek, and therefore the system is considered closed. The diversion on Carnero Creek is very large, 4.5 to 5 feet tall and captures all flow, constantly, even during heavy flood events. Since the Carnero Lake drainage is so small, the flows down to the diversion are relatively small even during extreme events, which occur primarily during the winter and snow melt. The 16.6 miles of Carnero Creek downstream of the diversion to the LCR is normally dry. The middle and lower portion of Carnero Creek runs only during extreme flood events, but with water from other parts of the watershed and not from the flow from Carnero Lake. Brian

Crawford, Wildlife Area Manager for Department Wildlife Areas around Springerville has ridden horseback along the entire drainage during extreme events and reports a fair amount of water flowing in the lower section but coming in from the numerous tributaries of Carnero Creek below the diversion. He has stated that flows coming downstream from Carnero Lake would never breach the diversion because of its size. In the very extreme case that the diversion is breached, it is very unlikely that a live fish would travel downstream to the LCR from Carnero Lake. Carnero Lake experiences frequent fish kills, which are related to the winter precipitation levels. A recent project investigating winter kills in high elevation lakes, including Carnero Lake, shows that winter kills are closely related to the amount of snowpack on top of the ice cover during the winter. A small amount or no snow allows some light penetration and phytoplankton/macrophyte photosynthesis that would support fish through the winter. However, a deep snowpack blocks almost all sunlight, resulting in no photosynthesis under the ice and a rapid depletion of oxygen. An extreme snowpack that would be required for extreme flood flows down upper Carnero Creek would cause a fish kill prior to those high spring flows.

Water can be released from Carnero Lake through a headgate into upper Carnero Creek, and all flow is diverted out into the ditch system described above for the operation of a spinedace refuge pond on the Grasslands Wildlife Area, and for irrigation on the wildlife area and cattle use on private property. The Department holds approximately 75% of the water rights, with the other 25% privately owned by local ranchers. When the lake is full, the spill follows the same path as the released irrigation water, with the diversion operating year round. The lake spills regularly during good precipitation years, and water is released annually for irrigation during the summer months.

Fish Movement

Stocked trout may be able to swim up the very short distance to the spring during spring runoff, but would not persist there because of the very low flows in the summer months. They could also leave the reservoir and into upper Carnero Creek when it spills, which is never very extensive, or when water is released for irrigation use downstream only to get diverted into the irrigation ditch at the diversion structure along with all the flow from the lake. Once in the ditch system, they could potentially spread throughout the irrigation system but would not persist because of the mostly shallow features of the ditch system and lack of water when not actively irrigating. The sand filter located on the pipeline leading to a Little Colorado spinedace refuge pond on the Grasslands Wildlife Area would keep all fish from reaching the refuge pond.

Carnero Lake is considered a closed system because the water in the lake and associated fish are not hydrologically connected to the LCR or its tributaries.

Community Description

Carnero Lake contains stocked rainbow trout and tiger salamander. No other fish species or crayfish are found in the lake. Fathead minnow exist in the lower ditch system and most of the stock ponds, most likely introduced into the ponds to control mosquitoes. Stocked trout only persist in Carnero Lake until there is an extensive fish kill. They are not known to reproduce in the lake or persist in the ditch system or spring. Table 26 provides a summary of recent fish surveys at Carnero Lake.

Table 26. Survey History of Carnero Lake with experimental gillnets.

Date	*Species collected*	*Number Collected*	*Size Range (mm TL)*
April 2008	*No fish*	-	-
April 2007	*No fish*	-	-
October 2006	*Rainbow trout*	*17*	*233-596*
May 2005	*Rainbow trout*	*66*	*308-501*
April 2004	*No fish*	-	-

Several surveys at the Grasslands Wildlife Area spinedace refuge pond have documented only spinedace for fish species, confirming that the sand filter is successful in keeping non native fish from entering the refuge from the irrigation ditches. Table 27 provides a recent survey history of the refuge pond. The surveys have also documented tiger salamander and wandering gartersnake.

Table 27. Survey history at the Grasslands Wildlife Area spinedace refuge pond.

Date	Survey gear	Species	Number collected/observed
October 2007	Hoop nets, minnow traps	Little Colorado spinedace Tiger salamander	1 Numerous
April 2008	Seine	No fish collected or observed No herps collected or observed	-
July 2009	Bank visual	Little Colorado spinedace Tiger salamander Wandering gartersnake	7 Abundant 20
July 2009	Snorkel	Little Colorado spinedace Tiger salamander	20 Abundant
July 2009	Hoop nets, minnow	Little Colorado spinedace	9

Date	Survey gear	Species	Number collected/observed
	traps	Tiger salamander Wandering gartersnake	3 2

Consultation specie or Critical habitat
Carnero Lake is considered a closed system with no aquatic species of concern in the area for analysis. Chiricahua and Northern leopard frogs were analyzed and discussed below. The lake is within Mexican spotted owl designated critical habitat and discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua leopard frog
Local Analysis: Although Carnero Lake and the LCR above Lyman buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Carnero Lake is low because there are no historical records for Chiricahua leopard frogs at Carnero Lake and it is a closed system. The likelihood of frogs being exposed to fish stocked in other sites within the LCR above Lyman buffered stocking complex is also low. There are historical records for Chiricahua leopard frogs from 3 sites in the buffered complex; Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974). In addition, Chiricahua leopard frogs were released at Trinity Reservoir in 1996 by the Department as part of ongoing recovery activities (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at Nelson Reservoir (SE Corner) (1987, 1992, 1993, and

1995), Nutrioso Creek (Correjo Crossing) (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was adequately surveyed for frogs after the 1996 release and no frogs were observed after the 1997 field season (D. Groebner and Sredl pers.comm.). In addition, the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish make the habitat less suitable for leopard frogs.Therefore, it is likely that Chiricahua leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from stocking sites in the LCR above Lyman buffered stocking complex is low. The northernmost part of the LCR above Lyman buffered stocking complex is just outside of the range of the Chiricahua leopard frog, therefore further downstream in the LCR is outside of the range of the Chiricahua leopard frog. There are records for Chiricahua leopard frogs just south of the LCR above Lyman buffered stocking complex, but these sites are in different watersheds and it is not feasible for stocked fish in the LCR above Lyman buffered stocking complex to reach these areas and the likelihood of frogs traveling the overland distance to the headwater of the tributaries to the LCR is low. These Chiricahua leopard frog localities will be assessed in different complex documents.

Northern Leopard Frog

Local Analysis: Although Carnero Lake and the LCR above Lyman buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to fish stocked in Carnero Lake is low because there are no historical records for northern leopard frogs at Carnero Lake and it is a closed system. There are records from 2007-2009 just downstream of Lyman Lake, which is within the LCR above Lyman buffered stocking complex. There are historical records for northern leopard frogs from 9 sites within the buffered stocking complex; Benny Creek (1979), Iris Spring (1979), LCR (Foot of Lyman Dam) (1935), LCR (Johnson Ranch) (1938), LCR (4.35 MI W of Eager) (1979), Nelson Reservoir (SE Corner) (1971), Nutrioso Creek (Correjo Crossing) (1979), Sheep Springs (1942), and Unnamed Creek (1 MI S of Alpine Divide Campground) (1974, 1979). There have been 68 surveys at 39 sites within the buffered stocking complex between 1935 and 2009, with most of them taking place between 1971 and 2009 (Figure 2, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (1992 and 1995), Iris Spring (1992, 1995, and 1997), LCR (Foot of Lyman Dam) (1997), LCR (Johnson Ranch) (1997), Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995), Nutrioso Creek (Correjo Crossing) (1995), Sheep Springs (1995), or Unnamed Creek (1 MI S of Alpine Divide Campground) (1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.). Although the LCR above Lyman buffered stocking complex has not been adequately surveyed, the Rudd Creek and Trinity Reservoir area was adequately surveyed for frogs after the 1996 release and no

frogs were observed after the 1997 field season (D. Groebner and Sredl pers.comm.). In addition, the LCR above Lyman buffered stocking complex lies at the edge of the range for the Chiricahua leopard frog and the presence of crayfish and non native fish make the habitat less suitable for leopard frogs.Therefore, it is likely that northern leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the LCR above Lyman buffered stocking complex is low. There are records from 2007-2009 for northern leopard frogs just below Lyman Lake within the LCR above Lyman buffered stocking complex and the likelihood that these frogs would be exposed to stocked sport fish in the buffered stocking complex is high (Drost, pers. comm.). However, there is only 1 other record downstream in the LCR at Salado Springs for northern leopard frogs (1939), but frogs were not observed at this site in 1997 and it is likely that northern leopard frogs no longer occupy this area or further downstream in the LCR or its tributaries (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl and Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

LITTLE COLORADO RIVER ABOVE LYMAN COMPLEX ANALYSIS

Water Distribution / Connectivity

The hydrology of the LCR above Lyman Lake was provided in the various site specific sections, specifically in the discussion for Lyman Lake. Water flow in the LCR downstream of Lyman

Lake was also discussed. Additional discussion on the LCR below Zion Reservoir would occur for each additional complex and tributary where stocking is occurring, below.

Fish Movement
Fish movement in the LCR above Lyman Lake was provided in the various site specific sections, specifically in the discussion for Lyman Lake. Movement in the LCR downstream of Lyman Lake was also discussed. Additional discussion on the LCR below Zion Reservoir would occur for each additional complex and tributary where stocking is occurring, below.

Community Description
The aquatic community above and below Lyman Lake has been previously discussed. Downstream of Lyman Lake in the LCR, through Zion Reservoir, and past Chevelon Canyon, East Clear Creek and into the Grand Canyon would be discussed in those respective sections or in the Watershed analysis summary for the Grand Canyon.

Consultation Species or Critical Habitats
Impacts to consultation species at the site level were previously discussed, and included areas downstream of Lyman Lake. Potential impacts to consultation species further downstream in the LCR (humpback chub, additional spinedace populations, roundtail chub, etc.) are discussed in other LCR complex sections and the Lower LCR Analysis of Impacts summary. It is not known with certainty which stocking site is the source of a stocked species, if they should be found in the LCR in the vicinity of a consultation species below Lyman Lake.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local and broad scale level within the site analysis, due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Mexican spotted owl and critical habitat and Southwestern willow flycatcher and critical habitat was discussed within the site analysis.

Little Colorado Spinedace and Critical Habitat

Spinedace occupied habitat occurs in Nutrioso Creek from the Town of Nutrioso downstream to Nelson Reservoir and from Nelson Reservoir dam downstream to the Forest boundary (Lopez et al. 2001; Sweetser et al. 2002). Spinedace also occupy lower Rudd Creek from a culvert near the Sipe Wildlife Area headquarters downstream to the confluence with Nutrioso Creek. Spinedace occupy the LCR from Lyman Lake upstream to the Airport Road in Springerville and the LCR from Salado Springs downstream to St. Johns. The specific distances to occupied habitats from Hulsey, Becker, Nelson and Lyman were discussed site by site above.

Surveys in the Little Colorado River have found only 3 rainbow trout within spinedace occupied habitat, two in 1993 and one in 1999 (T. Robinson pers.comm.) all within the Wenima Wildlife Area. Rainbow trout were stocked annually in the South Fork LCR, very near the confluence with the mainstem LCR, up through 1993. That stocking location was discontinued after 1993. Unusually high flows during the spring of 1993 could have washed some of these stocked trout downstream from this old stocking location; such high flows are not be expected to occur on a regular basis. Rainbow trout are stocked annually in the Greer lakes, which release water for irrigation use in Springerville. Plus, a healthy population of wild rainbow trout exists in the LCR from the National Forest boundary up to River Reservoir.

Surveys in Nutrioso Creek have found 28 rainbow trout within spinedace occupied habitat since the implementation of new management approaches in 1996. Five of these were marked trout found upstream of the reservoir, while 23 were found downstream of the reservoir in designated critical habitat, of which 19 were marked and 4 unmarked. The 24 total marked trout were obvious escapees from the reservoir. The origin of the 4 unmarked trout is still unexplained. They could have come downstream from a wild population of rainbow trout in upper Rudd Creek, since 3 of the unmarked trout were found at the confluence of Rudd and Nutrioso. Or they could be progeny from potential successful reproduction by escaped trout from Nelson; however, this has not been verified or previously documented.

In addition, crayfish are extremely numerous in the reaches where spinedace occur and likely present a significant threat. Portions of Nutrioso Creek and Rudd Creek dry up during low precipitation years, especially with water diversions occurring in and around the Town of Nutrioso, impacting habitat quality and availability to spinedace in Nutrioso Creek. Also, wild brown trout exist in the upper reaches of occupied habitat in the Little Colorado River.

Designated critical habitat for spinedace is located on Nutrioso Creek beginning just below Nelson Reservoir Dam and continuing downstream to the Apache-Sitgreaves Forest boundary and in East Clear Creek past the confluence of Chevelon Creek. The specific distances of designated critical habitat from Hulsey, Becker, Nelson and Lyman were discussed site by site above.

Potential Impacts

The proposed stocking activities could potentially impact Little Colorado Spinedace, if any stocked trout were able to escape during flooding events or in the case of Nelson Reservoir with no barriers to upstream movement and limited downstream barrier (dam if not during spill event) and Lyman where trout have potential to move upstream (see previous site by site discussion for further detail). These interactions could occur as predation on adults and juvenile Spinedace, larvae or eggs, or competition for space (refer to interactions discussion in Chapter 4). Since rainbow trout are stocked as catchables, they would not likely compete for food with spinedace. Stocked trout also do not reproduce in the lakes or in Nutrioso Creek in the habitat where spinedace occur, thus, there would be no impact from juvenile trout. The continuing implementation of the precautions identified in the previous Section 7 consultation in 2001, would continue to reduce impact/exposure from trout in Nelson (see previous site discussion).

Critical Habitat

Spinedace critical habitat in Nutrioso Creek, Chevelon Creek, and East Clear Creek has little potential to be impacted by stocked fish in the stocked lakes. There were no Primary Constituent Elements identified when critical habitat was designated for spinedace; however, several types of activities were identified that would be considered an impact to critical habitat. An escaped stocked trout would not contribute to any of these activities, directly or indirectly. Below is the critical habitat information for the effects analysis from the 2001 BO:

Critical habitat designation for spinedace occurred before the requirement to identify constituent elements or habitat qualities necessary to allow a species to survive and recover from extinction was added. Therefore, the best scientific and commercial data available were used to determine those characteristics of the designated critical habitat that support the species' survival and recovery (USFWS 1987). Currently no barriers exist to prevent upstream movement of trout into designated critical habitat upstream of Blue Ridge reservoir. Likewise there are no barriers to prevent downstream movement of trout from Blue Ridge or Nelson Reservoirs other than the dams that impound the stream. When critical habitat areas for spinedace were designated, these areas were reported as "…presently support(ing) healthy self-perpetuating populations of the Little Colorado spinedace" (USFWS 1987). Since that time, habitat degradation, introduction of non native fishes, and scarcity of water have resulted in low numbers of spinedace in East Clear Creek and Leonard Canyon. In years of high precipitation or during periods of high runoff, trout have the opportunity to move out of stocked area into spinedace habitat. Similarly, spinedace may move into trout areas. In either case, some spinedace could be consumed by rainbow trout or other non native species. Movement of predaceous fish into designated critical habitat may contribute to the disjunct distribution patterns and retreat of spinedace to suboptimal habitats. Results may include competition, predation, harassment or further loss of spinedace.

The act of stocking catchable rainbow trout upstream and downstream of critical habitat is reversible and does not diminish or preclude the role of that habitat for the survival and recovery of the spinedace.

WEST FORK LITTLE COLORADO RIVER COMPLEX

Drainage Area and Elevations

This complex drains off the northeast quarter of Mt. Baldy, with 4 out of the 5 main drainages originating on Mt. Baldy itself, and forms the uppermost headwaters of the Little Colorado River (Figure 3). These drainages are Hall Creek, West Fork LCR, Lee Valley Creek, and East Fork LCR. The fifth, the South Fork LCR, drains high elevation grassland and forest to the northeast of Mt. Baldy.

The highest elevations of the drainage within this complex are on Mt. Baldy, over 11,000 feet elevation. The lowest elevation within the complex is 7525 feet, at the confluence where the South Fork LCR drains into the LCR. The highest stocking site is at Lee Valley Lake, at 9418 feet elevation, and the lowest is River Reservoir at 8221 feet.

The West Fork Complex is composed of 8 stocking sites in the headwaters of the Little Colorado River (Figure 4), including White Mountain Reservoir, Mexican Hay Lake, River Reservoir, Tunnel Reservoir, Bunch Reservoir, LCR in Greer, Sheep's Crossing, and Lee Valley Lake.

The uppermost stocking site, Lee Valley Lake is located on Lee Valley Creek. The natural flow of Lee Valley Creek entered the East Fork LCR, however, water is not released from the dam and the lake's spillway leads into the West Fork LCR. The Sheep's Crossing stocking site is located on the West Fork LCR immediately upstream of where the spill from Lee Valley Lake enters the West Fork. The East Fork LCR and West Fork LCR come together in the Town of Greer to form the mainstem Little Colorado River. The LCR Greer stocking site is a series of release points centrally located around this confluence, ranging down onto the uppermost Little Colorado River and up into the lowermost reaches of the East Fork LCR and West Fork LCR, all within the Town of Greer.

The Little Colorado River drains directly into River Reservoir, one of the 3 Greer Lakes, at the bottom end of the Town of Greer. The other 2 Greer Lakes, Tunnel and Bunch Reservoirs, are located off channel in close proximity to River Reservoir. They are filled by a diversion coming off the Little Colorado River in the center of Greer. River Reservoir drains directly into the LCR, while Tunnel Reservoir runs into River Reservoir and Bunch Reservoir drains into a tributary that leads to Benny Creek, then Hall Creek, then into the LCR approximately 2.6 miles downstream of River Reservoir. White Mountain Reservoir is located on the upper reaches of Hall Creek and drains directly into Hall Creek. This flow runs for 5.7 miles where it joins with Benny Creek and the outflow coming from Bunch Reservoir, then for 0.3 miles to the LCR, where it joins the outflow from River Reservoir and everything above that.

Mexican Hay Lake is located in the headwaters of a tributary of the South Fork LCR. Water cannot escape Mexican Hay Lake in its current condition and operation; however, it does have the potential to be operated for irrigation storage. If that irrigation use occurs in the future, the outflow drains into Joe Baca Draw, then into the South Fork LCR, then into the Little Colorado River 5.6 miles downstream of River Reservoir (3.0 miles downstream of Hall Creek confluence) where it joins the outflow coming from all other stocking sites upstream (White Mountain Reservoir and Bunch Reservoir via Hall Creek, and River Reservoir, Tunnel Reservoir, LCR Greer, Sheep's Crossing, and Lee Valley Lake via the Little Colorado River).

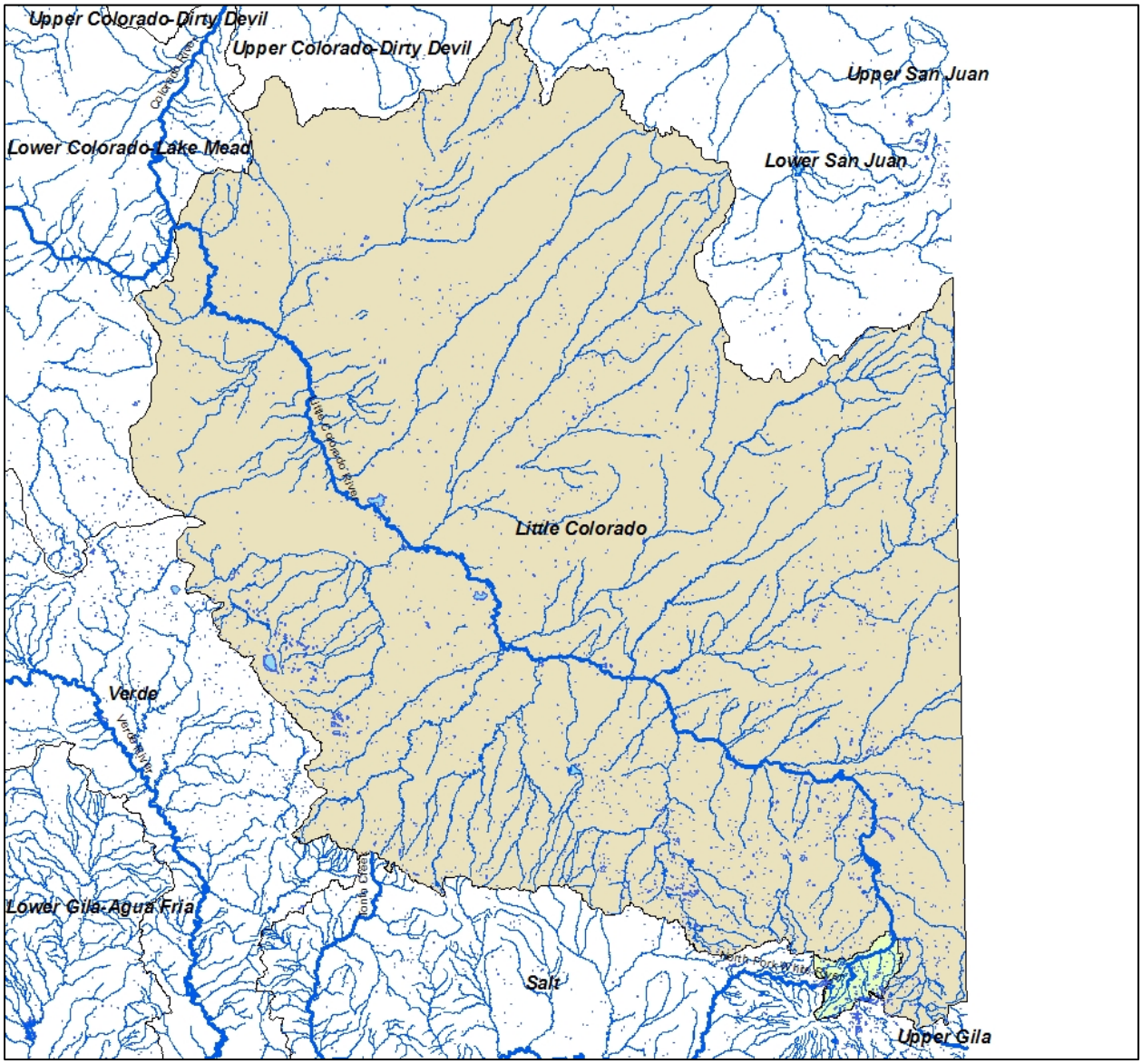


Figure 3. The West Fork Little Colorado River complex (green) is located in the headwaters of the Little Colorado River (brown).

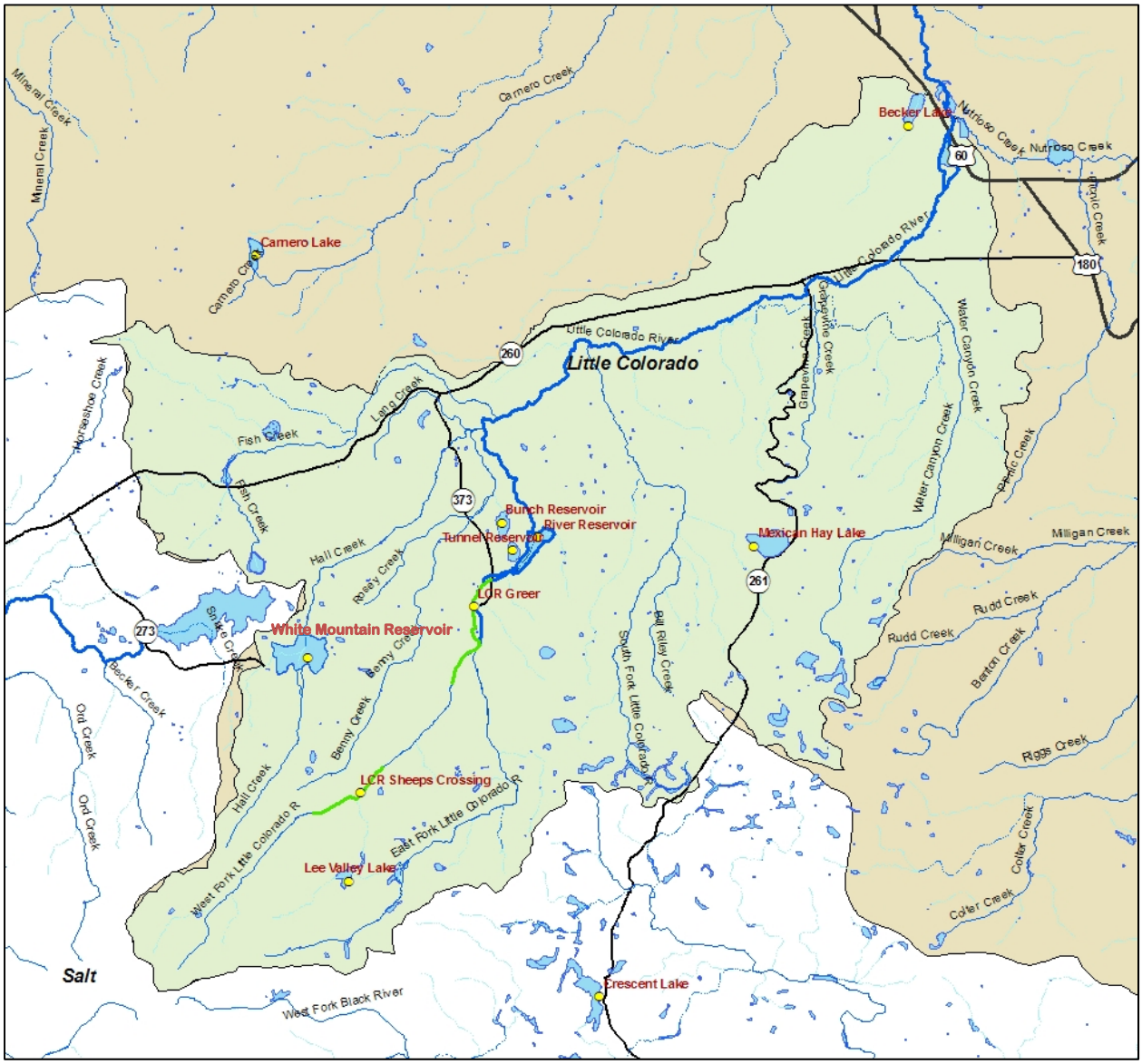


Figure 4. West Fork of the LCR Complex Overview Map.

<u>White Mountain Reservoir</u>

Site Description

White Mountain Reservoir is located on Hall Creek, a tributary of the Little Colorado River (LCR). The reservoir is located approximately 3 miles west of Greer on the Apache-Sitgreaves National Forest. The dam was built in 1929 and the reservoir is 20 surface acres, when full, at an elevation of 9164 feet. White Mountain Reservoir is an irrigation reservoir and water is released during the irrigation season from April 15 through September 15.

White Mountain Reservoir is located in open high elevation grasslands and is accessed by an all-weather gravel road, Forest Road 112, from April through November. There is a dirt parking lot near the east side of the dam, but no boat launch, restrooms, or other facilities, although primitive camping is allowed in the general area. The reservoir receives very little angler use, either summer or winter, because it is stocked so infrequently. The reservoir freezes over during the winter and is inaccessible from November through April.

Management of Water Body

White Mountain Reservoir has been managed previously as a put-grow-and-take cold water fishery, primarily stocking fingerling rainbow trout when water levels were going to persist through the summer irrigation season. Historically, brook, rainbow, and brown trout have been stocked (Table 28). During the wet cycle years of the 1960s through the early 1990s, the reservoir held enough water to manage a good fishery. However, the water levels are not as reliable as they once were. Currently, water levels do not persist like they used to. The reservoir would be better stocked with catchable or sub-catchable size trout, because there is not enough time to grow fingerling trout into a catchable size, even though the reservoir is very shallow and very productive and can grow trout quickly. The reservoir could be stocked with catchable rainbow trout opportunistically to support an occasional put-grow-and-take cold water fishery when conditions allow for it. Trout can overwinter in the reservoir if the water levels are sufficient, growing to 5-6 pounds if able to overwinter 2 years, but the current water management in the reservoir, as an irrigation reservoir drained extremely low every year, has not allowed recent overwintering to occur.

Table 28. Stocking history for White Mountain Reservoir.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1980	1980	1	15,000
Rainbow trout	1969	2000		120,556
Brown trout	1966	1967	2	20,000
Total			13	155,556

No creel surveys have been conducted at White Mountain Reservoir because of the sporadic stocking and low angler use.

White Mountain Reservoir fills, or nearly fills, every year with snowmelt runoff from Mt. Baldy. The reservoir is usually drained down very low by Round Valley Irrigation for use in the Springerville area, and is usually the first of a number of irrigation lakes to be utilized. White Mountain Reservoir is not stocked most years because of the way its water is managed.

Flexibility to stock annually is desired if water management changes at the reservoir would allow suitable stocking conditions. The reservoir is only stocked when it is anticipated to hold enough water to support trout past the summer irrigation season, usually only in very high precipitation years when little irrigation water is needed.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies the management objective at White Mountain Reservoir as basic-yield sport fish with a desired species assemblage of rainbow trout, which is consistent with the proposed action.

Proposed Action

The Department proposes to stock catchable and sub-catchable rainbow trout from April to June, only during years when the reservoir would hold enough water to support trout through the summer; numbers of rainbow trout stocked may be from 0 to 30,000 fish annually.

Water Distribution/Connectivity

White Mountain Reservoir is filled by upper Hall Creek draining off the high elevations of Mt. Baldy. There is normally a good snowmelt runoff coming down Hall Creek to fill or nearly fill White Mountain Reservoir every year except for extreme drought years. The very headwater of Hall Creek on Mt. Baldy is perennial, but becomes intermittent just above the reservoir, and flows into the reservoir only during the spring snowmelt; the 2 miles of Hall Creek immediately above the reservoir dries in the summer months. Hall Creek is intermittent below the reservoir, except when releasing water, until the final stretch about 3 miles above the LCR.

When water is released for irrigation from White Mountain Reservoir during the irrigation season from April 15 to September 15, it flows down Hall Creek for 6.0 miles and then into the LCR at a point 2.6 miles downstream of the confluence with River Reservoir.

At base flows, Hall Creek is mostly intermittent in the 2.9 miles just downstream of the reservoir as it flows through high elevation grassland and into a canyon. The lower 3.1 miles are located deep in a canyon and is perennial to the confluence with the LCR. There are a series of private ponds on Hall Creek approximately 1.2 miles upstream of the confluence with the LCR that impound the creek flow and spill out.

A tributary called Benny Creek enters Hall Creek approximately 0.3 miles above the confluence with the LCR. Bunch Reservoir is located on an unnamed tributary which flows for 0.4 miles to Benny Creek, then down Benny Creek for 1.4 miles to Hall Creek. At base flows, Benny Creek is perennial but has very low flows. However, the lowest 1.4 miles of Benny Creek flows with a substantial amount of water during the summer months when water is released for irrigation out of Bunch Reservoir. See the Greer lakes section for additional discussion of water flow in the area and in the Little Colorado River downstream of River Reservoir. Rosey Creek is a tributary to Benny Creek; the two streams meet just east of State Route 373, approximately 0.6 miles

upstream of the tributary that drains from Bunch Reservoir. Hydrographic status of these streams is not known, but fish survey results indicate that they support fish at least for some periods (Table 29).

Table 29. Surveys of tributaries to Hall Creek conducted in 2008 using a backpack electroshocker.

Stream Surveyed	Species Collected	Num. Collected
Benny Creek	Speckled dace	50
	Bluehead sucker	1
	Fathead minnow	164
	Brown trout	11
Rosey Creek	Speckled dace	71
	Fathead minnow	56

Fish Movement

Stocked trout can move upstream into upper Hall Creek, but only in the spring during the snowmelt high flow runoff. Surveys in 1999 did not find any rainbow trout in upper Hall Creek.

Stocked trout likely move downstream into Hall Creek when the reservoir spills or during irrigation releases during the irrigation season. During these high flows, a fish could move downstream for 6.0 miles into the LCR. Fish would have to also navigate through the private ponds on lower Hall Creek before reaching the LCR. The lower 3.1 miles of Hall Creek is perennial and has suitable trout habitat, but surveys in 1999 only found rainbow trout near the confluence below the private ponds. These trout could have come up from the LCR, down from the private ponds, or from White Mountain Reservoir. Trout would not persist long in the 2.9 miles of Hall Creek immediately below the reservoir because this reach dries up during base flows.

Trout that escape from White Mountain Reservoir and make it through the private reservoirs into the lowest section of Hall Creek could swim up Benny Creek during high flows or irrigation releases, but recent surveys in 2008 did not find any rainbow trout (Table 29). The dam and outlet would prevent any trout from getting up into Bunch Reservoir on the unnamed tributary to Benny Creek.

Once in the LCR, a trout could swim up the LCR for 2.6 miles until it got to River Reservoir dam. For downstream movement in the LCR, see the Greer lakes analysis, below.

Community Description

White Mountain Reservoir contains tiger salamanders and, only if stocked, rainbow trout (M. Lopez pers. comm.). Table 30 shows the survey history in White Mountain Reservoir.

Table 30. Survey history in White Mountain Reservoir using experimental gillnets.

Survey Date	Species Collected	Number Collected	Size Range (mm TL)
April 1967	Brown trout	4	173-216
June 1988	Rainbow trout	18	204-385
May 1993	Rainbow trout	14	209-318
April 1994	Rainbow trout	18	355-526

Hall Creek holds wild brook trout in the very upper 2 miles on Mt. Baldy. However, the 2 miles of Hall Creek immediately upstream of the reservoir and the 2.9 miles immediately below the reservoir are fishless because they go dry at base flows. Table 31 shows the distribution of fish in Hall Creek in 1999.

Lower Hall Creek contains rainbow trout and speckled dace (near the confluence with LCR), and many brown trout within the lowest 3.1 miles adjacent to the LCR. Brown trout and possibly specked dace reproduce in these lower reaches as evidenced by the small sizes caught by previous surveys (Table 29). The 2 rainbow trout in the lowest reach of Hall Creek were collected in the lowest 3 survey stations and likely originated from the Little Colorado River, where wild populations of rainbow and brown trout exist at the confluence with Hall Creek. However, it is possible that these rainbow trout could have escaped from White Mountain Reservoir, or from any of the Greer lakes.

Table 31. Distribution of fish in Hall Creek during comprehensive electrofishing survey (3 pass depletion) of 35 50-meter sites in 1999.

Reach 1 is located at the confluence of the LCR and Reach 8 is in the headwaters on Mt. Baldy. White Mountain Reservoir is located between reaches 5 and 6.

Location	Species	Num. Collected	Size Range (mm TL)
Reach 1 (LCR up to Hwy 373)	Rainbow trout	2	208-248
	Brown trout	58	75-303
	Speckled dace	11	55-98
Reach 2 (upstream of private property above Hwy 373)	Brown trout	176	67-305
Reach 3	Brown trout	110	74-260
Reach 4	-No fish	0	-
Reach 5	- No fish	0	-

Location	Species	Num. Collected	Size Range (mm TL)
White Mountain Reservoir			
Reach 6	Brook trout	31	52-147
Reach 7	Brook trout	27	51-207
Reach 8	Brook trout	18	53-165

Surveys of Benny Creek and Rosey Creek were conducted on May 15-16, 2008 (Table 29). These surveys found speckled dace, one bluehead sucker, fathead minnow, and brown trout. A historic record of Northern leopard frog in 1979 exists at a site on lower Benny Creek, located approximately 3.6 miles downstream of White Mountain Reservoir, however, recent herpetological surveys at that site documented only black necked garter snake and wandering garter snake in 1992 and bullfrogs in 1995. A survey conducted at a tank further up on the drainage on Benny Creek documented a tiger salamander in 1992 and nothing in 1993.

Water from White Mountain Reservoir flows down Hall Creek to the LCR and joins it very near the outflow from the Greer lakes. For this reason, refer to the Greer lakes analysis for a description of the fish communities lower down in the LCR.

Recovery populations of Apache trout are located in the East, West, and South Forks of the LCR, all above constructed fish barriers on each of the forks (3 barriers on East Fork, 2 on West Fork, and 2 on South Fork) above Greer.

Consultation species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to consultation to Apache trout are addressed below. Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts on Little Colorado spinedace and critical habitat,

southwestern willow flycatcher and critical habiat are discussed in the West Fork Little Colorado River complex analysis.

Apache trout

Stocked rainbow trout can escape from White Mountain Reservoir when water is released for irrigation during the summer months, or when it spills, and likely reach the LCR approximately 2.6 miles below River Reservoir. Escaped stocked trout would be unable to travel upstream past River Reservoir and could have no impact on recovery populations of Apache trout above Greer in the West Forks and East Forks LCR. It is possible the stocked trout could travel downstream for another 3.4 miles to the South Fork LCR confluence and up into the South Fork for 0.9 miles, but they could not get past the constructed fish barrier and into another Apache trout recovery population in the South Fork LCR.

Potential Impacts

Stocked rainbow trout in White Mountain Reservoir likely escape the reservoir into Hall Creek because the reservoir is nearly drained downstream on an annual basis. These escaped trout have access to the LCR. Once in the LCR, they have the same overall possible impacts to Apache trout as fish from the Greer lakes, but likely at a lower probability because of the extra distance to the LCR. Fish barriers prevent upstream movement of potentially escaped rainbow trout into Apache trout recovery populations.

Stocked rainbow trout moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

Apache trout escapement from recovery areas and exposure to stocked sport fish:

If recovery Apache trout were to move out of designated recovery areas to areas where stocked rainbow trout may be present (if they escape White Mountain Reservoir and move downstream), they would be subject to the special 4(d) rule. They would no longer be distinguishable from stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas

Northern Leopard Frog

Local Analysis: Although White Mountain Reservoir and the West Fork LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that fish

stocked in White Mountain Reservoir will have an impact on northern leopard frogs is low. There are no historical records for northern leopard frogs at White Mountain Reservoir. There are historical records for northern leopard frogs from 3 sites in the buffered complex: Benny Creek (SR 373) (1979), Little Colorado River (7 KM W of Eager) (1979), and Sheep Springs (FS 89 JCT W/HWY 260) (1942) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (SR 373) (1992 and 1995) or Sheep Springs (FS 89 JCT W/HWY 260) (1995) and it is likely that northern leopard frogs no longer occupy these sites (see previous survey discussion) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing stocked fish from White River Reservoir and the West Fork buffered stocking complex is moderate. Stocked fish could disperse as far downstream as Lyman Lake and there are records from 2007-2009 for northern leopard frogs just downstream of Lyman Lake (Drost, pers. comm.). Although the main drainage does not provide suitable habitat for northern leopard frogs because of fast flowing water and presence of crayfish, the frogs are occupying a series of ponds and marshy meadows along the outflow from the Lyman Lake dam (Drost, pers. comm.). In addition, this population is the last known extant population of northern leopard frogs in the Upper Little Colorado River drainage and is thought to be declining (Drost, pers. comm.).

Chiricahua Leopard Frog

Local Analysis: Although White River Reservoir and the West Fork LCR buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs will be exposed to fish stocked in White River Reservoir is low. There are no historical records for Chiricahua leopard frogs at White River Reservoir or within the West Fork buffered stocking complex. There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and no Chiricahua leopard frogs were observed. In addition, even though the West Fork LCR buffered stocking complex is within a Chiricahua leopard frog recovery unit, the majority of the complex is outside of the Black River Management Area, suggesting that habitat and conditions for recovery are less suitable in that area. Therefore, it is likely that Chiricahua leopard frogs do not occupy the West Fork buffered stocking complex.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing stocked fish from White Mountain Reservoir and the West Fork Complex is low. There are no records for Chiricahua leopard frogs in the Little Colorado River drainage where stocked fish could disperse to, but fish could travel downstream the Little Colorado River and upstream the tributary of Nutrioso Creek where there are 2 historical records for Chiricahua

leopard frogs: Nutrioso Creek (Correjo Crossing, 1979) and Nelson Reservoir (SE Corner, 1971). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995) and Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995) and it is not likely that Chiricahua leopard frogs currently occupy these sites or this area (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

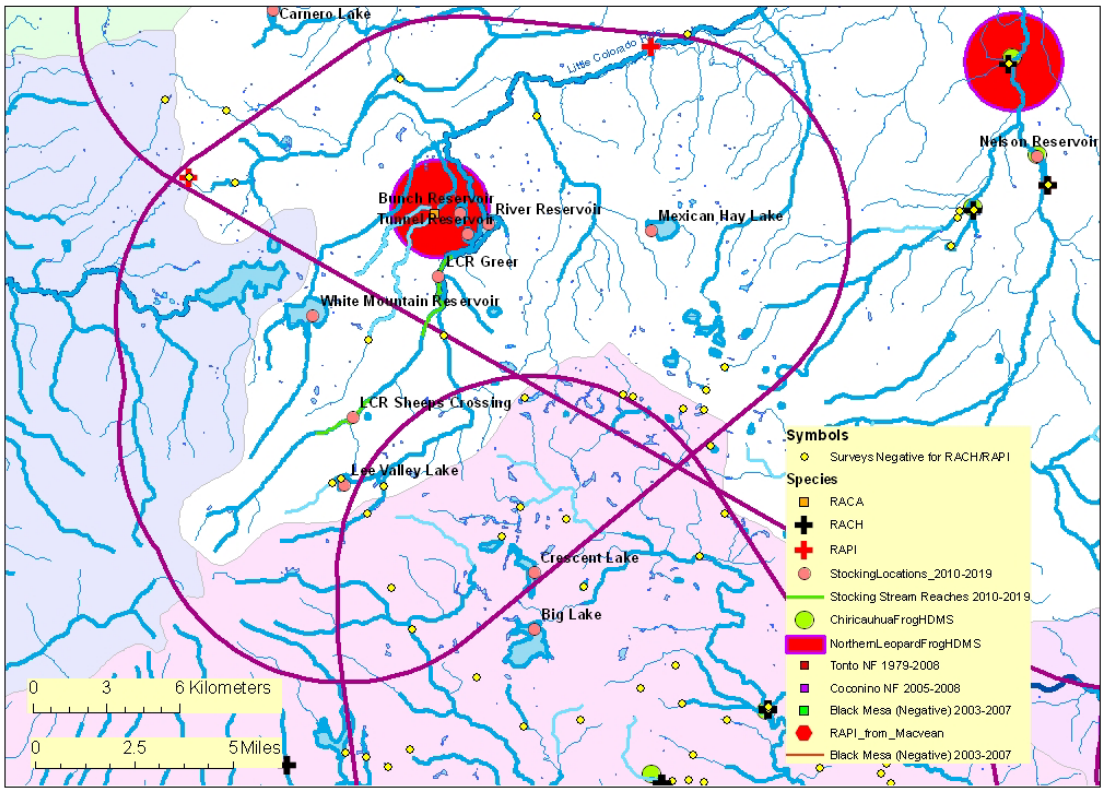


Figure 5. Map of West Fork Little Colorado buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Lee Valley Lake

Site Description

Lee Valley Lake is a 35 acre lake on Lee Valley Creek, a headwater tributary of the East Fork of the Little Colorado River (Figure 6). The lake is located at 9418 feet in elevation on the Apache-Sitgreaves National Forest about 6 miles southwest of Greer, and is filled by Lee Valley Creek

draining off the east slope of Mt. Baldy. The dam was constructed as an irrigation reservoir in 1899 and the water rights were later purchased by the Department and transferred to storage rights for wildlife and recreation in the lake.

Camping is not permitted at the lake, as it is located in the Lee Valley Recreation Area, which allows camping only in developed campsites. The closest developed campsites are at Winn Campground approximately 2 miles to the northeast of Lee Valley Lake.
Lee Valley Lake is accessed by an all-weather road (Hwy 273) from April through November, with this road closed to vehicles in the winter; however, it is currently being paved. The lake freezes over and is typically accessed only by snowmobile during the winter. Boat motors are restricted to the use of an electric motor only and the lake is popular with float tube fly fishers in the warmer season. A paved parking area and single boat ramp are located on the east side of the lake between the dam and the spillway. A vault toilet is present at the parking area.
The parking area and launch ramp is the only vehicle access to the lake. Anglers must hike or boat to other parts of the lake.

Figure 6. Photo of Lee Valley Lake.

Management of Water Body
Lee Valley Lake is managed as a featured species cold water fishery, offering only stocked Apache trout and Arctic grayling. The Apache trout in Lee Valley Lake are managed for recreation, not recovery, but must be compatible with recovery in the streams hydrologically connected to the lake. Arctic grayling are also considered compatible with Apache trout recovery

in the 3 connecting streams because they would not persist in the streams if they escape and have no trout hybridization potential.
Lee Valley Lake historically contained stocked brook trout, Apache trout, and Arctic grayling (Table 32). Brook trout were last stocked in 1985, but persisted for many years because they were able to spawn in the incoming stream. Lee Valley Lake was drained in 2003, in conjunction with chemical treatments in Lee Valley Creek (2003), East Fork LCR (2004-2005), and West Fork LCR (2006-2008) to remove non-native trout, with management focused on Apache trout recovery in the 3 streams.

Fish barriers for Apache trout recovery on the East Fork LCR and West Fork LCR are located downstream of the connection with Lee Valley Lake. A fish barrier is present on Lee Valley Creek, but is crumbling and is scheduled to be removed and replaced with a weir-type structure. One of the purposes of the fish barrier was to concentrate spawning grayling coming up from the lake to allow the Department to harvest eggs that would be hatched in a hatchery and later restocked into the lake. The barrier is located in a meadow reach, a poor location for a fish barrier, and experiences frequent problems because of the location. Replacement with a weir that can be open most of the year, then screened during the two week grayling spawning run would congregate the grayling for the spawn collection, keep the grayling from dispersing up into the stream, and reduce the erosion above the lake during high flows. Because non-native brook trout or rainbow trout are no longer present in the lake or above in Lee Valley Creek, the barrier is no longer necessary on the stream.

Catchable size Apache trout are stocked annually, 3,000-7,000 per year, usually in April-June. High pH levels usually prohibit stocking events in mid-summer. The lake experiences occasional winter kills, so fish are typically not stocked in the fall to prevent rapid use of oxygen under the ice cover. Plans are being developed that will help address the winterkill problems at Lee Valley Lake.

Arctic grayling are stocked opportunistically, when hatchery fish are available from the closest source in Wyoming. Grayling have been stocked only 3 times in the last 10 years, all at sub-catchable size. However, the Department prefers to stock grayling annually to maintain a robust fishery for this species, which are very popular with fly fishermen. Arctic grayling were hatched and raised in local state hatcheries in the 1980s on a regular basis when the lake did not winterkill, and a brood stock of grayling persisted in the reservoir. The Department is attempting to develop a brood stock of grayling again, and anticipate stocking both fingerling and sub-catchable grayling when that happens, up to 30,000 fingerlings per year, and/or up to 7,000 sub-catchables per year. Because sources of Apache trout and Arctic grayling are limited, the low bag limit and minimum size limit are expected to keep these fish in the reservoir for some time.

Table 32. Stocking history of Lee Valley Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Apache trout	1968	2009	38	70,212
Brook trout	1953	1985	28	356,286
Arctic grayling	1965	2008	17	149,179
Total			83	570,179

Lee Valley Lake received 11,468 angler use days in 2001 (Pringle 2004). Special regulations on the lake include artificial lure and fly only, 2 fish bag limit, with a minimum size of 12 inches. The lake freezes over and is typically accessed by snowmobile only during the winter, and the lake likely receives little ice fishing use because of the smaller fish available and artificial lure and fly regulation.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies the management emphasis for Lee Valley Lake as featured species sport fish, with a desired fish assemblage of Apache trout, Arctic grayling, and bluehead sucker. The proposed action is consistent with the emphasis identified in the plan.

Proposed Action

The Department proposes to stock Apache trout and Arctic grayling for the period covered by this consultation.

Catchable Apache trout would be stocked from April to June annually; numbers of Apache trout may be from 0 to 7,500 fish annually.

Fingerling and sub-catchable Arctic grayling would be stocked annually from April to October; numbers of grayling may be from 0 to 30,000 fish annually.

Water Distribution/Connectivity

Lee Valley Lake is the furthest upstream stocking site in this complex. The spillway drains into an unnamed drainage that goes into the West Fork LCR just downstream of Sheep's Crossing, then flows downstream into Greer, past the Greer lakes and on down towards Springerville. Lee Valley Creek flowing into Lee Valley Lake is mostly perennial, with the very lower reach drying up during drought years. There is approximately 2 miles of stream above the lake.

Lee Valley Creek below Lee Valley dam enters the East Fork LCR upstream of Colter Reservoir; however, water is not released out of the outlet valve. AGFD holds water rights at Lee Valley Lake and does not release this water for irrigation or other purposes. The spillway on the lake, however, spills overland into a shallow basin just northeast of the lake, then down a drainage for 1.5 miles into the West Fork of the LCR, just downstream of Sheep's Crossing (0.9 miles). This

unnamed drainage from the Lee Valley Lake spillway is intermittent and flows only when the lake is spilling, typically in the spring. However, the lake may not spill during drought years. From the point where this spillway drainage enters the West Fork LCR downstream, connectivity is discussed under the West Fork LCR at Sheep's Crossing stocking site.

Fish Movement

Currently, a constructed fish barrier is present on Lee Valley Creek a short distance upstream from the lake, which would prohibit upstream movement into Lee Valley Creek. This barrier was constructed when brook trout were present in the lake. Now that brook trout and rainbow trout have been removed, the barrier on Lee Valley Lake is being considered for removal.

An Apache trout swimming upstream into Lee Valley Creek could persist if it found a deep pool. The creek is suitable for trout, and is being used for recovery, but is extremely small. A catchable size Apache trout would be oversized for the habitat in Lee Valley Creek.

An Arctic grayling would likely not swim up into the creek until it was mature and ready to spawn. When they do attempt to spawn, the gravid fish tend to congregate in the lake near the creek, and then enter the creek in a group as the water temperatures warm in the late morning, typically in early May. Mature fish attempt to spawn, and then return back to the lake, based on observations made over several years in the late 1980s and early 1990s. Any grayling that do not return to the lake would not likely persist in the creek, because a mature grayling would be oversized for the habitat in Lee Valley Creek. Several surveys and two complete chemical treatments have never documented grayling persisting in Lee Valley Creek.

Stocked fish in Lee Valley Lake cannot get out through the dam and into the natural drainage and then into the East Fork LCR, but they can escape over the spillway into the West Fork LCR during spill events. In the very extremely low chance that a fish escaped into the East Fork during a brief valve check every 10 years, it would have no different impact than if a fish escaped out the spillway and into the West Fork. Both the East and West Fork LCR are managed for recovery populations of Apache trout, with barriers located downstream of the dam outlet on the East Fork and downstream of the spillway outlet on the West Fork. An escaped fish can swim upstream for several miles in either the East Fork or West Fork, depending upon which route it escaped, or it could swim downstream, over the barriers, and down to the confluence of the East and West Fork LCR, into the mainstem LCR, and down into River Reservoir. For downstream movement below River Reservoir, see the Greer Lake analysis.

Both the East and West Forks are suitable trout habitat, which is why they are being used for Apache trout recovery. An escaped Apache trout could persist in either of these streams above the barriers, in the absence of brown and rainbow trout. Downstream of the barriers, the habitat is suitable, but competition with brown trout keeps the Apache trout from establishing and reproducing in that area. This is similar in the Greer lakes as well. An Arctic grayling escaping

downstream might attempt to reproduce but would not persist. Numerous surveys and several complete chemical renovations have never found an Arctic grayling in the East or West Forks of the LCR.

Community Description

Lee Valley Lake currently contains pure hatchery Apache trout, Arctic grayling, and fathead minnow. The lake draining in 2003 removed all trout, but a few fathead minnow persisted in the remaining shallow pool, even through the winter. Tiger salamander and extremely low densities of crayfish were also documented during the draining effort in 2003. A herpetological survey at the lake in 1992 documented only tiger salamander. Fish surveys in Lee Valley Lake since 2000 are provided in Table 33.

Table 33. Survey history at Lee Valley Lake.

Survey date/gear type	**Species collected**	**Number collected**	**Size range (mm TL)**
May 2000 Trap nets (4)	Apache trout Arctic grayling Fathead minnow	1 120 540	300 236-378 Not measured
May, October, November 2003 Exp. gillnets/green meanie gillnets/bag seine	Apache trout Arctic grayling Fathead minnow	28 22 Thousands	233-388 220-372 Not measured
May 2005 Exp. gillnets (5)	Apache trout	10	102-390
April 2007 Exp. gillnets (3)	Apache trout Arctic grayling	17 2	405-565 260-262
May 2008 Exp. Gillnets (2)	Apache trout	35	327-405

Lee Valley Creek currently contains pure Apache trout that were stocked in 2004. A herpetological survey in Lee Valley Creek in 2002 did not collect amphibians or reptiles. The West Fork LCR currently contains pure Apache trout that were stocked in 2007, and annually at Sheep's Crossing, beginning in 2009. The East Fork LCR contains pure Apache trout that were stocked in 2006 and 2007. The chemical treatments removed wild brook trout from Lee Valley Creek in 2003, wild brook trout, speckled dace and bluehead sucker from the East Fork LCR above a third barrier at the Coulter Dam in 2004 and 2005, and wild brook trout and brown trout from the West Fork LCR above the barriers in 2006 and 2008. Speckled dace and bluehead sucker are scheduled to be repatriated into the East Fork LCR above the fish barriers because

they were present prior to the chemical treatment and native in the stream. Herpetological surveys conducted at 2 sites on the East Fork LCR at Colter and Phelps cabin in 1992 and 1995 documented only wandering garter snake at one site. Chiricahua leopard frog surveys were conducted throughout Lee Valley Creek and East Fork LCR in 2003, and West Fork LCR in 2006, prior to chemical treatments to remove non-native fishes, but found no leopard frogs.

Both the East Fork LCR and West Fork LCR below the barriers still contain wild brown trout and a few persisting rainbow and/or Apache trout seasonally from stocking the Greer site. The LCR through Greer and above River Reservoir contains wild brown trout, a few persisting rainbow and/or Apache trout seasonally from stocking the Greer site, and some speckled dace and bluehead suckers. Brown trout reproduce through this reach, but the rainbow and Apache trout do not appear to reproduce successfully.

River Reservoir contains stocked rainbow trout, wild brown trout, fathead minnows, yellow perch, and occasional common carp and bluehead sucker. The fatheads, yellow perch, and carp likely all spawn in the reservoir; however, trout likely do not. Some brown trout are known to run up into the river to spawn in the fall, but this has not been documented with the rainbow trout in River Reservoir, nor have young rainbow trout ever been collected from the reservoir. The aquatic community downstream of River Reservoir will be discussed in the Greer lakes analysis below.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to consultation species including Apache trout and southwestern willow flycatcher are addressed below. Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts due to the proposed action to Little Colorado spinedace and critical habitat are discussed in the West Fork Little Colorado River complex analysis.

Apache trout

Stocked Apache trout and Arctic grayling in Lee Valley Lake would have upstream access to Lee Valley Creek after the barrier is removed and to the West Fork LCR over the spillway. Emigration of Apache trout out of the reservoir is expected to be low, and those that do would either be assimilated into the pure Apache trout populations, move down past the barriers, or not persist. Stocked Apache trout would not be able to reach the East Fork LCR, except during the few minutes the valve is checked every 10 years, and this chance is extremely low. Again, even if they did, they would either be assimilated into the pure Apache trout population in the East Fork, move down past the barriers, or not persist.

Emigration of Arctic grayling is expected to occur, but at low levels. Escaped Arctic grayling would have little effect on recovery Apache trout populations in Lee Valley Creek and the West Fork LCR. Arctic grayling remain in the lake all year and observations indicate they only seek running water during a spawning run in early May, and only mature individuals that are ready to spawn enter the creek. Fish return to the lake immediately following spawning activities; they enter the creek during mid-day, spawn, and then return to the lake by late afternoon. There is the possibility for competition for resources between Arctic grayling and Apache trout during the several hours that grayling are in the stream, however competition would be extremely short term and not expected to have any measurable impact. Arctic grayling that went downstream over the spillway into the West Fork LCR would not be able to return to the lake, but would also not persist in the West Fork. It is possible for competition for resources between grayling and Apache trout in the West Fork, however, competition would be from very low numbers of grayling that might escape, and short term, possibly for a matter of several weeks, but this is unknown. No grayling have ever been detected in the 3 connecting streams. Food resources are also not known to be a limiting factor for Apache trout in this section of stream.

A comprehensive survey throughout the West Fork LCR in 1995, and 3 complete chemical treatments in 2006 found no Arctic grayling in West Fork LCR. Angler creel surveys in the West Fork LCR in 1982, 1987, 1998, 1999, and 2003 detected no Arctic grayling being caught by anglers. Arctic grayling have not been detected in Lee Valley Creek because the fish barrier has been in place since 1979. If and when the barrier is removed, it would be replaced with a weir that would be screened each year during the grayling spawning run, the only time they are inclined to exit the lake. If grayling are getting out of Lee Valley Lake since stocking them from 1965 through 2008, the numbers are so extremely small or they persist for such a short period that they are never found during surveys. Thus they would have very limited impact on the Apache trout populations.

The stocking of Arctic grayling does indirectly benefit Apache trout recovery in the connecting streams. Grayling are stocked partly to provide additional angling opportunity when the Apache trout in Lee Valley Lake are not biting. Grayling seem to handle the high pH levels in the

summer months better than the Apache trout. With just Apache trout in the lake, the fishing is good in the spring and early summer then is poor for the rest of the year. Grayling in the lake in sufficient numbers continue to provide decent fishing through the year even when the Apache trout stop biting. Anglers may be more likely to illegally stock another species if the fishing is not good. Stocking grayling and providing a better fishery may help to keep non-compatible non-native salmonids, like rainbow trout, brook trout, and brown trout from being illegally stocked.

Potential Impacts

Stocked Apache trout co-stocked with other species

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Arctic grayling do not appear to persist in streams in Arizona and their biology, feeding, and spawning behavior provide for only limited opportunity for overlap with Apache trout. The stocking of Arctic grayling could have a benefit to the recovery of Apache trout by maintaining good catch rates for anglers in the lake, which may deter anglers from illegally stocking other trout that are not compatible with Apache trout, such as rainbow trout, brook trout and brown trout. No Arctic grayling have been documented in Apache trout habitat downstream of Lee Valley Lake.

Impacts to stocked Apache trout from co-stocked Arctic grayling may include competition and less likely, predation of Apache trout eggs or juvenile fish. A detailed discussion of these impacts is found in Apache trout interactions section (Chapter 4).

Stocked Apache trout into recovery Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River whereby Apache trout stocked into Lee Valley Lake, upstream of the recovery reach, could escape and move into the recovery population. Apache trout are also stocked directly into the recovery population at Sheep's Crossing. Stocked Apache trout would not be able to reach the East Fork LCR, except during the few minutes the valve is checked every 10 years, and this chance is extremely low. Again, even if they did, they would either be assimilated into the pure Apache trout population in the East Fork, move down past the barriers, or not persist. All other recreational stockings of Apache trout will occur in non-recovery areas for Apache trout. This recovery population is designated open to angling under the special 4(d) rule. Once stocked, Apache trout will be considered part of the recovery population. The Department would stock hatchery reared apache trout into the recovery population at densities expected to maintain angler satisfaction while minimizing impacts to the population as a whole. Some density dependent competition may occur in the stocking reach however not throughout the entire recovery reach since stocking only occurs at the lower end of the reach where angler access is possible.

Stocked Arctic grayling moving into recovery reaches

There are three stocking sites that are not separated by a barrier from a recovery Apache trout reach; they are: 1) Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River whereby Apache trout stocked into Lee Valley Lake, upstream of the recovery reach, could escape and move into the recovery population. Apache trout are also stocked directly into the recovery population at Sheeps Crossing (see #4 below), 2) a recovery population in the South Fork of the Little Colorado River. This recovery reach is located above a barrier; however, Mexican Hay Lake is located upstream of both the barrier and recovery reach. Apache trout stocked into Mexican Hay Lake may escape and reach the recovery population downstream, and 3) Ackre Lake, located in the headwaters of Fish Creek Fish Creek is a recovery stream, and Apache trout or Arctic grayling may escape Ackre lake and enter the recovery population downstream in Fish Creek.

It is possible for competition for resources between grayling and Apache trout in Lee Valley Lake or downstream in the West Fork, however, competition would be from very low numbers of grayling that might escape, and short term, possibly for a matter of several weeks, but this is unknown. No grayling have ever been detected in the 3 connecting streams. Food resources are also not known to be a limiting factor for Apache trout in this section of stream. Arctic grayling do not appear to persist in streams in Arizona and their biology, feeding, and spawning behavior provide for only limited opportunity for overlap with Apache trout. The stocking of Arctic grayling could have a benefit to the recovery of Apache trout by maintaining good catch rates for anglers in the lake, which may deter anglers from illegally stocking other trout that are not compatible with Apache trout, such as rainbow trout, brook trout and brown trout.

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

If Apache trout stocked in Lee Valley Lake escape and move downstream into the Sheeps Crossing recovery population or the East Fork LCR move further downstream into River Reservoir or the LCR impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Northern Leopard Frog

Local Analysis: Although Lee Valley Lake and the West Fork LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs will be exposed to fish stocked in Lee Valley Lake is low. There are no historical records for northern leopard frogs at Lee Valley Lake. There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 3 sites in the buffered complex: Benny Creek (SR 373) (1979), Little Colorado River (7 KM W of Eager) (1979), and Sheep Springs (FS 89 JCT W/HWY 260) (1942) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (SR 373) (1992 and 1995) or Sheep Springs (FS 89 JCT W/HWY 260) (1995) and it is likely that northern leopard frogs no longer occupy these sites (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing stocked fish from Lee Valley Lake and the West Fork buffered stocking complex is moderate. Stocked fish could disperse as far downstream as Lyman Lake and there are records from 2007-2009 for northern leopard frogs just downstream of Lyman Lake (Drost, pers. comm.). Although the main drainage does not provide suitable habitat for northern leopard frogs because of fast flowing water and presence of crayfish, the frogs are occupying a series of ponds and marshy meadows along the outflow from the Lyman Lake dam (Drost, pers. comm.). In addition, this population is the last known extant population of northern leopard frogs in the Upper Little Colorado River drainage and is thought to be declining (Drost, pers. comm.).

Chiricahua Leopard Frog

Local Analysis: Although Lee Valley Lake and the West Fork LCR buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs will be

exposed to fish stocked in Lee Valley Lake is low. There are no historical records for Chiricahua leopard frogs at Lee Valley Lake or within the West Fork buffered stocking complex. There have been 32 surveys and site visits at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.); no Chiricahua leopard frogs were observed. In addition, even though the West Fork LCR buffered stocking complex is within a Chiricahua leopard frog recovery unit, the majority of the complex is outside of the Black River Management Area, suggesting that habitat and conditions for recovery are less suitable in that area. Therefore, it is likely that Chiricahua leopard frogs do not occupy the West Fork buffered stocking complex.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing stocked fish from Lee Valley Lake and the West Fork Complex is low. There are no records for Chiricahua leopard frogs in the Little Colorado River where stocked could disperse to, but stocked fish could travel downstream the Little Colorado River and upstream the tributary of Nutrioso Creek where there are 2 historical records for Chiricahua leopard frogs: Nutrioso Creek (Correjo Crossing, 1979) and Nelson Reservoir (SE Corner, 1971). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995) and Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995) and it is not likely that Chiricahua leopard frogs currently occupy these sites or this area (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Southwestern Willow Flycatcher and Critical Habitat

In the White Mountains, nesting flycatcher habitat can be found along the upper Little Colorado River (and a portion of its forks) downstream to the Town of Greer area. These areas primarily occur within the Apache Sitgreaves National Forest, although private land parcels are also included. Southwestern willow flycatchers have been documented nesting at three sites in the upper Little Colorado River drainage downstream to Eager.

Southwestern willow flycatcher critical habitat occurs within the White Mountains along the Little Colorado River drainage downstream to the Town of Greer. Lee Valley Lake is not located in critical habitat; the closest critical habitat is located approximately 1 mile due east on the East Fork of the Little Colorado River and approximately 1.2 miles due north on the West Fork Little Colorado River.

Potential Impacts

Stocking and angling at high elevation is most likely to occur in the late spring and summers because of the harsh winters and difficult access. Late spring and summer coincides with flycatchers nesting season.

In the White Mountains, the primary limit to angler use is the location of stocked trout and access. However, anglers are not anticipated to wander remarkably far from the stocked

locations. As a result, it is anticipated that most effects would occur near where trout are stocked. The Apache-Sitgreaves NF staff estimate that approximately 70,000 to 75,000 people use the recreation area in and around the Greer Area and forks of the Little Colorado River annually. Anglers will likely be on foot and either alone or in small parties. The proposed trout stocking actions are an ongoing action that has a long history of occurring in the headwaters of the Little Colorado River. As a result, it is anticipated that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, once anglers reach their destination, they are not anticipated to be fishing in tight areas where vegetation is dense that causes casting to be difficult.

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site. There may be some amount of disturbance to nesting flycatchers from anglers accessing the stocking site.

Critical Habitat
No impacts to critical habitat are anticipated. Lee Valley Lake is not located in critical habitat and anglers are not anticipated to wander remarkably far from the stocked locations.

West Fork LCR at Sheep's Crossing

Site Description
Sheep's Crossing is a short reach of stream habitat on the West Fork of the Little Colorado River (LCR), approximately 4.8 miles upstream of Greer at an elevation of 9200 feet elevation. This reach of the West Fork is located at the crossing of Highway 273 (Forest Road 113) on the Apache-Sitgreaves National Forest. The West Fork LCR is also an Apache trout recovery stream, established in 2007, with 2 constructed fish barriers to keep out non-native trout, located 1.9 and 2.2 miles downstream of Sheep's Crossing. The stocking reach is approximately 0.5 miles long.

Sheep's Crossing is located on a heavily used highway that leads to the popular Lee Valley and Big Lake Recreation Areas. Sheep's Crossing previously included a spur road from the old bridge leading upstream to a dirt parking lot near the Mt. Baldy Wilderness boundary; however, this parking area and spur road were removed in the 1990s. This left parking primarily along the road near the bridge, although a Mt. Baldy trail parking area was created further up the hill. There are no restrooms or picnic facilities down by the stream. Restrooms and picnic facilities are present at the trailhead at the top of the hill. Camping is not permitted at this location as it is within the Lee Valley Recreation Area; however, Winn Campground is located approximately 3 miles away.

Sheep's Crossing is currently open to the public and accessed by all-weather paved road, Forest Road 113/Highway 273, from April through November. The road is typically closed to vehicular access from December to April; however, it is a popular route for snowmobiles traveling to the Big Lake area to ice fish. Sheep's Crossing is also accessible by a popular foot trail along the West Fork LCR from Greer.

After construction the main parking area will be at the trailhead at the top of the hill, away from the stream, where several handicapped parking spaces are being created. A new bridge was built over the stream to facilitate a better flow of traffic to and from the Big Lake area. The old bridge will be retained for hikers and mountain bikers. A large railroad grade that crossed the river upstream of the old bridge, long ago abandoned, was removed as part of mitigation for the highway project.

Management of Water Body

The West Fork of LCR above the two fish barriers will be managed as a self sustaining Apache trout recovery stream, with a put-and-take intensive use sport fishery utilizing pure strain hatchery Apache trout stocked only at Sheep's Crossing. The put-and-take fishery is being retained at Sheep's Crossing to meet angler demand at this high-use area on the highway, and to discourage illegal stocking of non-native trout if the fishing was not good enough to support the demand. Angler use has been measured at Sheep's Crossing by angler creel surveys in 2003 (7,290 angler use days from May through August), 1999 (9,141 AUDs from June through Sept), 1998 (11,037 AUDs from May through Nov), 1987 (8,176 AUDs from May through Sept), and 1982 (8,065 AUDs from May through Oct). Self sustaining wild Apache trout will be managed in the remainder of the stream, both upstream and downstream of Sheep's Crossing.

Sheep's Crossing was originally managed in conjunction with recreational trout stocking on the LCR in Greer, stocking catchable rainbow trout weekly from May to September up through 1998. In 1999-2001, rainbow trout were phased out and replaced with Apache trout at Sheep's Crossing, and then stocked exclusively with Apache trout starting in 2002 through 2006.
Two fish barriers were constructed on the West Fork LCR between Sheep's Crossing and Greer in 2004-2005, and the stream was chemically treated several times in 2006 with a piscicide to eliminate all non-native trout upstream of the barriers (brown trout and brook trout). No rainbow trout were found during the treatments, which resulted in a total fish-kill allowing identification of individuals. Sheep's Crossing had been closed to the public since summer 2006 and re-opened in 2009, due to construction on Highway 273 from Sunrise to Crescent Lake. Sheep's Crossing was not stocked with hatchery fish during 2006-2008, but stockings began again with pure Apache trout in 2009. The upper West Fork LCR in the wilderness area was stocked twice in 2007 with wild Apache trout of East Fork White River origin; one stocking directly from East Fork White River, and one stocking from the West Fork of Black River, which was originally established with hatchery Apache trout in 1997.

Sheep's Crossing will be managed separately from the LCR in Greer stocking site, now that the fish barriers are in place and wild Apache trout are being managed for recovery purposes. Only pure Apache trout of East Fork White River strain will be stocked at Sheep's Crossing for recreational fishing; they are considered compatible with the wild self sustaining population in the remainder of the stream. See below for LCR at Greer for information on historic stocking in this reach. The historic stocking data was combined with the LCR at Greer in the hatchery stocking database.

Sheep's Crossing was stocked with "native" cutthroat trout in 1921-1936, brook trout in 1935-1937, brown trout in 1940-1953, rainbow trout in 1936-2001, and Apache trout in 1999-2006. Wild Apache trout of East Fork White River strain were stocked in the wilderness portion of the West Fork LCR upstream of Sheep's Crossing in 2007. Catchable hatchery trout are normally stocked on a weekly basis at Sheep's Crossing from May to September, because they get caught and removed so quickly.

Proposed Action

The Department proposes to stock Apache trout for the period covered by this consultation. Catchable Apache trout would be stocked multiple times from May to September annually; numbers of Apache trout stocked may be from 0 to 12,000 fish annually.

Water Distribution/Connectivity

Sheep's Crossing is a short reach of stream habitat on the West Fork LCR, which drains off high elevations on the east slope of Mt. Baldy. As water flows down from Sheep's Crossing for 1.0 miles, it meets an unnamed tributary from the spillway from Lee Valley Lake. Lee Valley Lake is located 1.53 miles up the unnamed tributary, which only flows in the spring when Lee Valley Lake spills. From the unnamed tributary, the West Fork LCR flows downstream for 0.9 miles to the upper of 2 constructed fish barriers. The second constructed fish barrier is located 0.3 miles downstream of the upper barrier. Everything above this lower barrier is managed for Apache trout recovery, or is compatible with Apache trout recovery. Colter Dam, located 6.2 miles upstream of the confluence of the East and West Forks and 8.5 miles upstream of River Reservoir, is also used as a fish barrier for Apache trout recovery (upstream most barrier), but was not constructed for that purpose. Another irrigation lake existed at one time at Colter Dam, but was abandoned when the lake would not hold water due to fissures in the lake bottom. A vertical drop exists in the outlet pipe that is always left open, and is a functional fish barrier to upstream fish movement

From the lower fish barrier, water flows downstream for 2.8 miles to the confluence with the East Fork LCR, where it forms the mainstem LCR in Greer. The mainstem LCR flows downstream through the LCR Greer stocking site, flowing for 2.3 miles into River Reservoir. The LCR upstream of River Reservoir is perennial from the headwaters of the East and West

Forks on Mt. Baldy downstream to the confluence of the forks and down into the reservoir. For connectivity with tributaries below River Reservoir, refer to the Greer lakes section.

Fish Movement

Stocked Apache trout have the ability to move upstream to the headwaters of the West Fork LCR, or downstream over the fish barriers in the lower West Fork LCR. Once below the barriers, trout can move down into the LCR through Greer and into River Reservoir, or up the East Fork LCR at its confluence with the West Fork. Stocked Apache trout could only travel up the East Fork LCR until they reach the first of two constructed fish barriers. All these waters are suitable trout habitat and stocked Apache trout could persist.

Community Description

The West Fork of LCR, above the 2 constructed fish barriers, contains pure Apache trout. The piscicide treatments in 2006 removed wild brown and brook trout that were established in the river. Downstream of the two constructed fish barriers brown trout are still wild and self sustaining. Stocked Apache trout, fish that either moved down from the Sheep's Crossing stocking site or moved upstream from the LCR Greer stocking site, and rainbow trout are also present. Wild brown trout, speckled dace, fathead minnow, bluehead sucker, stocked Apache trout from the LCR Greer stocking site, and rainbow trout are present in the LCR in Greer (M. Lopez pers. comm.).

The East Fork LCR was chemically treated several times in 2004-2005 to remove a wild population of brook trout above Colter dam which serves as the upstream most barrier of three barriers located on the East Fork LCR. Pure Apache trout were reintroduced into the East Fork LCR above Colter cam in 2006-2007. Wild brown trout, speckled dace, and bluehead sucker, plus stocked rainbow trout and Apache trout still exist below Colter Dam. Future chemical treatments will remove browns and rainbows between Colter cam and the downstream most barrier and with the reach will be restocked pure Apache trout. The middle barrier provides extra protection and isolation of non-native fishes should the lowest barrier fail.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in

Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to consultation species including Apache trout, Mexican spotted owl, New Mexico meadow jumping mouse and southwestern willow flycatcher are addressed below. Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts due to the proposed action to Little Colorado spinedace and critical habitat are discussed in the West Fork Little Colorado River complex analysis.

Apache Trout

Stocked hatchery Apache trout would likely mix with the wild Apache trout in the West Fork LCR, but are not expected to have any impact on the wild population. Wild Apache trout would potentially be suppressed by intensive stocking at Sheep's Crossing, as were brown trout when rainbow trout were stocked on top of them prior to 1999. However, the wild population of Apache trout is expected to be robust and healthy, largely unaffected by stocked Apache trout immediately upstream and downstream of the stocking site. An occasional stocked Apache trout may swim upstream or downstream and mix with the wild population, which is considered to be beneficial to the wild population. The wild population was established using wild fish from the same strain utilized in the hatchery, the East Fork White River strain. One stocking came directly from the East Fork White River and had no hatchery origin. The second stocking came from the West Fork Black River, which were originally established in 1997 with pure Apache trout directly from the hatchery. Both wild fish stockings in the West Fork LCR occurred in 2007.

The same strain of Apache trout would be used for stocking the West Fork of the LCR above the fish barrier as was used to establish the recovery population in this same reach. Other strains of Apache trout recovery populations in the East Fork LCR (Soldier Creek strain) and South Fork LCR (Big Bonito strain) are isolated by constructed fish barriers.

Potential impacts

Stocked Apache trout into recovery Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River. All other recreational stockings of Apache trout

will occur in non-recovery areas for Apache trout. This recovery population is designated open to angling under the special 4(d) rule. Once stocked, Apache trout will be considered part of the recovery population. The Department would stock hatchery reared apache trout into the recovery population at densities expected to maintain angler satisfaction while minimizing impacts to the population as a whole. Some density dependent competition may occur in the stocking reach however not throughout the entire recovery reach since stocking only occurs at the lower end of the reach where angler access is possible.

Apache trout escapement from recovery areas and exposure to stocked sport fish

If recovery Apache trout were to move out of Sheeps Crossing downstream into the Greer stocking reach or further downstream into River Reservoir or the LCR (areas where stocked Apache trout or other stocked species may be present), they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas (Stocked Apache trout co-stocked with other species).

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations downstream of Sheep's Crossing, in River Reservoir or downstream in the LCR may include predation, hybridization with other trout and/or competition.

Northern Leopard Frog

Local Analysis: Although Sheep's Crossing and the West Fork LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that fish stocked in Sheep's Crossing will have an impact on northern leopard frogs is low. There are no historical records for northern leopard frogs at Sheep's Crossing; however, there are historical records for northern leopard frogs from 3 sites in the buffered complex: Benny Creek (SR 373) (1979), Little Colorado River (7 KM W of Eager) (1979), and Sheep Springs (FS 89 JCT W/HWY 260) (1942) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 32 surveys and site visits at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (SR 373) (1992 and

1995) or Sheep Springs (FS 89 JCT W/HWY 260) (1995) and it is likely that northern leopard frogs no longer occupy these sites (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing stocked fish from Sheep's Crossing and the West Fork buffered stocking complex is moderate. Stocked fish could disperse as far downstream as Lyman Lake and there are records from 2007-2009 for northern leopard frogs just downstream of Lyman Lake (Drost, pers. comm.). Although the main drainage does not provide suitable habitat for northern leopard frogs because of fast flowing water and presence of crayfish, the frogs are occupying a series of ponds and marshy meadows along the outflow from the Lyman Lake dam (Drost, pers. comm.).

Chiricahua leopard frog

Local Analysis: Although Sheep's Crossing and the West Fork LCR buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs will be exposed to fish stocked in Sheep's Crossing is low. There are no historical records for Chiricahua leopard frogs at Sheep's Crossing or within the West Fork buffered stocking complex. There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.), no Chiricahua leopard frogs were observed. In addition, even though the West Fork LCR buffered stocking complex is within a Chiricahua leopard frog recovery unit, the majority of the complex is outside of the Black River Management Area, suggesting that habitat and conditions for recovery are less suitable in that area. Therefore, it is likely that Chiricahua leopard frogs do not occupy the West Fork buffered stocking complex.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing fish from Sheep's Crossing and the West Fork Complex is low. There are no records for Chiricahua leopard frogs in the Little Colorado River where stocked fish could disperse to, but fish could travel downstream the Little Colorado River and upstream the tributary of Nutrioso Creek where there are 2 historical records for Chiricahua leopard frogs: Nutrioso Creek (Correjo Crossing, 1979) and Nelson Reservoir (SE Corner, 1971). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995) and Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995) and it is not likely that Chiricahua leopard frogs currently occupy these sites or this area (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl Critical Habitat

The stocking stream reach (1.8 miles of it) is within Mexican spotted owl (MSO) critical habitat (CH), with the remaining 1.5 miles of stream outside of critical habitat.

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Southwestern Willow Flycatcher and Critical Habitat

In the White Mountains, nesting flycatcher habitat can be found along the upper Little Colorado River (and a portion of its forks) downstream to the Town of Greer area. These areas primarily occur within the Apache Sitgreaves National Forest, although private land parcels are also included. Suitable habitat may exist in this reach of the West Fork LCR. Dense stands of willows exist along the river at and around Sheep's Crossing. The most recent documented occurrences (2000 and 2005) were recorded below the reach near the town of Greer (AGFD HDMS) approximately 2.5 miles upstream. Southwestern willow flycatchers have been documented nesting at three sites in the upper Little Colorado River drainage downstream to Eager.

Critical Habitat is designated along the West Fork LCR beginning above Sheep's Crossing and extends downstream past the confluence of the East Fork LCR and including and past River Reservoir. The West Fork LCR stocking reach is located within critical habitat.

Potential Impacts

Stocking and angling at high elevation is most likely to occur in the late spring and summers because of the harsh winters and difficult access. Late spring and summer coincides with flycatchers nesting season.

In the White Mountains, the primary limit to angler use is the location of stocked trout and access. However, anglers are not anticipated to wander remarkably far from the stocked locations. As a result, it is anticipated that most effects would occur near where trout are stocked. The Apache-Sitgreaves NF staff estimate that approximately 70,000 to 75,000 people use the recreation area in and around the Greer Area and forks of the Little Colorado River annually. Anglers will likely be on foot and either alone or in small parties. The proposed trout

stocking actions are an ongoing action that has a long history of occurring in the headwaters of the Little Colorado River. As a result, it is anticipated that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, once anglers reach their destination, they are not anticipated to be fishing in tight areas where vegetation is dense that causes casting to be difficult.

There may be some amount of disturbance to nesting flycatchers from anglers accessing the stocking site.

Critical Habitat
There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site. Neither of the two primary constituent elements identified for Southwestern willow flycatcher critical habitat are affected by the proposed action.

New Mexico Meadow Jumping Mouse
Habitat for the New Mexico meadow jumping mouse at Sheep's Crossing and along the West Fork Little Colorado River is in the area affected by recreation use, including access for fishing by anglers. Frey (2008) did not conduct surveys along the West Fork because of heavy angler use of the site and the risk that traps would not be secure from interference.

Potential Impacts
Impacts to habitat for the jumping mouse are likely occurring at Sheep's Crossing due to angler use that may be affecting habitat quality. Impacts to the mouse from stocking sport fish are related to anglers accessing fishing areas within mouse habitats. Human access to mouse habitat may result in trampling of vegetation, fragmentation of habitat patches, and soil compaction that degrades or eliminates habitat for the mouse. Since the mouse has a limited active period, quality habitat for foraging must be available for the mouse to get sufficient food to rear young and survive hibernation (USFWS 2007). There is also an increased risk of predation if the mice must cross trails or other openings to reach habitat patches. These impacts are ongoing, and other recreation use contributes to the current conditions. Sheep's Crossing is the Trailhead for the Mt. Baldy Trail, a trail maintained by the Apache Sit-graves National Forest that parallels the creek upstream for several miles. The likelihood or extent of disturbance impacts is unknown at this site.

Little Colorado River at Greer
Site Description
The LCR Greer stocking site is a 2.7 mile reach of the Little Colorado River (LCR) and extreme lower portions of the East Fork LCR and West Fork LCR in the town of Greer. Land ownership

of this stocking reach is a mix of Apache-Sitgreaves National Forest and private property in the town of Greer.

The LCR in Greer is accessible year around by paved Highway 373, the lower West Fork LCR is accessed year around by all-weather gravel road Forest Road 575, and the East Fork LCR is accessed year around by all-weather gravel County Road 1121. There are no established facilities for anglers at stocking sites in Greer, except on Forest Service land at Government Springs, where there is dirt parking and a restroom. Greer is a popular tourist town and receives a fair amount of recreational use, including fishing, hiking, horseback riding, and more. Many users rent cabins or rooms in Greer, stay at nearby Benny Creek Campground and Rolfe C. Hoyer Campground just out of town off Hwy 373, or drive in for the day from surrounding communities and other campgrounds.

Camping is not permitted on the stream itself in Greer; however, the river is on private land through most of the town. Popular hiking trails follow the East Fork LCR and West Fork LCR upstream from Greer.

Management of Water Body
Table 7 provides a summary of historic stocking activity at West Fork LCR near Greer and at Sheep's Crossing. In the Department's Hatchery Stocking database, these two locations are grouped as one record, so separating historic stocking history was not possible. The primary fishery is a cold water summer intensive use put-and-take fishery. Catchable trout are stocked weekly from May through September. Apache trout stocking will be the focus; however, rainbow trout will be used when numbers of Apache trout in the hatchery are insufficient to meet the numbers identified for stocking the stream.

Table 34. Summary of stocking history at LCR Greer and Sheep's Crossing.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Apache trout	1999	2009	122	53,475
Rainbow trout	19336	2003	1012	1,076,648
Brook trout	1935	1937	2	29,264
Brown trout	1940	1973	17	59,394
Coho salmon	1973	1973	1	480
Native trout	1933	1936	2	20,000
Total			1,344	2,802,377

Greer stockings occur at accessible locations on the LCR upstream and into the lower portions of the East and West Forks of the LCR, for a total of about 2.7 miles all within the town of Greer. Fish are stocked from the first road crossing upstream through several sites in town to the end of

forest road 575 on the West Fork LCR in the Government Springs area, and to the Montlure church camp at the end of County Road 1121 on the East Fork LCR.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies the management emphasis for the LCR mainstem above River Reservoir as intensive use (put-and-take) sport fish with a desired fish assemblage of Apache trout, rainbow trout, brown trout, speckled dace, and bluehead sucker, which is consistent with the proposed action.

Proposed Action

The Department proposes to stock Apache trout and rainbow trout for the period covered by this consultation.

Catchable Apache trout would be stocked multiple times from May to September annually; numbers of catchable Apache trout stocked may be from 0 to 35,000 fish annually. Should numbers of Apache trout produced by the hatchery be insufficient to meet the numbers identified for stocking, rainbow trout will be stocked to make up the difference such that a total of no more than 35,000 trout are stocked into the reach.

Water Distribution / Connectivity

The East Fork LCR and West Fork LCR both originate in the high elevation of Mt. Baldy and flow 17.8 miles and 9.1 miles, respectively, to their confluence in the town of Greer, where they form the mainstem LCR. The LCR flows through Greer for 2.3 miles, and then into River Reservoir. The exception is a small portion of the East Fork LCR near Colter Reservoir that may dry up during extreme drought years; however, most of the drainage is perennial and supports wild fish. For connectivity downstream of River Reservoir, refer to the Greer lakes analysis.

Fish Movement

Trout stocked into the LCR Greer stocking site can swim up either the West Fork LCR or the East Fork LCR until they reach constructed fish barriers for Apache trout recovery in these forks. Two fish barriers were constructed on the West Fork LCR, 2.8 and 3.1 miles upstream of the confluence of the forks. Two fish barriers were constructed on the East Fork LCR, 2.2 and 2.4 miles upstream of the forks, plus a dam at the old Colter Reservoir, 6.2 miles upstream of the confluence of the forks, functions as a fish barrier.

Stocked trout can also swim downstream into River Reservoir, 0.4 miles below the lowest point of the stocking reach. These dispersing trout have the ability to move into the LCR downstream of River Reservoir during spill events in the spring or during irrigation releases in the summer. For fish movement downstream of River Reservoir, refer to the Greer lakes analysis.

Community Description

The LCR in Greer contains wild brown trout, stocked rainbow and Apache trout, fathead minnow, speckled dace, and bluehead sucker. The lower East Fork and West Fork LCR within

the stocking area contain primarily wild brown trout, and stocked rainbow and Apache trout. A herpetological survey on the lower East Fork LCR in Greer in 1995 documented wandering garter snakes. For a description of the aquatic community in and downstream of River Reservoir (downstream of this stocking site at Greer), refer to the Greer lakes analysis.

Southwestern willow flycatchers have been observed in the vicinity of the town of Greer in dense willow patches along the stream channel (Figure 7).

Figure 7. Photo of Greer town area where flycatchers were detected (2003).

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to consultation species including Apache trout, Mexican spotted owl, New Mexican meadow jumping mouse and southwestern willow flycatcher are addressed below.

Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts due to the proposed action to Little Colorado spinedace and critical habitat are discussed in the West Fork Little Colorado River complex analysis.

Apache Trout

Recovery populations of Apache trout occur a short distance upstream of the stocking site in the West Fork LCR and East Fork LCR; however, stocked trout cannot reach occupied habitat due to a number of constructed barriers. These structures were built exclusively to protect the recovery populations by prohibiting upstream movement of non-native salmonids. Another recovery population of Apache trout exists in the South Fork LCR which joins the mainstem LCR downstream of River Reservoir, but the South Fork also has constructed fish barriers to exclude non-native trout.

Potential Impacts

Stocked Apache trout co-stocked with other species:

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked rainbow trout may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts is found in Apache trout interactions section (Chapter 4).

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

Apache trout escapement from recovery areas and exposure to stocked sport fish:

If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Northern Leopard Frog

Local Analysis: Although LCR in Greer and the West Fork LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs will be exposed to fish stocked in LCR in Greer is low. There are no historical records for northern leopard frogs at LCR in Greer. There are historical records for northern leopard frogs from 3 sites in the complex: Benny Creek (SR 373) (1979), Little Colorado River (7 KM W of Eager) (1979), and Sheep Springs (FS 89 JCT W/HWY 260) (1942). There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (SR 373) (1992 and 1995) or Sheep Springs (FS 89 JCT W/HWY 260) (1995) and it is likely that northern leopard frogs no longer occupy these sites (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing stocked fish in the LCR in Greer and the West Fork buffered stocking complex is moderate. Stocked fish could disperse as far downstream as Lyman Lake and there are records from 2007-2009 for northern leopard frogs just downstream of Lyman Lake (Drost, pers. comm.). Although the main drainage does not provide suitable habitat for northern leopard frogs because of fast flowing water and presence of crayfish, the frogs are occupying a series of ponds and marshy meadows along the outflow from the Lyman Lake dam (Drost, pers. comm.).

Chiricahua Leopard Frog

Local Analysis: Although LCR in Greer and the West Fork LCR buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs will be exposed to fish stocked in LCR in Greer is low. There are no historical records for Chiricahua leopard frogs at LCR in Greer or within the West Fork buffered stocking complex. There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.); no Chiricahua leopard frogs were observed. In addition, even though the West Fork LCR buffered stocking complex is within a Chiricahua leopard frog recovery unit, the majority of the complex is outside of the Black River Management Area, suggesting that habitat and conditions for recovery are less suitable in that area. Therefore, it is likely that Chiricahua leopard frogs do not occupy the West Fork buffered stocking complex.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing stocked fish from LCR in Greer and the West Fork Complex is low. There are no records for Chiricahua leopard frogs in the Little Colorado River where stocked fish could disperse to, but fish could travel downstream the Little Colorado River and upstream the tributary of Nutrioso Creek where there are 2 historical records for Chiricahua leopard frogs: Nutrioso Creek (Correjo Crossing, 1979) and Nelson Reservoir (SE Corner, 1971). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995) and Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995) and it is not likely that Chiricahua leopard frogs currently occupy these sites or this area (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl Critical Habitat

The stocking stream reach is within Mexican spotted owl (MSO) critical habitat (CH). The lower 0.5 miles of the stocking stream reach is within the buffer and is also within a PAC. The topography within the PAC is incredibly steep, reducing the ability for angler access.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within boundary of at least one MSO PACs in the general vicinity of the site. There may be some disturbance of MSOs at the nest site, roosting or foraging areas within the PAC during the breeding season.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In

making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Southwestern Willow Flycatcher

In the White Mountains, nesting flycatcher habitat can be found along the upper Little Colorado River (and a portion of its forks) downstream to the Town of Greer area. These areas primarily occur within the Apache Sitgreaves National Forest, although private land parcels are also included. Suitable and occupied habitat exists along the LCR in Greer, within the stocking reach. Angling activity occurs on the LCR near the Route 373 road crossing. However, because of the density of willow patches, few anglers fish within occupied habitat. In 9 years of summer flycatcher surveys by the Department, one angler was seen within the willow patch, but was within 50 feet of the road and not near occupied habitat (C. Paradzick pers. comm.). Southwestern willow flycatchers have been documented nesting at three sites in the upper Little Colorado River drainage downstream to Eager.

Critical Habitat is designated along the West Fork LCR beginning above Sheep's Crossing and extends downstream past the confluence of the East Fork LCR and including and past River Reservoir. The Little Colorado River at Greer stocking reach is located within critical habitat.

Potential Impacts

Stocking and angling at high elevation is most likely to occur in the late spring and summers because of the harsh winters and difficult access. This coincides with flycatchers nesting times.

In the White Mountains, anglers primarily use the area around the stocking site and the access to that area (e.g., paths). Anglers are not anticipated to wander remarkably far from the stocked locations. As a result, it is anticipated that most effects would occur near where trout are stocked. The Apache-Sitgreaves NF staff estimate that approximately 70,000 to 75,000 people use the recreation area in and around the Greer Area and forks of the Little Colorado River annually. Anglers will likely be on foot and either alone or in small parties. The proposed trout stocking actions are an ongoing action that has a long history of occurring in the headwaters of the Little Colorado River. As a result, it is anticipated that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, once anglers reach their destination, they are not anticipated to be fishing in tight areas where vegetation is dense and could cause casting to be difficult.

There may be some amount of disturbance to nesting flycatchers from anglers accessing the stocking site. Neither of the two primary constituent elements identified for Southwestern willow flycatcher critical habitat are affected by the proposed action.

Critical Habitat

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site. Neither of the two primary constituent elements identified for Southwestern willow flycatcher critical habitat are affected by the proposed action.

New Mexico Meadow Jumping Mouse

Habitat for the New Mexico meadow jumping mouse at Sheep's Crossing and along the West Fork Little Colorado River is in the area affected by recreation use, including access for fishing by anglers. Frey (2008) did not conduct surveys along the West Fork because of heavy angler use of the site and the risk that traps would not be secure from interference. The newly located site on the East Fork Little Colorado River may also be affected by anglers as it is part of the area near Greer that is stocked.

Potential Impacts

Impacts to habitat for jumping mouse are likely occurring on the West Fork Little Colorado at Greer due to documented by heavy angler use that may be affecting habitat quality through maintaining degraded conditions. These impacts are ongoing, and other recreation use contributes to the current conditions. The stockings at Greer are made at several locations in the East and West Forks near the town, and it is likely that recreational access (including that by anglers) is also contributing to ongoing habitat degradation at the new East Fork Little Colorado River population. The likelihood or extent of disturbance impacts is unknown at either site.

Bunch, River, and Tunnel Reservoirs

Site Description

Bunch, River, and Tunnel Reservoirs are commonly known as the Greer lakes, located on the Apache-Sitgreaves National Forest approximately 1 mile northeast of Greer. These lakes are closely grouped together in the headwaters of the Little Colorado River (LCR), at the bottom of the West Fork complex.

River Reservoir is located on the mainstem LCR, with perennial flow from the river entering the reservoir year around. River Reservoir dam was constructed in 1896, rebuilt in 1950, and underwent a major repair in 2005. The reservoir sits at 8221 feet elevation, is 50 surface acres in size, and has maximum and average depths of 50 and 20 feet, respectively. River Reservoir spills directly into the LCR every year during the spring snowmelt.

Bunch and Tunnel Reservoirs are off-stream impoundments, filled by a diversion ditch from the LCR during the fill season from September 15 through April 15. Bunch Reservoir dam was built in 1929. The reservoir sits at 8256 feet elevation, is 20 surface acres in size, and has maximum and average depths of 20 and 10 feet, respectively. Tunnel Reservoir dam was built in 1951. The reservoir sits at 8261 feet elevation, is 15 surface acres in size, and has maximum and average depths of 15 and 10 feet, respectively.

Boat motors at River Reservoir are restricted to a single 10 horsepower gas motor, while Bunch and Tunnel Reservoirs are restricted to electric motors only.

Camping is not permitted at the lakes, but 2 Forest Service campgrounds, Benny Creek Campground and Rolfe C. Hoyer Campground, are located within a mile or two.
River, Bunch, and Tunnel Reservoirs are accessed year round by a paved road off Hwy 373 on National Forest Land, and are an integral part of the economy for the Town of Greer. The lakes freeze over from December through March and receive a fair amount of ice fishing use.

River Reservoir has 1 boat launch ramp, paved parking, 2 ramadas, and 1 restroom facility on the west side of the dam. It also has a dirt parking area, 2 ramadas, and another restroom facility on the east side about mid-lake, accessed by dirt Forest Road 245. Most of the shore fishing is centered at these main access points, plus a few anglers near a small pull-off of Forest Road 245 near the upper end of the lake.

Bunch Reservoir has 1 boat launch ramp, paved parking, 2 ramadas, and 1 restroom facility on the west side of the lake. Almost all the shore fishing use is concentrated along the west shoreline, as this is the only road access to the lake.

Tunnel Reservoir has 1 boat launch ramp, paved parking, 2 ramadas, and 1 restroom facility on the east side of the lake. A small paved parking area is also located right off Forest Road 245 on

the north side of the lake. Shoreline anglers use nearly the entire shoreline perimeter because the lake is so small and is usually drawn down for irrigation use first, making the lake even smaller during peak fishing season.

Management of Water Body
Bunch and Tunnel Reservoirs are managed primarily as put-and-take intensive use cold water fisheries, with some attempts at put-grow-and-take management in Bunch Reservoir. Bunch is typically stocked multiple times per year with catchable rainbow trout from April through June (Table 35). It has also been stocked opportunistically with sub-catchable and fingerling rainbow trout. Tunnel Reservoir has been stocked multiple times per year with catchable rainbow trout from April through June, with fingerling trout only stocked in 1999 in the last 10 years (Table 36).

River Reservoir is managed as a put-grow-and-take cold water fishery, and stocked multiple times per year with catchable, sub-catchable, and fingerling rainbow trout. Most trout were stocked in April through June (Table 37).

Table 35. Bunch Reservoir Stocking History.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1940	1943	2	28,800
Brown trout	1938	1993	14	78,038
Rainbow trout	1933	2009	166	1,165,319
Total			182	1,272,157

Table 36. Tunnel Reservoir stocking history.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1935	1993	19	127,665
Native trout	1937	1937	1	11,200
Rainbow trout	1937	2009	360	1,130,082
Total			380	1,268,947

Table 37. River Reservoir stocking history.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Largemouth bass	1920	1920	1	150
Brook trout	1937	1943	2	34,300

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1949	1993	26	432,852
Rainbow trout	1935	2009	284	2,715,627
Total			313	3,182,929

A statewide mail-out survey reported that the Greer lakes received a combined use of 38,024 angler use days in 2001 (Pringle 2004), with most use occurring from May through September. On site angler creel surveys in 2001 showed River Reservoir had 25,065 angler use days, Bunch had 10,192 angler use days, and Tunnel had 17,209 angler use days.

The Department intends to stock Apache trout opportunistically, primarily looking for flexibility to stock hatchery Apache trout. Hatchery Apache trout are stocked primarily in streams in the White Mountains and two lakes managed for featured species that are connected to recovery Apache trout streams. Typically the Department does not have enough supply to meet these stocking needs; however, hatcheries occasionally have more Apache trout on station than places into which they can be stocked. This can be caused by very dry years that result in Forest Closures, or low/warm water conditions in some Apache trout stocking sites. The Greer lakes offer good water quality conditions during mid-summer, something that is uncommon amongst lakes in the White Mountains, the critical time when the Department needs additional stocking sites for this species in dry years. The Greer lakes are also adjacent to rainbow/Apache trout stocking site in the LCR at Greer.

These reservoirs are used for irrigation. Water is released into the LCR for use downstream in Springerville and Eagar. Water in River Reservoir is released from a headgate at the dam directly into the LCR. Water in Bunch Reservoir is released through a headgate in the dam and flows into a drainage for 0.4 miles to lower Benny Creek, down Benny Creek for 1.4 miles to Hall Creek, down Hall Creek for 0.3 miles, and into the LCR approximately 2.6 miles downstream of River Reservoir. Water in Tunnel Reservoir is released through a valve to a pipe that flows directly into River Reservoir and ultimately into the LCR through the works on River Reservoir. Most water released is diverted from the LCR at major diversions 7.2 and 11.4 miles downstream of River Reservoir to Round Valley, which may reduce the potential for transport of stocked salmonids into spinedace habitat further downstream (see Complex Analysis, below).

The three reservoirs maintain relatively good water quality year round and usually experience no fish kills. The exception is Tunnel Reservoir, which may be drawn down to approximately 4 to 5 feet of water. Tunnel Reservoir usually experiences strong blue-green algae blooms and sometimes elevated pH levels; extremely low oxygen was recently recorded towards the end of summer in 2008. River Reservoir also experiences strong blue-green algae blooms, but maintains good pH levels. Bunch Reservoir is often somewhat turbid and does not experience heavy algae blooms.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies the management emphases for the Greer lakes as intensive use sport fish with rainbow trout catchables at Tunnel Reservoir; basic yield/intensive use sport fish with rainbow trout fingerlings and catchables at Bunch Reservoir; and intensive use sport fish with rainbow trout fingerlings and catchables at River Reservoir. The proposed action is generally consistent with this plan.

The proposed action is for intensive use with catchables at Bunch instead of basic yield, because the reservoir has been drained down so quickly each year that fingerlings do not have time to grow to catchable size. The intensive use emphasis at River Reservoir in the IFM plan is likely a mistake because the plan also recommends continuing to stock fingerlings and catchables, which is a basic yield (put-grow-and-take) strategy. The proposed action includes sub-catchables instead of fingerlings at River Reservoir to allow these smaller fish to reach catchable size quicker and have better survival rates in the face of predators in the reservoir, such as brown trout and yellow perch. The proposed action also includes catchable Apache trout for all Greer lakes that was not identified in the plan. This action would still be consistent with the plan as Apache trout behave in much the same way as rainbow trout and would be harvested out the same; many anglers cannot distinguish between the two. The Department does not intend to market these lakes for feature species, especially because stocking Apache trout in these lakes would occur only under special circumstances, such as a surplus Apache trout in hatcheries and no other suitable approved site to stock them.

Proposed Action

The Department proposes to stock rainbow trout and Apache trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from April to September annually in Bunch and Tunnel Reservoirs; catchable and sub-catchable rainbow trout would be stocked multiple times from April to September annually in River Reservoir. The numbers of rainbow trout stocked may be from 0 to 15,000 fish in Bunch Reservoir, 0 to 20,000 fish in Tunnel Reservoir, and 0 to 40,000 fish in River Reservoir annually.

Catchable, sub-catchable and fingerling Apache trout would be stocked from April to September only when a surplus occurs in the hatchery, and typical Apache trout stocking sites are not available or cannot support the surplus; numbers of Apache trout stocked may be from 0 to 15,000 fish total in the Greer lakes annually.

Water Distribution / Connectivity

River Reservoir is filled by the perennial flow of the LCR. The headwater tributaries of the LCR, the East and West Forks, both flow perennial from high elevation on Mt. Baldy down to their confluence in the town of Greer, where they form the mainstem of the LCR. The mainstem LCR then flows perennial for 2.3 miles into River Reservoir. Two constructed fish barriers are located

on the West Fork LCR for recovery of Apache trout in the stream above the barriers. The lower barrier is located 2.8 miles upstream of the confluence of the East and West Forks, 5.1 miles upstream of River Reservoir, and the upper barrier is located 3.1 miles upstream of the confluence of the East and West Forks, 5.4 miles upstream of River Reservoir. Spill from Lee Valley Lake enters the West Fork LCR approximately 0.9 miles upstream of the upper barrier. Two constructed fish barriers are located on the East Fork LCR for recovery of Apache trout in the stream above the barriers. The lower barrier is located 2.2 miles upstream of the confluence of the East and West Forks, 4.4 miles upstream of River Reservoir, and the upper barrier is located 2.4 miles upstream of the confluence of the East and West Forks, 4.7 miles upstream of River Reservoir.

Bunch and Tunnel Reservoirs are filled from a diversion ditch out of the LCR during the “fill season” from September 15 through April 15. They are off-channel irrigation reservoirs operated in conjunction with River Reservoir. The diversion takes water from the LCR approximately 1.8 miles upstream of River Reservoir. The ditch flows from the LCR for 1.6 miles then splits to fill either Tunnel Reservoir or Bunch Reservoir, each about 0.2 miles from the split in the ditch. Once these lakes are full, the irrigation ditch is shut down to let River Reservoir fill. During the time the irrigation ditch is operating, the river downstream from that diversion can be extremely low. Water is also released out of Tunnel and Bunch during the irrigation season (April 15-September 15) for use downstream in Springerville and Eagar. When water is released from the outlet at Bunch Reservoir, it flows down an unnamed tributary for 0.4 miles into Benny Creek, then down Benny Creek for 1.4 miles to Hall Creek, then down Hall Creek for 0.3 miles and directly into the LCR downstream of River Reservoir. This water travels down the LCR to be pulled back out towards Springerville and Eagar. When water is released from Tunnel Reservoir, it flows directly into the west side of River Reservoir and is metered out through the River Reservoir dam outlet. All 3 reservoirs are often drained down quite low by the end of the irrigation season, especially in dry years when more irrigation water is needed downstream.

River Reservoir spills annually in the spring during snowmelt runoff. Water is also released out the outlet in the dam directly into the LCR during the irrigation season of April 15 to September 15, to be pulled back out downstream near Springerville and Eagar. All three reservoirs are often drained down to the depth of the outlet structures, leaving a small minimum pool at the end of the summer. No legal minimum pool agreements are in place. The remaining pool level is left because it cannot be released without pumping up to the outlet.

Colter Dam, located 6.2 miles upstream of the confluence of the East and West Forks and 8.5 miles upstream of River Reservoir, is also used as a fish barrier for Apache trout recovery, but was not constructed for that purpose. Another irrigation lake existed at one time at Colter Dam, but was abandoned when the lake would not hold water due to fissures in the lake bottom. A

vertical drop exists in the outlet pipe that is always left open, and is a functional fish barrier to upstream fish movement.

River Reservoir fills and spills every year during the spring snowmelt runoff. While the reservoir does not spill at other times of the year, water is released directly into the LCR through an outlet structure in the dam for use downstream in Springerville during the irrigation season from April 15 to September 15. The LCR downstream of River Reservoir flows perennially all the way to Lyman Lake, even at base flows with or without irrigation releases. From River Reservoir dam, the LCR flows downstream for 16.1 miles to the upper extent of occupied spinedace habitat at Airport Road in Springerville. Along this reach, tributaries enter the LCR, Hall Creek at 2.6 miles downstream of River Reservoir, Fish Creek at 3.1 miles downstream of River Reservoir, and the South Fork LCR at 5.9 miles downstream of River Reservoir. A major water diversion is located 1.3 miles downstream of the South Fork LCR confluence, which diverts much of the irrigation water released from the Greer lakes during the summer. Continuing down the LCR in Springerville, another tributary, Nutrioso Creek, enters 1.7 miles downstream of Airport Road. Another major diversion structure is located approximately 1 mile downstream of Nutrioso Creek confluence, at which point the mainstem LCR continues downstream for another 17.0 miles to Lyman Lake. The tributary Coyote Creek enters the LCR a few miles upstream of Lyman Lake. A number of small water diversions exist throughout Springerville and downstream towards Lyman Lake and are not fish barriers for trout but may be for smaller sized species. For a detailed description of water connectivity below Lyman Lake, see the Lyman Lake analysis. Additional Information on water connectivity with Hall Creek, a tributary to the LCR below River Reservoir, was provided in the White Mountain Reservoir section. Additional information on water connectivity with the South Fork LCR, a tributary to the LCR below River Reservoir, will be provided in the Mexican Hay Lake section below.

Fish Movement

Fish have the ability to move upstream into the LCR from River Reservoir at all times of the year because it is perennial. They can move up the LCR for 2.6 miles largely unobstructed to the confluence of the East and West Fork LCR, although a number of beaver dams in the town of Greer can slow them down, and a small diversion structure to Bunch and Tunnel Reservoirs is an obstruction, but not a barrier. Further upstream, a fish could travel up the West Fork LCR for 2.8 miles until it reaches the lower constructed fish barrier for Apache trout recovery. Another constructed fish barrier is located 0.3 miles upstream on the West Fork in case the lower barrier fails. From the confluence of the East and West Forks, stocked trout may also travel up the East Fork LCR for 2.2 miles to a lower constructed fish barrier for Apache trout recovery. Another constructed fish barrier is located 0.2 miles upstream on the East Fork LCR in case the lower barrier fails. An old dam located 3.77 miles upstream of the upper barrier on the East Fork LCR also acts as a third fish barrier (Colter Dam). The constructed fish barriers were designed and

built to isolate and protect recovery populations of Apache trout above from non-native trout downstream of the barriers.

Fish can only escape upstream in the diversion ditch from Bunch and Tunnel Reservoirs during the fill season from September 15 to April 15 when the ditch is running with water. This ditch is empty during the irrigation season because it is only used to fill Bunch and Tunnel Reservoirs. Once in the LCR a fish could travel upstream much the same way as described above for River Reservoir.

Stocked trout could escape River Reservoir into the LCR downstream when it spills in the spring, or when irrigation water is released during the summer. Once in the LCR a fish could theoretically travel all the way to Lyman Lake because it runs perennial all the way. Two diversion structures on the LCR near Springerville could divert a downstream migrating fish into diversion ditches, but these ditches are only operating during the irrigation season and not during high spring runoff flows. A fish could also swim up tributaries of the LCR, such as perennial Hall Creek, but only up to the dam of a private pond 1.2 miles upstream of the LCR. A fish could also swim up Fish Creek but only during the spring runoff because the lower reaches are dry during the summer because water is diverted out of that creek directly for irrigation. A fish could swim up into perennial South Fork LCR, but only for 0.9 miles until it came to a constructed fish barrier for Apache trout recovery. A second constructed fish barrier is located 1.8 miles upstream of the first in case that lower barrier fails.

Stocked trout in Tunnel Reservoir could escape into River Reservoir when water is released for irrigation, then travel through similar routes as those trout escaping River Reservoir. Stocked trout in Bunch Reservoir could escape into the unnamed tributary when water is released for irrigation, then down to Benny Creek. Once in Benny Creek it could either go upstream, or downstream to Hall Creek. Once in Hall Creek it could either go upstream to a dam of a private pond a short distance upstream, or downstream to the Little Colorado River. Once in the Little Colorado River, an escaped trout could travel upstream for 2.6 miles to the base of River Reservoir dam, or move downstream along the same route as those trout escaping River Reservoir.

The 7.2 miles immediately downstream of River Reservoir is suitable trout habitat and escaped Apache and rainbow trout probably travel, persist, and reproduce within this reach, although recruitment from Apache trout is not expected. The next 8.9 miles downstream are somewhat marginal for trout, with findings of brown and rainbow trout consistently, but in low numbers and larger sizes, suggesting they do not reproduce within this reach. The next 7.5 miles is very marginal for trout, with findings of brown trout in very low numbers and rarely any rainbow trout. Three records of rainbow trout exist within this reach, 2 trout in 1993 and 1 in 1999.

Additional information on fish movement and occurrence can be found below in the Complex Analysis.

Community Description

River Reservoir contains stocked rainbow trout, plus fathead minnow, yellow perch, bluehead sucker, carp, brown trout, and crayfish (Table 38). The fathead minnow, yellow perch, and carp likely reproduce in the reservoir, but no evidence exists suggesting that trout do. Stocked trout can persist in the reservoir if it maintains good water quality, even at minimum pool, and if it does not experience fish kills. There has been no history of fish kills in River Reservoir.

Bunch and Tunnel Reservoirs contain stocked rainbow trout, plus fathead minnow, brown trout, and crayfish (Table 39 and Table 40, respectively). Only the fathead minnow reproduce in Tunnel and Bunch Reservoirs. Stocked trout can persist in Bunch Reservoir if it maintains good water quality, even at minimum pool, and if it does not experience fish kills. There has been no history of fish kills in Bunch Reservoir. Stocked trout may persist in Tunnel Reservoir, but this lake can experience very low oxygen levels when drawn down to minimum pool. Tunnel reservoir has experienced 4 fish kills in its history. Brown trout are most likely maintained in the reservoirs by wild fish spawning in the LCR and fish entering the lakes through the diversion ditch.

Table 38. Survey history at River Reservoir with experimental gillnets.

Survey date	Species collected	Number collected	Size range (mm TL)
April 2000	Rainbow trout	16	117-336
	Brown trout	10	361-691
	Yellow perch	9	178-248
April 2003	Rainbow trout	1	407
	Brown trout	1	826
	carp	1	Not measured
April 2004	Rainbow trout	36	295-447
	Brown trout	8	251-695
	Bluehead sucker	1	210
April 2007	Brown trout	4	306-634
	Apache trout	1	299
April 2008	Rainbow trout	7	205-370
	Brown trout	3	300-650
	carp	1	590

Table 39. Survey history at Bunch Reservoir using experimental gillnets.

Date surveyed	Species collected	Number collected	Size range (mm TL)
April 1988	Rainbow trout	39	195-259
	Brown trout	5	224-451
March 1989	Rainbow trout	15	214-324
	Brown trout	16	242-454
April 1990	Rainbow trout	5	208-268
	Brown trout	17	230-485
April 2003	Rainbow trout	7	185-263
	Brown trout	5	283-632
April 2008	Rainbow trout	36	210-340
	Brown trout	4	408-465

Table 40. Survey history at Tunnel Reservoir.

Survey date	Species collected	Number collected	Size range (mm TL)
March 1986	Brown trout	33	296-405
October 1988	Rainbow trout	13	239-304
	Brown trout	15	185-440
March 1989	Brown trout	8	312-345
April 1990	Brown trout	32	233-485
October 2008	Rainbow trout	25	232-351
	Brown trout	23	222-690

The LCR upstream of River Reservoir contains stocked rainbow and Apache trout, plus reproducing populations of brown trout, fathead minnow, speckled dace, and bluehead sucker.

Recovery populations of pure Apache trout are located in the West Fork LCR and East Fork LCR above the constructed fish barriers, 5.1 miles and 4.4 miles upstream of River Reservoir, respectively.

The LCR downstream of River Reservoir for 7.2 miles contains reproducing populations of brown trout, rainbow trout, speckled dace, bluehead sucker, Little Colorado sucker, fathead minnow and crayfish. The next 8.9 miles contains few but consistent rainbow and brown trout, and reproducing populations of fathead minnow, speckled dace, bluehead sucker, Little Colorado sucker and crayfish. The next 8.5 miles from Airport Road in Springerville (16.1 miles downstream of River Reservoir) to below Wenima Wildlife Area contains few but consistent brown trout, very rarely rainbow trout (only 3 documented records, 2 in 1993 and 1 in 1999), and

reproducing populations of Little Colorado spinedace, Little Colorado sucker, speckled dace, bluehead sucker, fathead minnow, green sunfish, and crayfish. The next 13.5 miles of the LCR down to Lyman Lake contains reproducing populations of Little Colorado spinedace, Little Colorado sucker, speckled dace, bluehead sucker, fathead minnow, green sunfish and crayfish. Table 41 provides a summary of recent fisheries surveys of the LCR from River Reservoir to Lyman Lake.

Table 41. Summary of recent (2006-09) surveys in the LCR from River Reservoir downstream to Lyman Lake, with downstream sites listed first and upstream sites listed last.

Date	Location	Species collected	Num.
6/30/2008	Wiltbank property	Little Colorado spinedace	36
		Little Colorado sucker	94
		Speckled dace	55
		Fathead minnow	676
		Green sunfish	50
		Unidentified sucker fry	8
6/30/2008	Nielson property	Little Colorado spinedace	3
		Little Colorado sucker	43
		Bluehead sucker	7
		Fathead minnow	1,510
		Green sunfish	114
		Unidentified sucker fry	50
8/3/2009	Richville Valley	Little Colorado sucker	2
		Bluehead sucker	2
		Fathead minnow	43
		Green sunfish	12
8/3/2009	The Corral	Little Colorado spinedace	27
		Little Colorado sucker	9
		Speckled dace	79
		Bluehead sucker	7
		Fathead minnow	23
7/30/2009	Wenima Wildlife Area – lower Slade	Little Colorado spinedace	75
		Little Colorado sucker	22
		Speckled dace	108
		Bluehead sucker	67
		Fathead minnow	48
7/30/2009	Wenima Wildlife Area – upper Slade	Little Colorado spinedace	50
		Little Colorado sucker	12

Date	Location	Species collected	Num.
		Speckled dace	99
		Bluehead sucker	55
		Fathead minnow	55
		Green sunfish	2
		Unidentified fry	1
7/29/2009	Wenima Wildlife Area - Fence	Little Colorado spinedace	70
		Little Colorado sucker	20
		Speckled dace	104
		Bluehead sucker	57
		Fathead minnow	109
		Brown trout	3
		Unidentified sucker fry	1
7/9/2009	Wenima Wildlife Area - Bridge	Little Colorado spinedace	46
		Little Colorado sucker	8
		Speckled dace	85
		Bluehead sucker	16
		Fathead minnow	64
		Brown trout	2
		Green sunfish	2
		Unidentified sucker fry	2
		Unidentified fry	4
7/30/2009	Wenima Wildlife Area – upper end	Little Colorado spinedace	22
		Little Colorado sucker	7
		Speckled dace	94
		Bluehead sucker	9
		Fathead minnow	29
		Brown trout	3
		Green sunfish	101
6/11/2009	Rest Area	Little Colorado spinedace	16
		Little Colorado sucker	30
		Speckled dace	196
		Bluehead sucker	25
		Fathead minnow	39
		Brown trout	1
4/18/2007	Downstream of Wastewater Treatment	Little Colorado sucker	1
		Speckled dace	198
		Fathead minnow	102

Date	Location	Species collected	Num.
6/10/2009	Becker Wildlife Area - #1 seine	Little Colorado spinedace	21
		Speckled dace	20
		Bluehead sucker	2
		Fathead minnow	15
7/8/2009	Becker Wildlife Area - #1 shock	Little Colorado spinedace	55
		Little Colorado sucker	5
		Speckled dace	139
		Bluehead sucker	22
		Fathead minnow	87
		Unidentified fry	2
7/8/2009	Becker Wildlife Area - #2 shock	Little Colorado spinedace	30
		Little Colorado sucker	9
		Speckled dace	30
		Bluehead sucker	2
		Fathead minnow	41
		Unidentified sucker fry	1
		Unidentified fry	7
7/8/2009	Becker Wildlife Area - #3 shock	Little Colorado spinedace	5
		Little Colorado sucker	3
		Speckled dace	52
		Bluehead sucker	5
		Fathead minnow	13
3/22/2007	Becker Wildlife Area	Little Colorado spinedace	80
		Little Colorado sucker	6
		Speckled dace	154
		Bluehead sucker	11
		Fathead minnow	321
		Brown trout	1
6/11/2009	Airport Road – below diversion	Little Colorado spinedace	50
		Little Colorado sucker	20
		Speckled dace	142
		Bluehead sucker	8
		Fathead minnow	123
		Brown trout	2
6/11/2009	Airport Road-above diversion	Little Colorado sucker	3
		Speckled dace	3
		Bluehead sucker	4

Date	Location	Species collected	Num.
		Fathead minnow	7
4/12/2007	Above Airport Road	Little Colorado sucker Speckled dace Bluehead sucker Fathead minnow Brown trout	3 139 3 94 3
6/10/2009	Hwy 260 Bridge	Speckled dace Bluehead sucker Fathead minnow Brown trout Rainbow trout	89 1 4 1 1
6/10/2009	Hwy 261 Bridge	Speckled dace Bluehead sucker Fathead minnow Brown trout	109 5 18 2
6/10/2009	State Land Section 16	Little Colorado sucker Speckled dace Brown trout Rainbow trout	1 63 1 1
11/6/2007	State Land Section 16	Little Colorado sucker Speckled dace Bluehead sucker Brown trout	6 1,166 9 51
4/4/2006	USFS downstream of Fish Creek	Speckled dace Brown trout Rainbow trout	9 164 19
4/4/2006	USFS between Fish Ck. and River Res.	Brown and rainbow trout Speckled dace	225 6

Historic records of Northern leopard frogs exist in or near this stretch of the Little Colorado River. They have been documented approximately 7 km upstream of Eagar in 1979, at the Johnson Ranch (4.4 miles upstream of Lyman Lake) in 1938, and in lower Benny Creek in 1979. Recent herp surveys within this reach of the LCR 1992 and 1997 have documented only wandering garter snake and Woodhouse's toad. Recent surveys in lower Benny Creek in 1992 and 1995 documented only black necked garter snake, wandering garter snake and bullfrogs.

The South Fork LCR contains a recovery population of Apache trout above the fish barriers. Wild brown trout and rainbow-Apache hybrids were present in the South Fork until it was

chemically treated in 2007 and 2008. Pure Apache trout were reintroduced in 2008 and 2009. Speckled dace, brown trout, rainbow trout, and bluehead sucker still exist in the lower portion of the South Fork below the fish barriers (Table 42). During the four chemical treatments needed to remove all fish above the barrier, brown trout and hybrid rainbow-Apache trout were documented. Herpetological surveys conducted in 1992 documented wandering garter snakes at the South Fork campground and striped chorus frogs in Pool Corral Lake near the headwaters of the South Fork. Chiricahua leopard frog surveys were conducted throughout the South Fork LCR in 2007, finding no leopard frogs, but documenting tiger salamander and non-ranid tadpoles.

Table 42. Number of fish collected in the lower South Fork LCR, below the constructed fish barrier, in 2007. A backpack electroshocker was used to sample fish. Fish collected were not measured.

Species	**Number collected**
Brown trout	74
RainbowXApache hybrid trout	22
Speckled dace	73
Bluehead sucker	1

Lower Hall Creek contains wild brown trout, speckled dace, and rainbow trout in the lower reaches (downstream of White Mountain Reservoir). Surveys in August 1999 collected 347 brown trout, 2 rainbow trout, and 11 speckled dace in 21 50-meter stations below White Mountain Reservoir (Table 3). All the dace and rainbow trout were collected in the lower 3 stations near the confluence with the LCR, indicating the 2 rainbow trout may have come upstream from the LCR.

Surveys of Benny Creek (a tributary to Hall Creek) and Rosey Creek (a tributary to Benny Creek), were conducted on May 15-16, 2008. These surveys found speckled dace, one bluehead sucker, fathead minnow and brown trout (Table 29).

Fish Creek was surveyed in July 1999, documenting speckled dace (n = 31) in the middle permanent reaches of the stream. Chorus frogs were also documented during this survey. Herpetological surveys near Fish Creek in 1992 and 1995 were negative.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to consultation species including Apache trout, Mexican spotted owl and southwestern willow flycatcher are addressed below. Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts due to the proposed action to Little Colorado spinedace and critical habitat are discussed in the West Fork Little Colorado River complex analysis.

Apache Trout

Recovery populations of Apache trout are located in the West Fork LCR upstream of a fish barrier constructed 5.1 miles upstream of River Reservoir, and in the East Fork LCR upstream of Colter dam, which is a 3rd functional fish barrier, 8.5 miles upstream of River Reservoir. Stocked trout likely swim upstream from River Reservoir into the LCR in Greer and can get into the lower East and West Forks, but cannot get upstream of the constructed fish barriers and into the recovery populations of Apache trout.

Apache trout may disperse downstream below the barriers and experience competition for food and space, hybridization with stocked rainbow trout, reduced levels of recruitment, and possible predation on juvenile Apache trout for the life of those dispersing trout; however, this would not impact the recovery of the population above the barrier because that particular fish is lost to the population and because of the barrier separation. Recovery of Apache trout is designed to occur above isolation barriers from non-native trout, and as long as non-native trout do not invade above the barriers they will not impact the recovery. Dispersing individual Apache trout may be impacted below the barrier, but would never re-enter the gene pool of that population. The wild brown trout below the barriers, not part of the proposed action, are the main threat to Apache trout dispersing downstream of the barriers. The brown trout are much more of a threat because they are aggressive wild fish with established territories, they are very numerous, more so than stocked trout, and they exist in all size classes, therefore more levels of competition. Stocked trout in the LCR and lower East and West Forks are caught out quickly by high angler use in this resort town and rarely persist in the stream near town.

Upstream escape of stocked trout in Tunnel and Bunch reservoirs through the diversion ditches to the LCR is possible, but much less likely than trout swimming upstream in the LCR from River Reservoir. The ditch is not a natural channel; it is exposed, silt lined, and with no overhead

cover. A catchable size trout is not likely to swim upstream for 1.8 miles in such a channel with no cover. However, if one were to make that journey, it would enter into the same discussion as for the River Reservoir fish moving upstream, not being able to get upstream of the Apache trout barriers on the Forks of the LCR.

A recovery population of Apache trout is also located in the South Fork LCR upstream of a fish barrier constructed 0.9 miles upstream from the confluence with the LCR. Trout likely escape downstream into the LCR from all three Greer lakes, especially River Reservoir, as it is located right on the LCR. They likely persist in the 7.2 miles downstream of River Reservoir in suitable trout habitat and have access into the lower South Fork LCR. They cannot, however, get above the constructed Apache trout fish barriers, and therefore cannot impact the population above the barrier. Downstream dispersing Apache trout may face the same impacts as described above.

Potential Impacts
Stocked Apache trout co-stocked with other species

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked rainbow trout may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts is found in Apache trout interactions section (Chapter 4).

Stocked sport fishes moving above failed barriers or moving into recovery reaches

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Northern Leopard Frog

Local Analysis: Although Bunch, River, and Tunnel Reservoirs and the West Fork LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs will be exposed to fish stocked in Bunch, River, and Tunnel Reservoirs is low. There are no historical records for northern leopard frogs at Bunch, River, or Tunnel Reservoirs. There are historical records for northern leopard frogs from 3 sites in the buffered complex: Benny Creek (SR 373) (1979), Little Colorado River (7 KM W of Eager) (1979), and Sheep Springs (FS 89 JCT W/HWY 260) (1942) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (SR 373) (1992 and 1995) or Sheep Springs (FS 89 JCT W/HWY 260) (1995) and it is likely that northern leopard frogs no longer occupy these sites (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing stocked fish in Bunch, River, and Tunnel Reservoirs and the West Fork buffered stocking complex is moderate. Stocked fish could disperse as far downstream as Lyman Lake and there are records from 2007-2009 for northern leopard frogs just downstream of Lyman Lake (Drost, pers. comm.). Although the main drainage does not provide suitable habitat for northern leopard frogs because of fast flowing water and presence of crayfish, the frogs are occupying a series of ponds and marshy meadows along the outflow from the Lyman Lake dam (Drost, pers. comm.). In addition, this population is the last known extant population of northern leopard frogs in the Upper Little Colorado River drainage and is thought to be declining (Drost, pers. comm.).

Chiricahua Leopard Frog

Local Analysis: Although Bunch, River, and Tunnel Reservoirs and the West Fork LCR buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs will be exposed to fish stocked in Bunch, River, and Tunnel Reservoirs is low. There are no historical records for Chiricahua leopard frogs at Bunch,

River, or Tunnel Reservoirs or within the West Fork buffered stocking complex. There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and no Chiricahua leopard frogs were observed. In addition, even though the West Fork LCR buffered stocking complex is within a Chiricahua leopard frog recovery unit, the majority of the complex is outside of the Black River Management Area, suggesting that habitat and conditions for recovery are less suitable in that area. Therefore, it is likely that Chiricahua leopard frogs do not occupy the West Fork buffered stocking complex.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing fish from Bunch, River, and Tunnel Reservoirs and the West Fork Complex is low. There are no records for Chiricahua leopard frogs in the Little Colorado River where stocked fish could disperse to, but fish could travel downstream the Little Colorado River and upstream the tributary of Nutrioso Creek where there are 2 historical records for Chiricahua leopard frogs: Nutrioso Creek (Correjo Crossing, 1979) and Nelson Reservoir (SE Corner, 1971). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995) and Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995) and it is not likely that Chiricahua leopard frogs currently occupy these sites or this area (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl Critical Habitat

All three proposed reservoirs are within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Southwestern Willow Flycatcher

In the White Mountains, nesting flycatcher habitat can be found along the upper Little Colorado River (and a portion of its forks) downstream to the Town of Greer area. These areas primarily occur within the Apache Sitgreaves National Forest, although private land parcels are also included. Suitable and occupied habitat for the Southwestern willow flycatcher occurs near the Greer lakes, along the LCR upstream in Greer. Suitable habitat may exist at the Reservoirs because of stands of willow present at those lakes; however, no known occurrences have been documented at the lakes themselves. Only Tunnel Reservoir has dense stands of willows and those are only located in a narrow band around the shoreline. Angling activity occurs on the LCR near Route 373 road crossing to target trout stocked at the LCR Greer sites. Some stocked trout in River Reservoir may swim upstream into the LCR and get caught by an angler, but the dispersing stocked trout from River Reservoir are not attracting the anglers in flycatcher habitat on the river. The anglers are attracted to trout stocked into the river itself. However, because of the density of willow patches, few anglers fish near or within occupied habitat. In 9 years of summer flycatcher surveys by the Department, one angler was seen within the willow patch, but was within 50 feet of the road and not near occupied habitat (C. Paradzick pers. comm.). Southwestern willow flycatchers have been documented nesting at three sites in the upper Little Colorado River drainage downstream to Eager.

Critical Habitat is designated along the West Fork LCR beginning above Sheep's Crossing and extends downstream past the confluence of the East Fork LCR and including and past River Reservoir. River Reservoir is located within critical habitat; however, Tunnel and Bunch reservoirs are not located within critical habitat.

Potential Impacts

Stocking and angling at high elevation is most likely to occur in the late spring and summers because of the harsh winters and difficult access. However, during these instances flycatchers could be nesting and it would be during the nesting habitat's growing season.

In the White Mountains, the primary limit to angler use is the location of stocked trout and access. However, anglers are not anticipated to wander remarkably far from the stocked locations. As a result, it is anticipated that most effects would occur near where trout are stocked. The Apache-Sitgreaves NF staff estimate that approximately 70,000 to 75,000 people use the recreation area in and around the Greer Area and forks of the Little Colorado River annually. Anglers will likely be on foot and either alone or in small parties. The proposed trout stocking actions are an ongoing action that has a long history of occurring in the headwaters of the Little Colorado River. As a result, it is anticipated that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk

between patches of dense vegetation. Additionally, once anglers reach their destination, they are not anticipated to be fishing in tight areas where vegetation is dense that causes casting to be difficult. There may be some amount of disturbance to nesting flycatchers from anglers accessing the stocking site.

Critical Habitat

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site. Neither of the two primary constituent elements identified for Southwestern willow flycatcher critical habitat are affected by the proposed action.

Mexican Hay Lake

Site Description

Mexican Hay Lake is situated on Joe Baca Draw, a dry intermittent tributary to the South Fork of the Little Colorado River (LCR). The South Fork LCR drains into the mainstem LCR approximately 5.9 miles downstream of River Reservoir Dam, making Mexican Hay Lake the lowest water in the complex where it enters the LCR. The dam was constructed in 1908, creating the 100 acre lake, which is very shallow even when full, with a maximum depth of 8 feet. The lake is located at an elevation of 8890 feet on the Apache-Sitgreaves National Forest approximately 7 miles southwest of Springerville.

There are no recreational facilities at the lake; it is managed primitively because of the sporadic stocking and use. The lake can be accessed year round by paved Highway 261, which passes along the east side of the lake shoreline. The lake ices over in the winter, but the road is not closed to Mexican Hay Lake.

Management of Water Body

Primary fishery will be a cold water Apache trout put-and-take fishery when water levels are suitable. Catchable Apache trout would be stocked once per year in the spring/early summer, if the water level is suitable to sustain trout through the season. The main goal is to provide a fishery when the lake has sufficient water, to discourage anglers from illegally stocking the lake with a species that is not compatible with the recovery of the Apache trout population in the South Fork LCR. Mexican Hay Lake has previously been managed as a put-grow-and-take rainbow trout fishery, but will change to the proposed action because of the change in management of the South Fork LCR downstream of the lake.

A limited angler creel survey was conducted on-site at Mexican Hay Lake in 1980, reporting an average catch rate of 0.31 fish/hour. The survey did not have angler use calculated. A statewide mail-out creel survey in 2001 did not include Mexican Hay Lake because it had not been stocked since 1995 (Pringle 2004).

Mexican Hay Lake has been managed only occasionally as a sport fishery; water levels have not been suitable to support trout since the last stocking in 1995 (Table 43), and the irrigation headgate has not been operated for years prior to that date. When the lake level is suitable, the lake grows large trout quickly because of high nutrients, and it is very popular with anglers.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies the management emphasis for the lake as basic yield (put-grow-and-take) sport fish, with a desired species assemblage of rainbow trout. The proposed action is inconsistent with the plan in regards to species; however, the plan did not consider the slim chance of stocked fish escaping and getting into Apache trout habitat in the South Fork LCR. Rainbow trout are definitely not consistent with Apache trout recovery if they were to escape. The lake has been stocked only sporadically in the past because of poor water levels, but the proposed action is to stock annually if the conditions improve; if conditions continue as they have, the lake will be stocked only sporadically.

Table 43. Stocking history for Mexican Hay Lake

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1980	1980	1	15,000
Rainbow trout	1965	1995	37	214,556
Total			38	229,556

Proposed Action

The Department proposes to stock Apache trout during the period covered by this consultation. Catchable Apache trout would be stocked from April through June annually, when the water level is sufficient to support trout through the summer; numbers of Apache trout stocked may be from 0 to 10,000 fish annually.

Water Distribution / Connectivity

Mexican Hay Lake does not spill because it has no spillway, but water can be released from it for irrigation through the headgate into Joe Baca Draw and into the South Fork LCR. Irrigation water is no longer used from the lake, although the potential for future use exists. The headgate is currently silted in and would take a lot of work to make it functional. Except for irrigation delivery, there is no mechanism for salmonids to travel into occupied spinedace or Apache trout habitat within the LCR. In the event of irrigation delivery from Mexican Hay Lake, water would be diverted above Springerville through Round Valley. The potential for transport of salmonids from the Mexican Hay Lake to occupied Apache trout or spinedace habitat is extremely low.

The lake is “filled” primarily by snowmelt runoff from the small watershed above the lake, but no permanent stream feeds the lake. The lake is very shallow when it is full, with a maximum

depth of 8 feet; however the lake is often much shallower and not able to support fish during dry years. It does not go completely dry, but functions more as a waterfowl marsh in dry years.

If the lake were to fill and water were released for irrigation, which is unlikely within the timeframe of this consultation, water would flow down an unnamed tributary for 0.5 miles to Joe Baca Draw, then down Joe Baca Draw for 1.3 miles to the South Fork LCR. The unnamed tributary is intermittent, flowing only with snowmelt runoff coming from downstream of the dam. Joe Baca Draw is perennial but at an extremely low flow that is unsuitable for trout most of the year. The South Fork of the LCR is a good quality perennial trout stream that flows year round. From the confluence with Joe Baca, water flows down the South Fork for 3.5 miles to a lower constructed fish barrier for Apache trout recovery, then another 0.9 miles to the mainstem LCR.

There are 2 other main tributaries on the South Fork LCR coming in upstream of Joe Baca Draw, both having some perennial water suitable for trout. A second constructed fish barrier for Apache trout is located between the confluence of Joe Baca and the lowest barrier downstream.

The LCR flows perennial from the confluence of the East Fork and West Fork LCR, which originate on Mt. Baldy, down through the Town of Greer, through River Reservoir, and past the South Fork LCR confluence located 5.9 miles downstream of River Reservoir. Two other tributaries enter into the LCR between River Reservoir and the South Fork confluence; Hall Creek and Fish Creek (see the Bunch, River, and Tunnel section and the White Mountain Reservoir section for additional information on Hall Creek and its tributaries).

Downstream of the confluence with the South Fork, the mainstem LCR flows downstream for 1.3 miles to a major diversion structure, which diverts water into a main ditch, which feeds into fields in Springerville and Eagar. Downstream of the diversion structure the LCR flows into Springerville and into Little Colorado spinedace occupied habitat 10.2 miles, at Airport Road, downstream of the South Fork confluence. The LCR meets tributary Nutrioso Creek 1.7 miles downstream of Airport Road, then another major diversion structure approximately 1 mile downstream of Nutrioso Creek confluence, then on for another 17.0 miles to Lyman Lake. Tributary Coyote Creek enters the LCR a few miles upstream of the lake.

All the drainages described above flow well and are connected during snowmelt runoff in the spring. Some of the intermittent reaches described above become connected when irrigation water is released from an upstream reservoir during the irrigation season in the summer (April 15-September 15). These include Hall Creek from White Mountain Reservoir downstream to the Little Colorado River, an unnamed drainage and lower Benny Creek from Bunch Reservoir downstream to Hall Creek, and potentially, though not likely, an unnamed drainage from Mexican Hay Lake downstream to Joe Baca Draw.

Fish Movement
Stocked trout in Mexican Hay Lake likely will never get out of the lake, because the outlet is not currently functional. However, because the potential exists for a future irrigation release, an escaped trout could travel down the unnamed tributary and Joe Baca Draw. These 2 drainages do not have enough water or any at all during base flows to support a catchable size trout. Continuing downstream, a catchable size trout could reach the South Fork LCR, which is quality habitat for trout and it would have a good chance of persisting. At this point, stocked Apache trout become part of the recovery population located in the South Fork LCR. Traveling down the South Fork and into the mainstem LCR, a catchable Apache trout could persist in the 7.2 miles of the LCR below River Reservoir. This reach of stream is suitable for trout and already supports reproducing populations of wild brown and rainbow trout.

For details of connectivity and possible fish movement through the LCR and downstream to Lyman Lake, see the Greer Lakes analysis and the complex analysis below.

Community Description
Mexican Hay Lake is currently fishless and has not been stocked since 1995. Low water conditions in 1996 killed the remaining rainbow trout. Table 44 provides a summary of fish surveys at Mexican Hay Lake.

Table 44. Survey history at Mexican Hay Lake using experimental gillnets

Survey date	**Species collected**	**Num. collected**	**Size range (mm TL)**
April 1985	No fish	-	-
April 1988	Rainbow trout	19	262-425
March 1989	No fish	-	-
April 1991	Rainbow trout	14	375-434
April 1992	Rainbow trout	22	365-496

The South Fork Little Colorado River contains a recovery population of Apache trout. They occur above fish barriers on the lower part of the stream. Wild brown trout and rainbow-Apache hybrids were present in the South Fork until it was chemically treated in 2007 and 2008 (Table 42). Pure Apache trout were reintroduced above the fish barriers in 2008 and 2009. Speckled dace, brown trout, rainbow trout, and bluehead sucker exist in the lower portion of the South Fork below the fish barriers. During the four chemical treatments needed to remove all fish above the barrier, only brown trout and hybrid rainbow-Apache trout were documented.

Herpetological surveys conducted in and near the South Fork LCR in 1992 documented wandering garter snakes at the South Fork campground at the lower end and striped chorus frogs in Pool Corral Lake near the headwaters. Chiricahua leopard frog surveys were conducted

throughout the South Fork in 2007 prior to the chemical renovations, finding no leopard frogs, but did document tiger salamander and non-ranid tadpoles.

Little Colorado sucker are present in the LCR just downstream of the South Fork confluence, along with wild brown and rainbow trout, speckled dace, bluehead sucker, fathead minnow, and crayfish. The wild trout in the LCR persist and reproduce in the 7.2 miles of river downstream of River Reservoir. In the 8.9 miles of stream below the suitable habitat for trout but upstream of occupied spinedace habitat, there is a reach that supports Little Colorado sucker, speckled dace, bluehead sucker, a small number of likely not reproducing brown trout, even rarer rainbow trout, and crayfish. Occupied spinedace habitat occurs from 10.2 miles downstream of the South Fork confluence downstream for 19.7 miles to Lyman Lake, and also downstream of Lyman Lake.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to consultation species including Apache trout are addressed below. Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts due to the proposed action to Little Colorado spinedace and critical habitat are discussed in the West Fork Little Colorado River complex analysis.

Apache Trout
Stocked trout in Mexican Hay Lake likely will never get out of the lake, because the outlet is not currently functional. However, because the potential exists for a future irrigation release, an escaped trout could travel down the unnamed tributary and Joe Baca Draw. These 2 drainages do not have enough water or any at all during base flows to support a catchable size trout. Continuing downstream, a catchable size trout could reach the South Fork LCR, which is quality habitat for trout and it would have a good chance of persisting. At this point, stocked Apache trout become part of the recovery population located in the South Fork LCR. Traveling down the South Fork and into the mainstem LCR, a catchable Apache trout could persist in the 7.2 miles

of the LCR below River Reservoir. This reach of stream is suitable for trout and already supports reproducing populations of wild brown and rainbow trout.

Potential Impacts

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

There are three stocking sites that are not separated by a barrier from a recovery Apache trout reach; they are: 1) Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River whereby Apache trout stocked into Lee Valley Lake, upstream of the recovery reach, could escape and move into the recovery population. Apache trout are also stocked directly into the recovery population at Sheeps Crossing (see #4 below), 2) a recovery population in the South Fork of the Little Colorado River. This recovery reach is located above a barrier; however, Mexican Hay Lake is located upstream of both the barrier and recovery reach. Apache trout stocked into Mexican Hay Lake may escape and reach the recovery population downstream, and 3) Ackre Lake, located in the headwaters of Fish Creek Fish Creek is a recovery stream, and Apache trout or Arctic grayling may escape Ackre lake and enter the recovery population downstream in Fish Creek.

The potential for stocked fish to escape Mexican Hay Lake and move into occupied recovery waters is extremely unlikely since there is no function outlet (see fish movement discussion), although if future irrigation releases resulted in the potential escapement of fish and they did reach occupied habitat, these fish would become part of the recovery population and would be considered neither detrimental nor beneficial.

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

If stocked Apache trout escaped Mexican Hay Lake and travelled downstream as far as the LCR below River Reservoir, impacts to stocked Apache trout from species of fish currently existing as

wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Northern Leopard Frog

Local Analysis: Although Mexican Hay Lake and the West Fork LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs will be exposed to fish stocked in Mexican Hay Lake is low. There are no historical records for northern leopard frogs from Mexican Hay Lake. There are historical records for northern leopard frogs from 3 sites in the complex: Benny Creek (SR 373) (1979), Little Colorado River (7 KM W of Eager) (1979), and Sheep Springs (FS 89 JCT W/HWY 260) (1942) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Benny Creek (SR 373) (1992 and 1995) or Sheep Springs (FS 89 JCT W/HWY 260) (1995) and it is likely that northern leopard frogs no longer occupy these sites (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing stocked fish in Mexican Hay Lake and the West Fork buffered stocking complex is moderate. Stocked fish could disperse as far downstream as Lyman Lake and there are records from 2007-2009 for northern leopard frogs just downstream of Lyman Lake (Drost, pers. comm.). Although the main drainage does not provide suitable habitat for northern leopard frogs because of fast flowing water and presence of crayfish, the frogs are occupying a series of ponds and marshy meadows along the outflow from the Lyman Lake dam (Drost, pers. comm.).

Chiricahua leopard frog

Local Analysis: Although Mexican Hay Lake and the West Fork LCR buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs will be exposed to fish stocked in Mexican Hay Lake is low. There are no historical records for Chiricahua leopard frogs at Mexican Hay Lake or within the West Fork buffered stocking complex. There have been 32 surveys at 24 sites within the buffered stocking complex between 1942 and 2002 (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and no Chiricahua leopard frogs were observed. In addition, even though the West Fork LCR buffered stocking complex is within a Chiricahua leopard frog recovery unit, the majority of the complex is outside of the Black River Management Area, suggesting that habitat and conditions for recovery are less suitable in that area. Therefore, it is likely that Chiricahua leopard frogs do not occupy the West Fork buffered stocking complex.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing fish from Mexican Hay Lake and the West Fork Complex is low. There are no records for Chiricahua leopard frogs in the Little Colorado River where stocked fish could disperse to, but fish could travel downstream the Little Colorado River and upstream the tributary of Nutrioso Creek where there are 2 historical records for Chiricahua leopard frogs. Chiricahua leopard frogs were documented at Nutrioso Creek (Correjo Crossing, 1979) and Nelson Reservoir (SE Corner, 1971). Chiricahua leopard frogs were not observed during subsequent surveys at Nutrioso Creek (Correjo Crossing) (1995) and Nelson Reservoir (SE Corner) (1987, 1992, 1993, and 1995) and it is not likely that Chiricahua leopard frogs currently occupy these sites or this area (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

WEST FORK LITTLE COLORADO RIVER COMPLEX ANALYSIS

Water Distribution / Connectivity

The headwater tributaries of the LCR, the East and West Forks, both flow perennial from high elevation on Mt. Baldy down for 17.8 miles and 9.1 miles, respectively, to their confluence in the town of Greer, where they form the mainstem of the LCR. Spill from Lee Valley Lake, which is filled by mostly perennial Lee Valley Creek from high elevation on Mt. Baldy, enters the West Fork LCR approximately 4.0 miles upstream of the confluence of the main forks. The mainstem LCR then flows perennial for 2.3 miles through the Town of Greer into River Reservoir.

Water flows perennially into River Reservoir, but is also diverted during the "fill season" into off channel reservoirs, Bunch and Tunnel Reservoirs, from September 15 through April 15. They are off-channel irrigation reservoirs operated in conjunction with River Reservoir. The diversion takes water from the LCR approximately 1.8 miles upstream of River Reservoir. The ditch flows from the LCR for 1.6 miles then splits to fill either Tunnel Reservoir or Bunch Reservoir, each about 0.2 miles from the split in the ditch. Once these lakes are full, the irrigation ditch is shut down to let River Reservoir fill. During the time the irrigation ditch is operating, the river downstream from that diversion can be extremely low, but still continuous and perennial. Water is also released out of Bunch and Tunnel Reservoirs during the irrigation season (April 15-September 15) for use downstream in Springerville and Eagar. When water is released from the outlet at Bunch Reservoir, it flows down an unnamed tributary for 0.4 miles into Benny Creek, then down Benny Creek for 1.4 miles to Hall Creek, then down Hall Creek for 0.3 miles and directly into the LCR downstream of River Reservoir. This water travels down the LCR to be pulled back out towards Springerville and Eagar. When water is released from Tunnel Reservoir, it flows directly into the west side of River Reservoir and is metered out through the River Reservoir dam outlet.

River Reservoir spills annually in the spring during snowmelt runoff. Water is also released out the outlet in the dam directly into the LCR during the irrigation season of April 15 to September 15, to be pulled back out downstream near Springerville and Eagar. All three reservoirs are often drained down to the depth of the outlet structures, leaving a small minimum pool at the end of the summer. No legal minimum pool agreements are in place. The remaining pool level is left because it cannot be released without pumping up to the outlet.

The LCR downstream of River Reservoir flows perennially all the way to Lyman Lake, even at base flows with or without irrigation releases. From River Reservoir dam, the LCR flows downstream for 16.1 miles to the upper extent of occupied spinedace habitat at Airport Road in Springerville. Along this reach, tributaries enter the LCR, Hall Creek at 2.6 miles downstream of River Reservoir, Fish Creek at 3.1 miles downstream of River Reservoir, and the South Fork LCR at 5.9 miles downstream of River Reservoir. A major water diversion is located 1.3 miles downstream of the South Fork LCR confluence, which diverts much of the irrigation water

released from the Greer lakes during the summer. Continuing down the LCR in Springerville, another tributary, Nutrioso Creek, enters 1.7 miles downstream of Airport Road. Another major diversion structure is located approximately 1 mile downstream of Nutrioso Creek confluence, at which point the mainstem LCR continues downstream for another 17.0 miles to Lyman Lake. The tributary Coyote Creek enters the LCR a few miles upstream of Lyman Lake. A number of small water diversions exist throughout Springerville and downstream towards Lyman Lake and are not fish barriers for trout but may be for smaller sized species.

The tributary Hall Creek, entering the LCR 2.6 miles downstream of River Reservoir, contains the spill and irrigation releases from White Mountain Reservoir. White Mountain Reservoir is filled by upper Hall Creek draining off the high elevations of Mt. Baldy. There is normally a good snowmelt runoff coming down Hall Creek to fill or nearly fill White Mountain Reservoir every year except for extreme drought years. The very headwater of Hall Creek on Mt. Baldy is perennial, but becomes intermittent just above the reservoir, and flows into the reservoir only during the spring snowmelt; the 2 miles of Hall Creek immediately above the reservoir dries in the summer months. Hall Creek is intermittent below the reservoir, except when releasing water, until the final stretch about 3 miles above the LCR.

When water is released for irrigation from White Mountain Reservoir during the irrigation season from April 15 to September 15, it flows down Hall Creek for 6.0 miles and then into the LCR. Lower Hall Creek also transports the irrigation releases from Bunch Reservoir, as described above. The tributary South Fork LCR has Mexican Hay Lake located near the headwaters of the South Fork tributary Joe Baca Draw. Mexican Hay Lake does not spill and has not been used as an irrigation reservoir for over 15 years, and is not likely to be used for irrigation anytime in the near future. However, because the potential exists, and if the buried outlet structure was dug out, released water would flow down an unnamed tributary for 0.5 miles to Joe Baca Draw, then down Joe Baca Draw for 1.3 miles to the South Fork LCR. The unnamed tributary is intermittent, flowing only with snowmelt runoff coming from downstream of the dam. Joe Baca Draw is perennial but at an extremely low flow that is unsuitable for trout most of the year. The South Fork of the LCR is a good quality perennial trout stream that flows year round. From the confluence with Joe Baca, water flows down the South Fork for 3.5 miles a lower constructed fish barrier for Apache trout recovery, then another 0.9 miles to the mainstem LCR. However, if the outlet works are not dug out and opened for irrigation, water in Mexican Hay Lake cannot leave the lake except by evaporation and seepage into the ground.

Fish Movement

Stocked Apache trout and Arctic grayling in Lee Valley Lake could disperse upstream into Lee Valley Creek once the unnecessary fish barrier is soon removed, with Apache trout assimilating into the recovery population of Apache trout in the stream. Arctic grayling likely would only move into the stream above the lake during spawning season for a short period (several hours)

then most returning to the lake after spawning. Those that could not return to the lake would not persist long in the stream, for weeks at the most. Lee Valley Creek is extremely small and not suitable habitat for a mature spawning Arctic grayling that is likely 13-14" in size. Smaller and not mature grayling are not likely to move up into the creek. The two stocked species could move down into the West Fork LCR when Lee Valley Lake spills on a regular basis (except during drought years). This likely happens, although very low numbers of fish are likely to move at any one time. Once in the perennial and high quality trout waters of the West Fork, a dispersing Apache trout would assimilate into the recovery population of Apache trout in the West Fork. A dispersing Arctic grayling would not persist long in the West Fork because grayling have not been documented to persist or establish in streams in Arizona.

Apache trout stocked into Sheep's Crossing on the West Fork LCR could move upstream and downstream in the perennial and high quality trout waters of the West Fork, assimilating into the recovery population of Apache trout. Those stocked trout moving downstream, including those that might be coming from Lee Valley Lake (Arctic grayling likely would never get past this point because they would persist for such a short period of time), could disperse downstream of 2 fish barriers on lower West Fork, and down into the Little Colorado River in the Town of Greer. They could then continue downstream into River Reservoir. Rainbow and Apache trout stocked into the LCR in Greer could also move downstream into River Reservoir or move upstream into the East and/or West Forks of the LCR. But the stocked trout in Greer could not get upstream of constructed fish barriers on the West Fork at 2.8 and 3.1 miles upstream of the confluence or upstream of fish barriers on the East Fork at 2.2, 2.4 and 6.2 miles upstream of the confluence and into recovery habitat for Apache trout.

Trout stocked into Tunnel Reservoir could disperse up the diversion ditch that feeds it, but it is not likely. They are much more likely to exit the lake by way of irrigation releases into River Reservoir. Trout stocked into Bunch Reservoir could disperse up the diversion ditch that feeds it, but it is not likely. They are much more likely to exit the lake by way of irrigation releases into an unnamed tributary, then into Benny Creek, then into Hall Creek, then down into the LCR at a point 2.6 miles downstream of River Reservoir.

Rainbow trout stocked into White Mountain Reservoir could swim up into upper Hall Creek during spring runoff, or they could escape downstream when the reservoir spills or releases irrigation water downstream. Going downstream, a dispersing trout could travel down lower Hall Creek into the LCR at a point 2.6 miles downstream of River Reservoir.

Trout stocked into River Reservoir likely move upstream occasionally, but not far (fish barriers on the forks). Trout likely escape from all the Greer lakes and White Mountain Reservoir when they spill, or more likely when water is released for irrigation. All four of these lakes are routinely drawn down very low during the irrigation season from April 15 through September

15, with trout having a good potential to escape downstream. Many of the trout escaping likely end up in the LCR, especially those coming out of River Reservoir because it drains directly into the LCR. Trout escaping from Bunch and White Mountain Reservoir have a little longer path to take in tributaries before they reach the LCR.

Once in the Little Colorado River, dispersing trout could persist in the suitable habitat for trout in the 7.2 miles downstream of River Reservoir, and possibly reproduce in this reach, although recruitment would not be expected for Apache trout in the face of the wild brown trout populations in the reach. Dispersing trout could move up into the tributary South Fork LCR, but only for 0.9 miles until it reached an impassable fish barrier constructed for Apache trout recovery on that stream. Another fish barrier was constructed 1.8 miles upstream of the lower barrier. Stocked Apache trout into Mexican Hay Lake will most likely never escape the lake except by angler harvest or predation. There is a remote possibility that the irrigation outlet could be restored after many years of disrepair and non-use and a stocked Apache trout disperses downstream into Joe Baca Draw, then into the perennial high quality trout habitat in the South Fork, where it would assimilate into the Apache trout population. It could also continue to disperse downstream over the barriers and into the LCR, where it could persist but likely not reproduce in the presence of wild brown trout. But more likely, stocked trout in Mexican Hay Lake would never even reach the South Fork.

Dispersing trout in the Little Colorado River, most likely from River Reservoir, the other Greer Lakes, or from White Mountain Reservoir, in that order, could move further downstream into an 8.9 mile reach upstream of the Town of Springerville. Trout could persist here for some time, but likely not reproduce because it is marginally suitable for trout, especially rainbow trout or Apache trout.

From that reach, dispersing trout could further move downstream into an 8.5 mile reach of the LCR from Airport Road in Springerville to just below Wenima Wildlife Area, which is occupied habitat for Little Colorado spinedace. This reach is marginally suitable for brown trout, where large individuals are found but in very low numbers, but is not suitable for rainbow trout. Only 3 rainbow trout have been documented in this reach through many years of surveys, 2 in 1993 and 1 in 1991. This very rare occurrence record for rainbow trout indicates that they disperse into this area very infrequently, in very low numbers, and do not persist.

It is within this reach that the tributary Nutrioso Creek enters. The lower reaches of Nutrioso Creek is normally dry, however does flow during a good spring runoff, potentially allowing dispersing trout to move upstream towards the closest Designated Critical Habitat for Little Colorado spinedace. But it is extremely unlikely that trout stocked anywhere in this complex would reach this point. The collections of rainbow trout found within this critical habitat (see Nelson Reservoir analysis in the LCR above Lyman complex) are more likely coming from

Nelson Reservoir. Dispersing trout from the West Fork Complex are very unlikely to get to this reach on the LCR, based on the very low numbers found in the survey history. If they do reach this area, it would be in very low numbers and likely only after a heavier than normal flood event that would transport fish long distances. The unsuitable habitat for rainbow and Apache trout would discourage them from dispersing this far downstream, or allow them to persist only for a very short period.

A trout could possibly disperse further downstream towards and into Lyman Lake, however, the remaining 13.5 miles of the LCR to Lyman and entirely unsuitable for trout because no trout have been documented in this reach, even wild brown trout.

Community Description

The West Fork LCR and East Fork LCR above the fish barriers contain only Apache trout following the chemical renovations that removed all the non-native trout. Lee Valley Creek also contains only Apache trout following chemical renovations there as well. Arctic grayling may enter Lee Valley Creek from Lee Valley Lake for very short periods to spawn, but do not stay more than several hours based on observations in the 1980s and 1990s. Those that cannot get back to the lake do not persist in the creek. Multiple surveys and several complete chemical renovations on Lee Valley Creek have never found an Arctic grayling in the stream. Arctic grayling may also end up in the West Fork LCR from dispersing over the spillway from the lake, but again will not persist in the stream. Intensive surveys and several complete chemical renovations have never documented a grayling in the West Fork LCR. For greater details, see the Lee Valley Lake and Sheep's Crossing stocking sites analyses.

Wild brown trout and stocked rainbow trout and Apache trout occur in the West Fork LCR below the barriers. Wild brown trout, stocked rainbow and Apache trout, and speckled dace, and bluehead sucker occur in the East Fork LCR downstream of the barriers. The same species as the East Fork below the barriers, plus fathead minnow, occur in the LCR through Greer and above River Reservoir. For greater details, see the analysis for the LCR Greer stocking site.

Stocked rainbow trout, and wild brown trout, yellow perch, carp, fathead minnow, bluehead sucker, and crayfish occur in River Reservoir. Stocked rainbow trout, and wild brown trout, fathead minnow, and crayfish occur in Tunnel and Bunch Reservoirs.

Wild brown and rainbow trout, speckled dace, bluehead sucker, LC sucker, fathead minnow, and crayfish occur in the 7.2 miles of the LCR downstream of River Reservoir. This stretch likely contains escaped rainbow trout as well, but is assimilated into an already wild population of rainbow trout.

Speckled dace, bluehead sucker, LC sucker, fathead minnow, crayfish, and consistent but low densities of brown trout and to a lesser extent rainbow trout, occur in the next 8.9 miles of the LCR to the upper end of Springerville.

Little Colorado spinedace, speckled dace, bluehead sucker, LC sucker, fathead minnow, crayfish, green sunfish, and occasionally brown trout occur in the next 7.5 miles of the LCR from Airport Road in Springerville downstream to just below Wenima Wildlife Area. Rainbow trout occur in this reach extremely infrequently. Only 3 records of rainbow trout exist, 2 in 1993 and 1 in 1999, indicating that the habitat is not suitable for rainbow trout, and that rainbow trout disperse into this habitat from upstream very rarely, in very low numbers, and do not persist. These collections of rainbow trout may have been from trout stocked into Becker Lake when it was managed differently that it is today (now cannot escape Becker), or dispersing from wild populations in the upper watershed or from stocked trout in the Greer area.

Little Colorado spinedace, speckled dace, bluehead sucker, LC sucker, fathead minnow, crayfish, green sunfish, and carp occur in the next 18 miles of the LCR down to Lyman Lake. There have been no records of any species of trout within this reach of the LCR. For greater details and references on the aquatic community in the Greer lakes and LCR downstream to Lyman Lake, see the Greer lakes analysis.

Brook trout occur in the headwaters of tributary Hall Creek, while rainbow trout (when stocked) and tiger salamander occur in White Mountain Reservoir. Brown trout, speckled dace, and rainbow trout occur in lower Hall Creek below White Mountain Reservoir. Rainbow trout were found only in sites near the confluence with the LCR, indicating that those fish were likely coming upstream from a wild population in the LCR at the confluence.

Apache trout occur in the South Fork LCR above the fish barriers. No fish currently occur in Mexican Hay Lake in the headwaters of the South Fork. Rainbow trout were most recently stocked in 1995, however, all trout died off when the long term drought began in 1996, and has not been stocked since. Wild brown and rainbow trout, speckled dace, bluehead sucker, and crayfish exist in the lowest reach of the South Fork downstream of the fish barriers.

As noted above, crayfish are widespread and numerous throughout much of the watershed. The exceptions are in the East Fork LCR, West Fork LCR, Lee Valley Creek, upper Hall Creek, Fish Creek, and upper South Fork LCR. Crayfish are uncommon in Lee Valley Lake and unknown in White Mountain Reservoir or Mexican Hay Lake.

Wandering garter snakes and tiger salamander are common throughout much of the watershed, and recent records exist for Woodhouse's toad, striped chorus frog, and Arizona mountain treefrog. Bullfrogs are known from lower Benny Creek and Lyman Lake, but are likely more widespread. No recent records of Chiricahua leopard frogs exist in the watershed. Historic

records of Northern leopard frogs exist on the Little Colorado River and lower Benny Creek, but recent surveys have not found them in the vicinity of this stocking complex.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to Little Colorado spinedace and critical habitat is addressed below. Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Little Colorado spinedace and Critical Habitat
The nearest occupied spinedace habitat is in the Little Colorado River in Springerville, about 14 miles from Mexican Hay Lake and 13 miles from Bunch Reservoir, which is the closest of these proposed stocking sites. Water from White Mountain Reservoir is drained through a headgate into Hall Creek to use for irrigation downstream in the Eager/Springerville area. Spinedace occupy the next 25.6 miles of the LCR downstream to Lyman Lake, and also from Lyman Lake to St. Johns. Spinedace also occupy Nutrioso Creek, where the confluence is 17.8 miles downstream of River Reservoir, above and below Nelson Reservoir.

The nearest designated critical habitat is located in 5 miles of Nutrioso Creek from the dam at Nelson Reservoir downstream to the Forest boundary. Constituent elements for all areas of critical habitat include clean, permanent flowing water with pools and a fine gravel or silt-mud substrate (USFWS 1987).

Potential Impacts
Rainbow trout likely escape downstream into the LCR from all 3 Greer lakes, especially River Reservoir because it is located right on the LCR, and they likely persist in the 7.2 miles of suitable trout habitat immediately below River Reservoir. However, several large diversions impede this downstream movement, by directing fish washing down into irrigation ditches. Plus, the stream habitat in Springerville, and downstream, is not suitable for Apache trout and they would likely not persist because the water temperatures exceed their thermal maxima.

This 7.2 mile reach of the LCR below River Reservoir has wild populations of brown trout and rainbow trout. Escaped trout, or wild trout from the LCR reach below River Reservoir, do get into the next 8.9 miles of marginal trout habitat in somewhat consistent but low numbers, but they apparently do not persist. Recent surveys in 2009 found 1 rainbow trout in 2 of 3 sites within this reach. They were not collected there in previous surveys. Escaped trout rarely get into occupied spinedace habitat in Springerville and below, and there is no evidence that they persist. Only 3 rainbow trout have been caught in occupied spinedace habitat in the LCR in nearly 2 decades of surveys; 2 in 1993 and 1 in 1999. These very infrequent rainbow trout found in the Springerville area could have come from one of the Greer lakes or from another stocking location closer to Springerville. These escaped trout could prey directly on adult or juvenile spinedace (Blinn et al. 1993) or compete for food and space. Blinn et al. (1993) and Robinson et al. (2000) reported changes in habitat use by spinedace when rainbow trout were present. Robinson et al. (2000) noted that there was little diet overlap between spinedace and larger trout, but noted that competition for food would likely occur between spinedace and trout of the same size.

There is no evidence that trout reproduce in the Greer lakes, and escaped trout would not likely reproduce in the LCR near Springerville, but escaped trout could spawn in the suitable trout habitat just below River Reservoir. Progeny from this area could possibly disperse downstream into spinedace occupied habitat and potentially compete for food, but there is no evidence this is occurring. If it does occur, it is at an extremely low level. There would be very little chance of impact to upstream dispersal of spinedace by stocked trout. Spinedace seem to be limited to upstream dispersal by numerous water diversion structures present on the LCR- see the discussion in the Mexican Hay Lake analysis. In addition, brown trout are more consistently found than rainbow trout in the reach above occupied habitat and are a greater threat due to their broader temperature tolerance and more piscivorous nature. Brown trout are not part of the proposed stocking action anywhere in the Headwaters or Upper LCR watersheds.

The proposed stocking activity could impact indirectly the Little Colorado spinedace due to the connectivity of habitat and some, but rare, documented occurrences of trout in occupied spinedace habitat. The level of impact would be very low as documented by the very low numbers of rainbow trout found in the surveys, and the fact that they do not persist in the occupied reach year-round because habitat conditions within spinedace occupied habitat are unsuitable for rainbow trout or Apache trout.

Stocked Arctic grayling could conceivably reach Little Colorado spinedace occupied habitat, but it is extremely unlikely. They would have to travel 1.5 miles over the spillway of Lee Valley Lake, and drainage to the West Fork LCR, down the West Fork for 4.0 miles through a recovery stream for Apache trout, which are also stocked, down the LCR for 2.3 miles to River Reservoir, through the Reservoir, then down the LCR 16.1 miles to occupied spinedace habitat.

The survey history shows that some trout may get washed downstream into spinedace occupied habitat during extreme flooding events, but do not persist. Only 3 rainbow trout and no Apache trout or Arctic grayling have been found within occupied spinedace habitat in over 2 decades of surveys(Table 41 for recent surveys; also see Young et al 2001, Dorum and Young 1995, Minckley 1984, McKell 2005d; KansasGap database). Additionally, because trout are also stocked into multiple locations located on private land, and exist in wild populations in connected streams, it is difficult to determine the source of any trout that might be surveyed.

The greatest threat to Little Colorado spinedace in the Little Colorado River is not from stocked trout, but from invasive crayfish, which are very numerous throughout occupied habitat in the LCR, from wild brown trout, which are present in low numbers only in the upper portions of occupied habitat from Airport Road in Springerville downstream to just below Wenima Wildlife Area, from wild green sunfish present throughout occupied habitat, from fathead minnows, which are numerous throughout occupied habitat, and from altered stream flows (dams/diversions) and habitat.

Critical Habitat

While Apache trout and Arctic grayling could survive in the West Fork, in the LCR down to River Reservoir, in River Reservoir, or in about 7 miles of stream below River Reservoir, they would not survive through the summer in the warm waters of the LCR as it flows through Springerville and known occupied spinedace habitat. It would be even more difficult for a stocked Apache trout or Arctic grayling to reach critical habitat located approximately 7 miles up a normally intermittent reach of Nutrioso Creek to perennial water. If an Apache trout did make it, it would be indistinguishable from a recovery trout emigrating from the West Fork, East Fork, or South Fork of the LCR. Arctic grayling have never been found in the West Fork LCR or the entire mainstem Little Colorado River downstream from Lee Valley Lake. Hatchery Apache trout have been collected and documented in the West Fork LCR, because they have been stocked at Sheep’s Crossing annually from 1999-2006, and in the LCR in Greer, because they have been stocked in Greer annually from 1999-2008. It is most likely these collections were Apache trout stocked directly in those locations. Apache trout have not been collected downstream of River Reservoir in recent times. Historically, Apache trout were native to the entire suitable trout habitat in this upper LCR drainage. The proposed action is not expected to impact any of the critical habitat constituent elements for LC spinedace.

Upper Little Colorado River Complex

The Upper LCR Complex consists of 2 stocking sites: Concho Lake and Little Ortega Lake. These lakes are downstream from the LCR and above Lyman and West Fork LCR complexes, but still in the relative vicinity of the LCR headwaters (Figure 8). These 2 stocking sites are not hydrologically connected and were grouped together in this complex because of their proximity

to each other (4.1 miles apart) and isolation/distance from the next closest stocking site (Figure 9). Concho Lake is located on the headwaters of Concho Creek, a tributary to the LCR; however, water and fish from Concho Lake never reach the LCR due to the operation of the lake as an irrigation reservoir, the small watershed, and the timing of irrigation releases that do not coincide with potential flood flow events. Little Ortega Lake is a natural depression with no outlet, and located at the terminus of Mineral Creek, with no hydrologic connection to the LCR.

Concho Lake

Site Description

Concho Lake is an 80 surface-acre irrigation storage reservoir on upper Concho Creek, formed by flow from Concho Springs. The dam was originally built in the 1880s and rebuilt in 1930. The lake has a maximum depth of 16.4 feet and an average depth of 8.2 feet. The lake is located on private and BLM lands, which are managed by the Department, at an elevation of 6296 feet, approximately 2.1 miles south of the town of Concho and 26 miles northeast of Show Low.

Concho Lake is accessed year around by paved Highway 61. The Department manages a portion of land on the east and west side of the lake, with a boat launch ramp, camping/picnic area, and toilet on the west side. The inlet and dam area of the lake are privately owned, but currently allow shoreline access. Boat motors are restricted to electric motors. The lake may ice over briefly in the winter, but the lake does not receive ice fishing use.

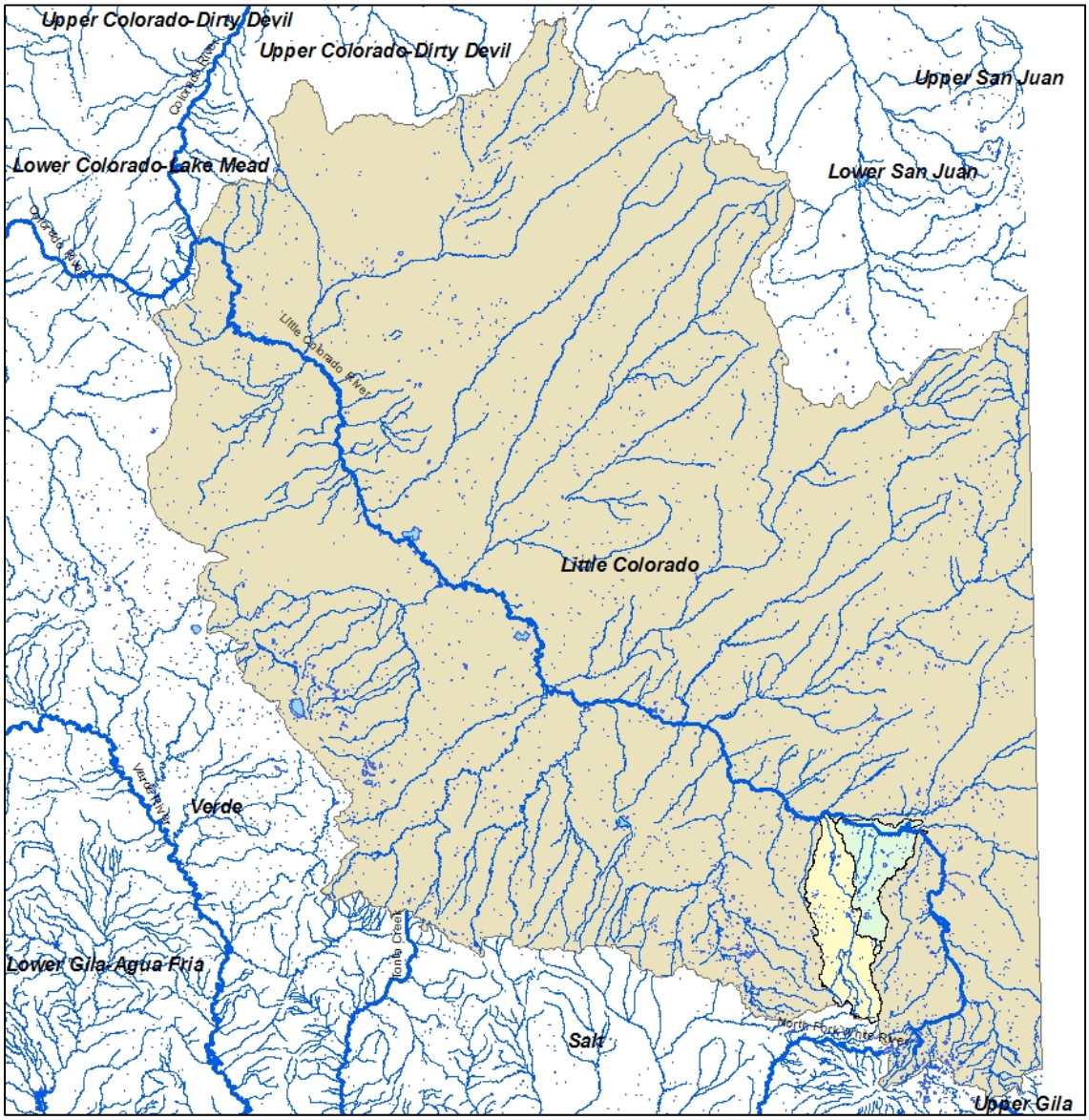


Figure 8. The Upper LCR complex is located near the headwaters of the LCR and consists of two sub-drainages.

Management of Water Body

Primary fishery is a cold water rainbow trout intensive use put-and-take fishery, with a proposed secondary warm water fishery of self sustaining largemouth bass and bluegill, and put-grow-and-take channel catfish fishery.

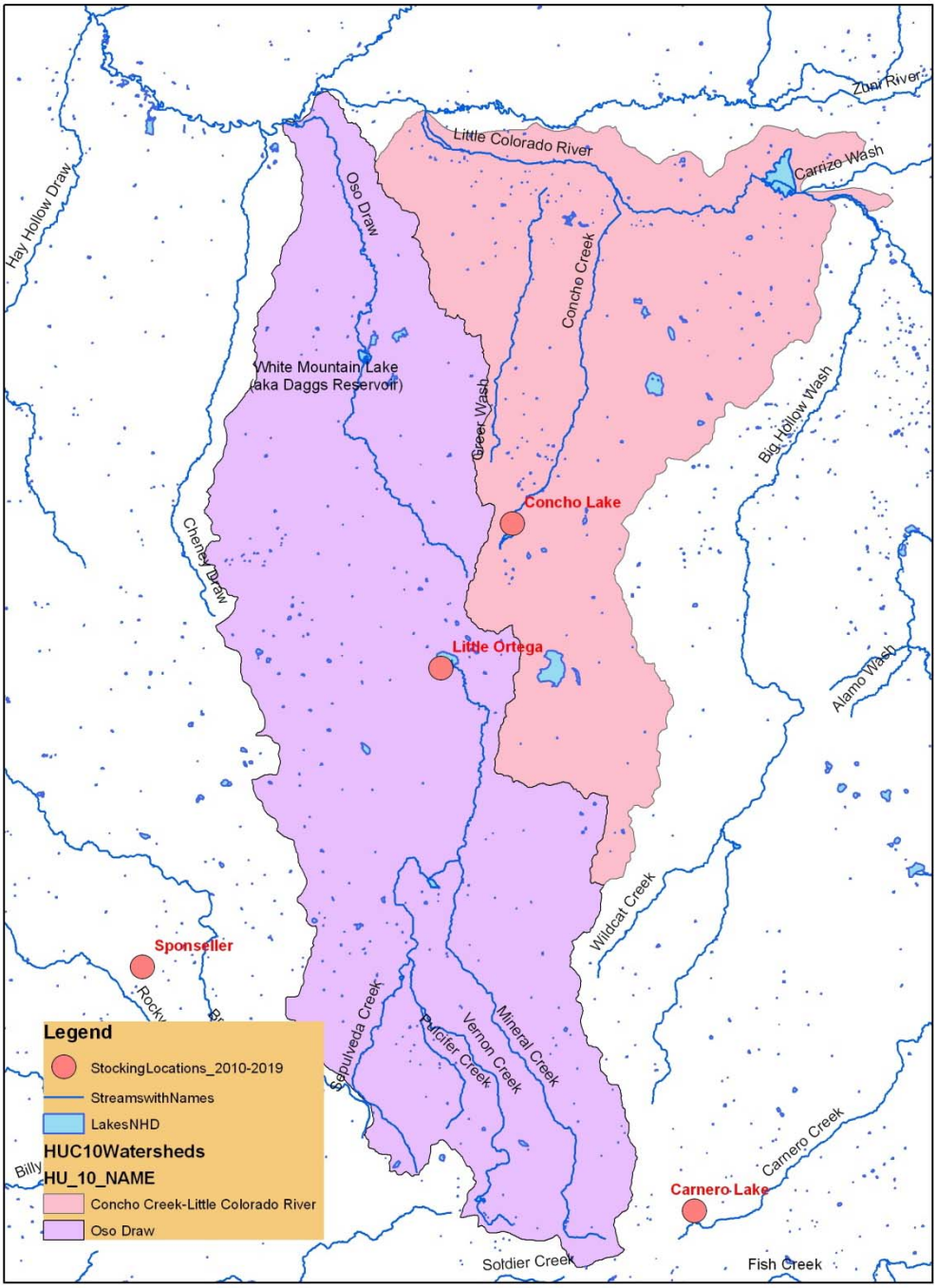


Figure 9. Overview of the Upper LCR stocking sites, Little Ortega and Concho lakes.

Historically, Concho Lake was managed as a cold water fishery utilizing rainbow trout (Table 45). The addition of several warm water species is proposed due to water chemistry, warm water conditions, and heavy irrigation draw-downs that impact trout survival. We will attempt to manage Concho Lake first as a cold water fishery with rainbow trout while trying to help form

an agreement to maintain a suitable minimum pool in the lake. If the water level issue cannot be resolved, we will add a secondary objective to provide a warm water fishery of largemouth bass, bluegill, and channel catfish to provide some angling opportunity when the water quality will not support trout. The Department may change the primary objective to a warm water fishery and drop managing trout altogether if the water conditions continues to be severe.

Catchable trout are stocked multiple times in the spring and early summer. The largemouth bass and bluegill are proposed to be stocked initially to start the populations, and then only when needed to augment or restart them after a catastrophic fish kill. Catchable, sub-catchable, and fingerling channel catfish would be stocked annually throughout the stocking season if the secondary warm water fishery is initialized.

Table 45. Stocking history at Concho Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1977	1994	31	734,757
Crayfish	1971	1971	1	325
Cutthroat trout	1980	1995	11	326,455
Rainbow trout	1957	2009	246	6,140,255
Total			289	7,201,792

Concho Lake is heavily used for irrigation, with all water rights privately held. The lake is often drawn down significantly, impacting fisheries in the lake. For example, the lake was drawn down so low in the summer of 2008, and again in 2009, that a fish kill occurred. The lake does retain water at times and the aquatic weeds grow aggressively and often become a nuisance. The Department uses a mechanical weed harvester to thin the weeds when the water level is high enough to launch the harvester. Lately, the lake is often too low and the weeds continue to grow. Concho Lake also experienced a couple of fish kills early in the season in May 2004 and May 2005, when water quality should have been good. High pH and strong blue-green algae blooms were documented in association with these kills. The problem has not re-occurred since 2005.

A developer has purchased the private parcels around Concho Lake and plans to build homes around the lake and on the private shoreline. However, the problem of draining the lake for irrigation on a regular basis is not helping to sell lots. A plan to provide irrigators with their full water rights, with an agreement to maintain a minimum pool of water, is being explored, but would have to be approved by water rights holders and the irrigation board.

Currently, catchable rainbow trout are stocked early in the year, providing good fishing until the lake is drawn down quickly and the water quality declines, leaving poor trout fishing until the next time the lake is stocked the following year. The Department would prefer to manage the

lake for a cold water fishery, as the lake produced good trout fishing in the past when water levels were maintained. However, if an agreement cannot be made with the irrigation company and water rights holders, it would be wise to provide an alternative angling opportunity such as largemouth bass, bluegill, and channel catfish. This would help discourage anglers from illegally stocking other species that might be a greater threat to other wildlife in the area.

The most recent on-site angler creel survey at Concho Lake was conducted in 2000, identifying a total angler use of 10,414 AUDs, and a statewide angler mail out survey reported 9,268 AUDs in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis of cold water sport fish of basic yield, put-grow-and-take with rainbow trout, which is mostly consistent with the primary proposed action. The primary proposed action includes stocking catchable rainbow trout for an intensive use put-and-take fishery, while a basic yield fishery involves stocking smaller fish and utilizing growth in the lake. The 2001 plan was written prior to excessive draw downs of the reservoir, which no longer allows trout the ability to grow to catchable size, often not even surviving through the later summer months. The current stocking regime is providing fishing opportunity for approximately 4 months, after which the water quality becomes so poor due to excessive draw downs that trout fishing is meager until the next stocking the following spring. The secondary warm water fishery proposal would be implemented only if a solution to the water quantity and quality issues cannot be found. Warm water fishes would be better able to handle the extreme draw downs and associated water quality problems than would trout.

Proposed action

The Department proposes to stock rainbow trout, largemouth bass, bluegill sunfish, and channel catfish in Concho Lake for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from March to June annually; numbers of trout stocked may be from 0 to 15,000 fish annually.

Largemouth bass (fingerling, sub-catchable, catchable) and bluegill sunfish (fingerling, sub-catchable, catchable) may be stocked initially to start naturally reproducing populations, then on an as-needed basis at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Channel catfish (fingerling, sub-catchable, catchable) may be stocked from April to September each year; numbers of channel catfish stocked may be from 0 to 20,000 fish annually.

Water Distribution/Connectivity

Concho Creek flows north to the confluence with the LCR, with Concho Lake located in the headwaters. The drainage begins at Concho Spring 0.5 miles upstream of Concho Lake and runs through a private property golf course to the lake. The spring runs year around, with the 0.5 miles of upper Concho Creek running perennial; however, the flows are fairly low and subject to withdrawals from the golf course. The watershed above the lake is extremely small and does not contribute much water to the lake. Because of the low water input into Concho Lake, it never spills (W. Hooe, pers. comm.). Water is released from Concho Lake during the summer months for irrigation use downstream from April to September. All the released water is diverted into irrigation ditches within the Town of Concho during the irrigation season. Concho Creek below the lake is normally dry, except when water is released from a head gate in the dam for irrigation use in Concho. The creek can also flow towards the LCR when snowmelt and heavy winter precipitation flows that originate from the watershed downstream of Concho Lake. The two events never happen at the same time, because water is not being released from the lake for irrigation when snowmelt or heavy winter precipitation is flowing down lower Concho Creek because that is outside of the irrigation season and irrigation water is not needed at that time. By the time irrigation water is needed in the summer, the creek below the lake has dried. All water released for irrigation is diverted into ditches in Concho and no irrigation water flows north of Concho in the creek itself. Thus, fish stocked in Concho Lake will never have the opportunity to travel the 13.1 miles of Concho Creek from the lake to the LCR.

Fish Movement

Stocked fish have the ability to move upstream into upper Concho Creek because it is perennial, but cannot go any further than the 0.5 miles to the spring.

Trout have the potential to persist in Concho Lake if it retains enough water through the irrigation season; however, that has not been happening recently. Trout do not reproduce in the lake, and are not known to reproduce in the spring above the lake. Warm water fish will likely persist much longer in the lake than trout because they are not as sensitive to poor water quality problems; they may be able to reproduce in the spring.

The lake never spills, but fish can escape downstream into Concho Creek when water is released for irrigation from April to September. All released water is diverted for irrigation within or near the town of Concho and fish do not have the ability to travel downstream of Concho. By the time winter precipitation and spring snowmelt runoff arrives, the creek and diversion ditches have been dry and all escaped fish would have died.

Community Description

Concho Lake contains rainbow trout when stocked, plus naturally reproducing green sunfish, fathead minnow, common carp, and crayfish (Table 46). Concho Creek above the lake has not

been surveyed; however, it is known to have rainbow trout, common carp, and crayfish according to conversations with the golf course operators (M. Lopez, pers. comm.).

Concho Creek below the lake may have some escaped fish temporarily during irrigation releases down to the diversions, but this section dries up after irrigation releases stop. The creek downstream of Concho contains no fish because it dries up entirely and receives no irrigation released water.

Table 46. Survey history at Concho Lake with experimental gillnets (GN).*

Species	**March 2004 6 GN**	**March 2005 3 GN**	**May 2006* 3 GN**	**April 2007* 3 GN**	**March 2008 3 GN**
Rainbow trout	92 (200-414)	40 (250-505)	242 (118-353)	12 (175-343)	36 (285-448)
Carp			22 (206-443)	3 (439-481)	3 (258-525)
Channel catfish					1 (480)
Green sunfish	54 (81-216)		35 (70-245)	8 (119-151)	1 (158)
Black bullhead			1 (322 mm)	1 (344 mm)	
Fathead minnow			1 (81 mm)		

* Effort for each survey is listed as number of gillnet nights (GN). Size ranges are listed as mm TL in parenthesis for fish caught during the surveys. * Note: surveys in 2006 and 2007 were conducted after spring stocking had begun.

Consultation species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

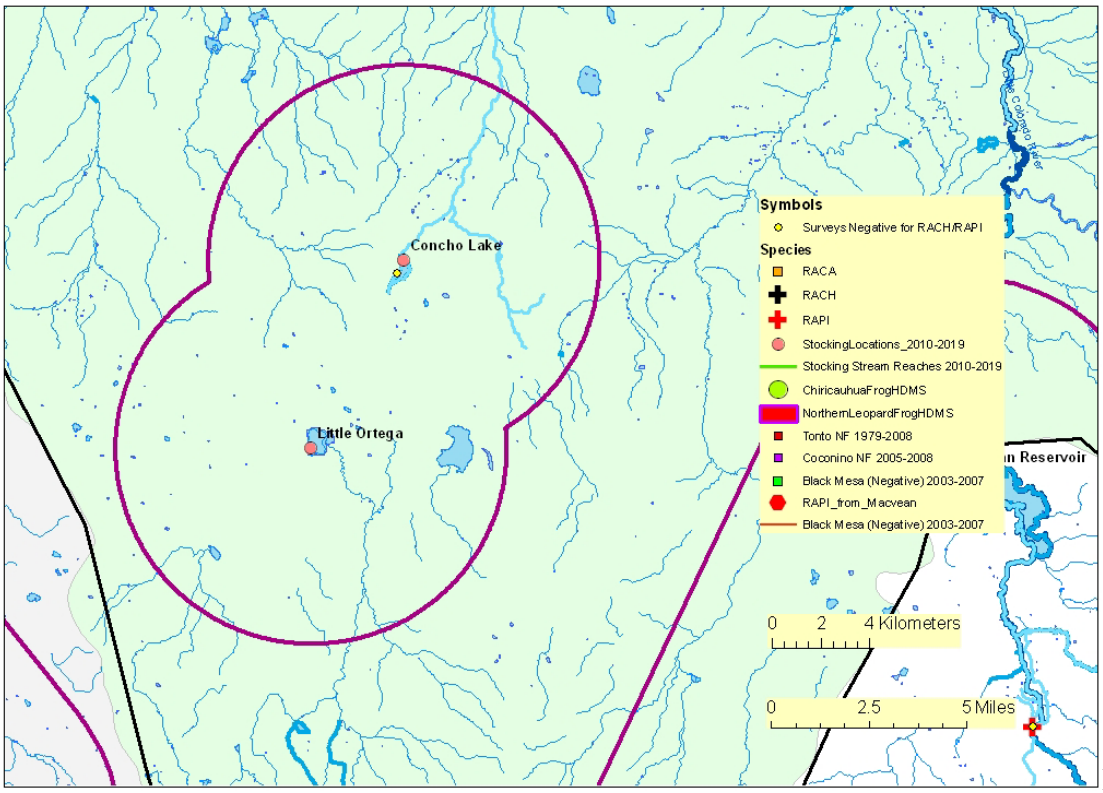
Northern Leopard Frog

Local Analysis: Although Concho Lake and the Upper LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Concho Lake is low. There is one historical record for northern leopard frogs from Concho Lake in 1958 and there have not been subsequent surveys. (Figure 10, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Upper LCR buffered complex because the presence of non-native fish and crayfish make Concho Lake less suitable for northern leopard frogs.

Broad Scale Analysis*: The likelihood that northern leopard frogs could be exposed to fish stocked at Concho Lake that dispersed outside the buffered stocking complex is low. As mentioned in the Fish Movement and Water Distribution/Connectivity section, the lake never spills, fish can only travel upstream 0.5 miles to Concho Springs and cannot swim downstream to the Little Colorado River.*

Chiricahua leopard frog

Local Analysis: Concho Lake is not within the historical range of the Chiricahua leopard frog.



Little

Figure 10. Map of Upper Little Colorado River buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Ortega Lake

Site Description

Little Ortega Lake is located at the terminus of Mineral Creek, approximately 7 miles southwest of the town of Concho. The lake is a closed system formed by a natural shallow basin, with no spillway or outlet. The lake is located on State Trust land at an elevation of 6420 feet.

Little Ortega Lake is accessed year around by a short dirt road off paved Highway 61. There are no facilities, restrooms, signs, or a boat launch ramp at the lake. Camping is allowed at the lake with a valid fishing license and with the act of fishing because the lake is located on State Trust Land; however, camping is rarely practiced.

Management of Water Body

Primary fishery is a warm water channel catfish put-grow-and-take fishery when the lake contains enough water to support fish (Table 47). Catchable, sub-catchable, and fingerling channel catfish are stocked throughout the stocking season, opportunistically in years when the lake has sufficient water levels.

Table 47. Stocking history at Little Ortega Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1941	1986	2	16,000
Channel catfish	1975	2008	12	37,362
Largemouth bass	1920	1993	5	15,550
Total			19	68,912

Little Ortega Lake is often dry or extremely shallow and not stocked. During heavy precipitation years, the lake captures enough water to allow stocking channel catfish. The water is always turbid and productivity may be low, so the lake is under-stocked for its size. The lake receives very little angler use because of the infrequent stocking and lack of facilities.

The management of Little Ortega Lake has been minimal. The water coming into the lake itself is not controlled and cannot be released for irrigation. The lake is stocked with channel catfish when the lake level is suitable.

There have been no angler creel surveys conducted at Little Ortega Lake because the fishing opportunity has been so sporadic and angling use is low.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identified the management objective for Little Ortega Lake as warm water sport fish, with a desired species assemblage of channel catfish, bluegill, and largemouth bass. The proposed action is mostly consistent with this emphasis, with stocking channel catfish; however, bluegill and largemouth bass are not proposed.

Proposed action

The Department proposes to stock channel catfish for the period covered by this consultation.

Catchable, sub-catchable, and fingerling channel catfish will be stocked multiple times from April to September during years when the lake has sufficient water levels; numbers of channel catfish stocked may be from 0 to 10,000 fish annually.

Water Distribution/Connectivity

Little Ortega Lake is fed primarily by Mineral Creek, which originates from a series of springs on the Apache-Sitgreaves National Forest. Upper Mineral Creek is perennial, providing habitat for a recovery population of Apache trout. From the spring, Mineral Creek flows for 3.1 miles to a constructed fish barrier on Mineral Creek. A diversion located approximately 50 meters downstream of the fish barrier diverts all the base flow for private irrigation use year-round. The next 16.4 miles of Mineral Creek downstream of the diversion to Ortega Lake is dry most of the time, and in most years water never reaches Little Ortega Lake. Normal high spring flows would also be entirely diverted into the irrigation ditch. It would take a flood for water to flow over the diversion on Mineral Creek to connect perennial flows in upper Mineral Creek with Little Ortega Lake. More often heavy snowmelt runoff or heavy winter precipitation flows into the lake from other sources in the Mineral Creek watershed below the diversion.

Once water reaches Little Ortega Lake, which is a natural sink, there is no outlet or any way to release water. Water can persist in the lake if additional incoming flows offset evaporation and seepage; otherwise, the water in Little Ortega Lake eventually dries up. Water levels in Little Ortega Lake fluctuate significantly across years, occasionally being very full, then completely dry in other years. It is entirely dependent upon the winter precipitation and spring snowmelt runoff coming from the headwaters of Mineral Creek.

Fish Movement

Fish stocked in Little Ortega Lake may persist as long as the water persists. The fish die when the lake dries up, which occurs on a regular basis. The fish can only escape the lake one way, upstream in Mineral Creek, but only when flood flows coming down Mineral are sufficient to allow fish movement. Most years there is no flow or extremely low flow. It is possible for a fish

to swim up the 16.4 miles to the water diversion, which may be a partial barrier, but likely not a complete barrier. Fifty meters upstream of the diversion is a constructed fish barrier to prevent upstream movement of fish into Apache trout habitat above the barrier. Fish escaping upstream from Little Ortega Lake could not get past this fish barrier. The closed basin prevents the stocked fish from getting into any other waters than those already described.

Community Description

Little Ortega Lake currently contains stocked channel catfish. It is unknown if they reproduce within the lake (Table 48). Lower Mineral Creek does not support fish because it is dry most of the time. Any fish escaping the lake would die in the creek when it dries. Upper Mineral Creek contains a recovery population of Apache trout (Table 49) that are isolated by the intermittent drainage and a constructed fish barrier. Surveys in 1994-1995 found tiger salamander and striped chorus frog within the watershed near the headwaters, but not in the creek itself.

Table 48. Summary of fish surveys in Little Ortega Lake.

Date	**Gear type**	**Effort (net nights)**	**Species**	**Num. Collected**	**Size range (mm TL)**
Sept 1976	Trap net	1	Green sunfish	43	96-199
March 1977	Gill nets	2	Largemouth bass	1	254
April 1979	Gill and trap nets	4	Green sunfish Fathead minnows	29 many	105-156
April 1981	Gill net		Rainbow trout Green sunfish Fathead minnow	2 7 30	494-546 105-163
April 1987	Gill net	2	Largemouth bass Channel catfish Green sunfish	2 15 3	326-348 206-345 132-195

Table 49. Summary of fish surveys in upper Mineral Creek, using backpack electroshockers.

Date	**Species Collected**	**Num. Collected**	**Size Range (mm TL)**
October 1985	Apache trout	7	75-235
November 1986	Apache trout	8	85-278
July 1991	Apache trout	6	134-241
July 1996	Apache trout	10	88-156
October 2000	Apache trout	46	Not recorded
May 2001	Apache trout	1	86
May-June 2003	Apache trout	1	121

Consultation species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to Apache trout are discussed below and potential impacts to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog
Local Analysis: Although Little Ortega Lake and the Upper LCR buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Little Ortega Lake is low. There are no historical records for northern leopard frogs from Little Ortega Lake (Figure 10, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is one record for northern leopard frogs from within the Upper LCR buffered complex; Concho Lake (1958) but there have been no subsequent surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Upper LCR buffered complex because the presence of non-native fish and crayfish make Little Ortega Lake less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Little Ortega Lake that dispersed outside the buffered stocking complex is low. As mentioned in the Fish Movement and Water Distribution/Connectivity section, the lake is a closed system and fish that do escape cannot move upstream of a fish barrier in Mineral Creek. Additionally, Little Ortega Lake dries often, making the habitat less suitable for Chiricahua leopard frogs.

Chiricahua leopard frog
Local Analysis: Little Ortega Lake is not within the historical range of the Chiricahua leopard frog.

Apache Trout

Apache trout are located in the headwaters of Mineral Creek. Stocked channel catfish cannot get to the Apache trout habitat located upstream of a constructed fish barrier, 50 meters upstream of a major water diversion. Mineral Creek is normally dry for the 16.4 miles downstream of the diversion to the lake because the water diversion directs flows into an irrigation ditch year-round, even at normal high spring flows. Only flood flows would overtop this diversion, connecting upper Mineral Creek permanent flows with Ortega Lake. A catfish would have to swim the entire 16.4 miles in the short timeframe of intense spring flows, which would likely be difficult for a warm water fish in the very cold snowmelt runoff. If a catfish got over the diversion during flood flows, it could not get above the constructed fish barrier 50 meters upstream of the diversion. A fish could potentially reach the 50 meters of permanent flow between the diversion and the fish barrier, although likely would not survive. This habitat is not suitable for channel catfish, because of the very small base flows and lack of deep pools. A channel catfish large enough to make that journey 16.4 miles upstream in the short time required before the creek dried up, would not be able to find habitat deep enough to persist. The lower reach of Apache trout habitat in Mineral Creek does not even support trout because of the lack of pools, with most trout found in the upper higher gradient reaches where pool habitat is more abundant.

An Apache trout could disperse downstream to Little Ortega Lake when the creek floods and is connected with the lake. This fish is considered lost to the recovery population because it will never bet back above the fish barrier and will not establish/reproduce in Little Ortega Lake. Stocked channel catfish may impact an individual dispersed trout in the lake, but this would be very rare and would have no impact to the Apache trout recovery population. Potential impacts to the individual dispersed trout in the lake could be predation by channel catfish if the trout is small enough, or competition for food resources within the lake. Stocked catfish will not have anticipated competition for space within the lake because trout are open water fish while catfish occupy the bottom usually around structure. There are no issues with hybridization because these fish are from different families. A recruitment level of the listed species is not an issue because trout cannot spawn in Little Ortega Lake, and catfish cannot get to spawning habitat above the barrier. There would be no dispersal of the listed species because the creek and lake downstream of the diversion are unsuitable for trout because they both dry up regularly, nor is there a need for connectivity reduction between populations of Apache trout because no other populations with hydrologically connected waters.

Potential Impacts

Apache trout escapement from recovery areas and exposure to stocked sport fish:

If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered subject to the

special 4(d) rule. They would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

UPPER LITTLE COLORADO RIVER COMPLEX ANALYSIS

Water Distribution / Connectivity

Concho Lake is located on the headwaters of Concho Creek, a tributary to the LCR; however, water and fish from Concho Lake never reach the LCR due to the operation of the lake as an irrigation reservoir, the small watershed, and the timing of irrigation releases that do not coincide with potential flood flow events. Little Ortega Lake is a natural depression with no outlet, and located at the terminus of Mineral Creek, with no hydrologic connection to the LCR.

Fish Movement

Stocked fish in Concho Lake and Little Ortega Lake can escape the lakes, during irrigation releases at Concho and during flood flows into the lake from Mineral Creek at Little Ortega Lake, but cannot reach where listed aquatic species are or may occur. The catfish at Little Ortega Lake can get to perennial water just below a constructed fish barrier for Apache trout above, but are unlikely to ever make it that far due to the distance of the normally dry stream because there is nowhere to persist until the next high flow.

Community Description

Concho Creek above the lake is known to have rainbow trout, common carp, and crayfish according to conversations with the golf course operators (M. Lopez, pers. comm.). The Creek below the lake may have some escaped fish temporarily during irrigation releases down to the diversions, but this section dries up after irrigation releases stop. The creek downstream of Concho contains no fish because it dries up entirely and receives no irrigation released water.

Little Ortega Lake currently contains stocked channel catfish, and it is unknown whether they reproduce. Lower Mineral Creek does not support fish because it is dry most of the time. Any fish escaping the lake would die in the creek when it dries. Upper Mineral Creek contains a recovery population of Apache trout (Table 49) isolated by the intermittent drainage and a constructed fish barrier.

Consultation Species or Critical Habitat

Potential impacts to Apache trout, Chiricahua leopard frog and northern leopard frog are addressed at the site specific stocking locations above. There are no anticipated impacts to listed species downstream from either Concho or Little Ortega lakes.

WHITE MOUNTAIN COMPLEX

The White Mountain Complex is a sub-drainage located within the Silver Creek drainage that flows into the Little Colorado River Watershed (Figure 11). The complex consists of 5 stocking sites; 4 reservoirs and one stream reach, located in or draining into Silver Creek, near Show Low, Arizona (Figure 12).

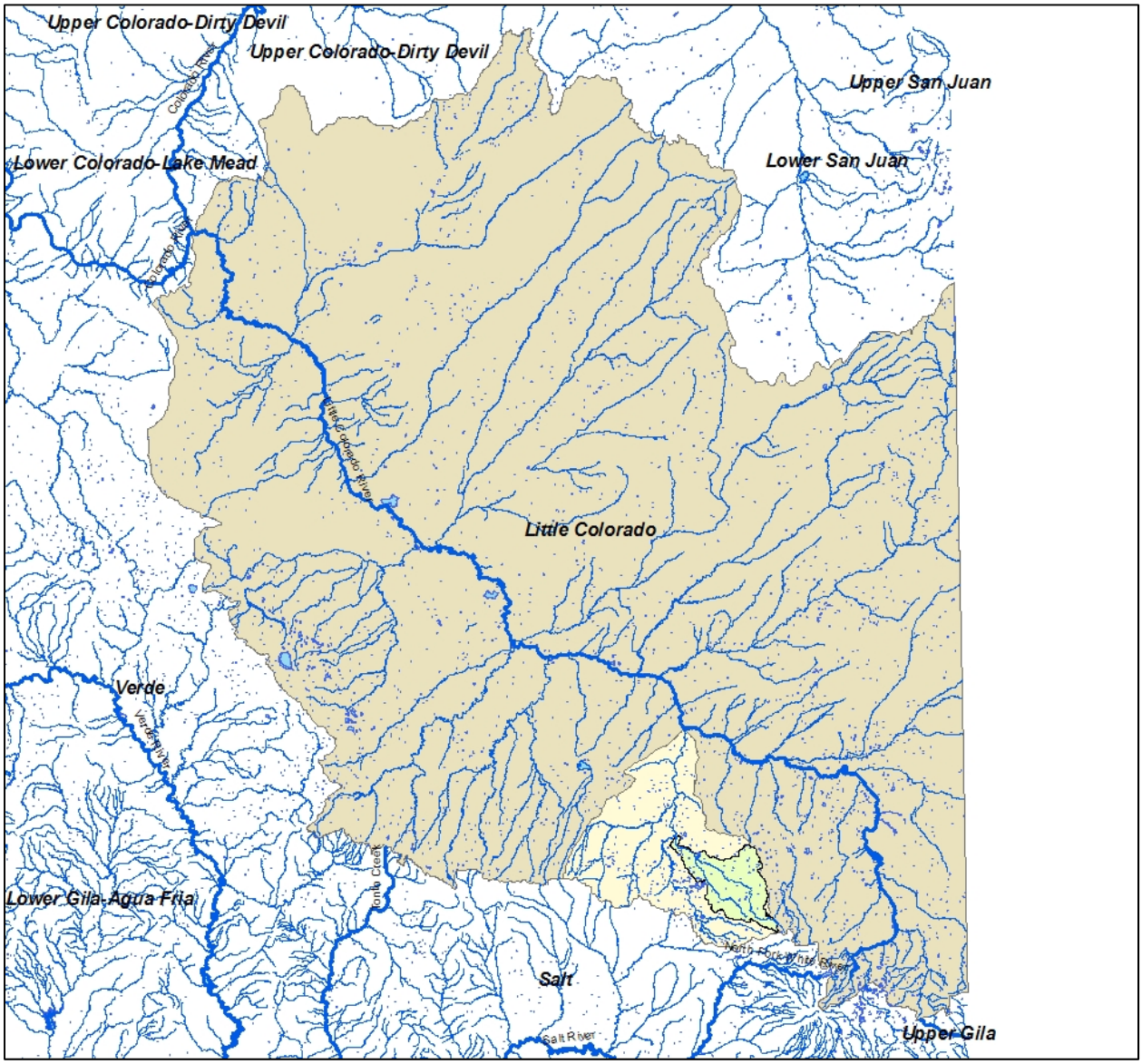


Figure 11. White Mountain Complex sub-drainage (green) is located within the Silver Creek drainage (yellow) of the Little Colorado River watershed.

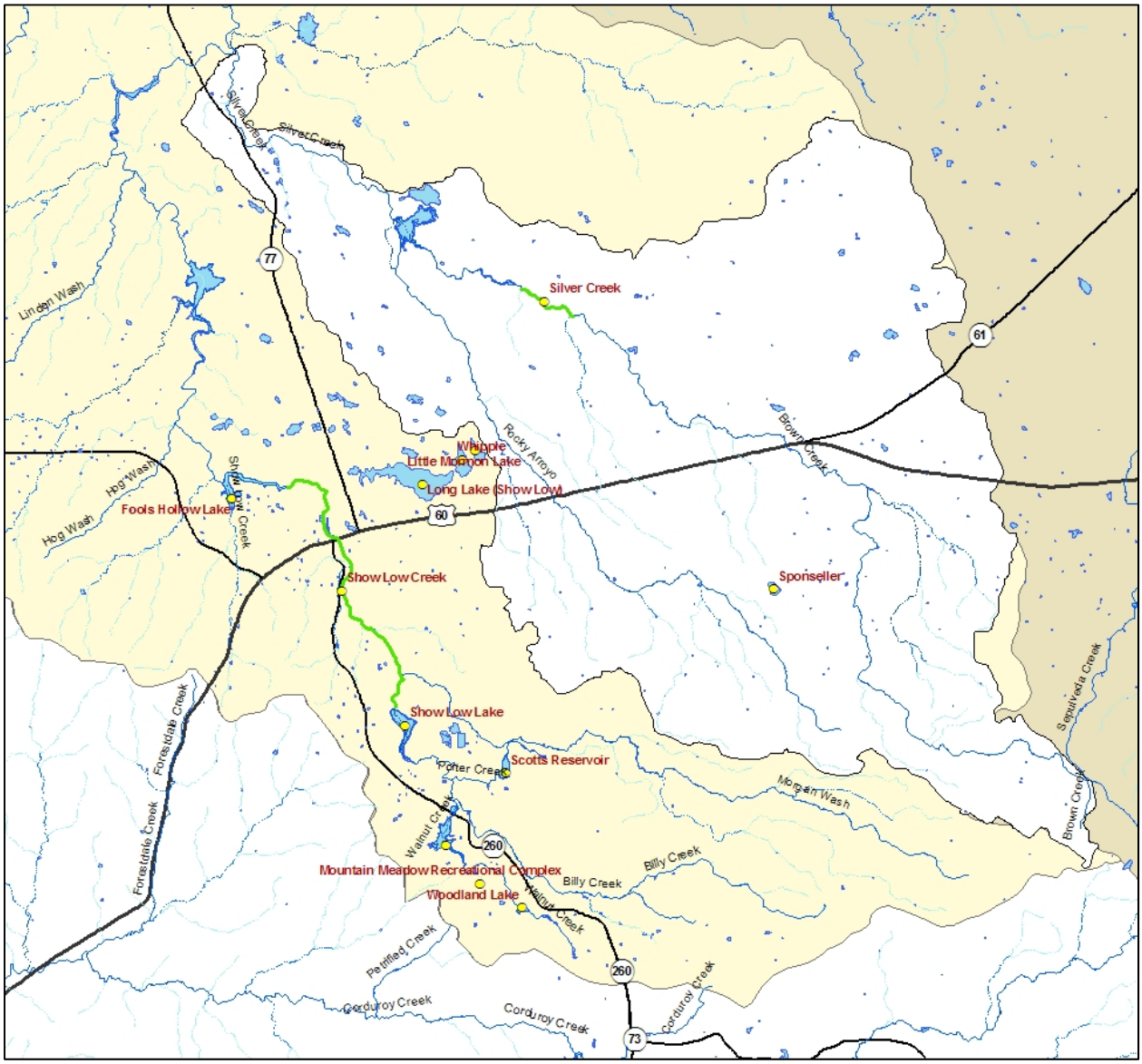


Figure 12. The White Mountain Complex sub-drainage contains 5 stocking locations and is located within or drainage diverted to the Silver Creek drainage.

Sponseller Lake

Site Description

Sponseller Lake is a natural closed basin, located at an elevation of 6960 feet on the Apache-Sitgreaves National Forest (Figure 13). The lake is about 34 surface acres in size when containing water, and located approximately 9 miles northeast of Pinetop-Lakeside. The lake is often dry and not stocked. Sponseller Lake is in a natural sinkhole and only catches enough water to create a lake during high snowpack in very wet years. Sponseller Lake is included in the

White Mountain Complex because it is in the vicinity of the other waters in the complex, but it is not hydrologically connected to them. Sponseller is located approximately 7.4 miles southeast of Little Mormon, Whipple, and Long lakes, and approximately 8.0 miles southeast of the Silver Creek stocking site.

Figure 13. Image of Sponseller Lake located in the White Mountain complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Sponseller Lake is managed opportunistically as a put-grow-and-take cold water fishery; it is shallow and weedy, when it has water, creating productive conditions that grow large trout.

Trout stocked in 1993 were over 6 pounds by 1995. Sponseller Lake has only been stocked 9 times; in 1993, 1994, 1995, 2005, 2008, and 2009, all with catchable rainbow trout, except in 2005 when subcatchable rainbow trout were stocked (Table 50). The trout stocked in 1993-1995 did very well and persisted for a couple years, but were gone by 1996 when the lake dried up. Recent stockings have not done as well because water in the lake has not persisted long enough to grow large trout.

Table 50. Stocking history for Sponseller Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Rainbow trout	1993	2009	9	32,810
Total			9	32,810

The lake is monitored each spring to determine the amount of water collecting in the lake and only stocked if it will hold suitable water into the following year.

Sponseller Lake is accessed by a rough, primitive dirt spur road off Forest Road 45. Depending upon the road conditions, Sponseller could be reached most times of the year; however wet weather makes the road inaccessible. There are no boat launch ramps, restrooms, established parking, or picnic facilities at the lake. Primitive camping is allowed but not often practiced because of the proximity to Pinetop-Lakeside and the extremely low angler use.

There have been no angler creel surveys conducted at Sponseller Lake. The Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) and the Lakeside Area Fisheries Management Plan (Meyer et al. 2008) identify a management emphasis of basic yield put-grow-and-take sport-fish for Sponseller Lake, with a desired species assemblage of rainbow trout, which is consistent with this proposed action.

Proposed Action

The Department proposes to stock rainbow trout are proposed for the period covered by this consultation. Catchable and sub-catchable rainbow trout would be stocked up to multiple times per season, from March to June, only when the lake holds enough water to support trout through the summer; numbers of trout stocked may be from 0 to 10,000 fish annually.

Water Distribution/Connectivity

Sponseller Lake is fed by snowmelt runoff by a normally dry drainage coming off Marshall and Ziegler Mountains. Sponseller Lake sits in a natural depression and there is no spillway it is a closed basin. There is no hydrologic connection with other drainages or waters. The drainages

coming off Marshall and Ziegler Mountains are almost always dry, running only during spring runoff, and possibly during an extreme monsoon rain event.

Sponseller Lake is often completely dry, particularly during years with below average winter snowpack. In other years, Sponseller has some water but not enough to stock trout. Occasionally the lake catches enough water that persists through the summer fishing season and is stocked during that season.

Fish Movement

Trout stocked into Sponseller Lake have no way of escaping because it is a closed basin. It is remotely possible for a trout to swim up the un-named drainage towards Marshall and Ziegler Mountains during a heavy spring runoff, but they cannot reach any other drainage. The normally dry drainage is only 1.9 miles long up one fork to the extreme top of Marshall Mountain, and another fork goes for another 1.2 miles to the extreme top of Ziegler Mountain. If the trout did not immediately return to the lake before spring runoff ended, it would die as the drainage dried in late spring.

Trout can persist in Sponseller Lake if the lake holds sufficient water long enough. There are no records of winter kill; however the lake does dry up causing complete fish kills.

Community Description

Sponseller Lake contains only rainbow trout, when stocked, and tiger salamanders. The lake dries entirely in most years and rainbow trout are the only species restocked. Sponseller Lake currently contains rainbow trout, and reproduction has not been documented in the lake. The dry drainage coming from Marshall and Ziegler Mountains have no aquatic species present because they dry every year following the end of spring runoff. Two surveys were done on Sponseller Lake; one in 1995 resulted in the collection of 3 rainbow trout, and one in April 2009 resulted in the collection of 49 rainbow trout.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Because Sponseller Lake is a closed system, there is no opportunity for movement of stocked fish out of the lake. Potential impacts to Chiricahua and Northern leopard frogs (analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur), along with northern Mexican and narrow-headed garter snakes, are addressed below at the site level.

Northern Leopard Frog

Local Analysis: Although Sponseller Lake and the White Mountain buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Sponseller Lake is low. There are no historical records for northern leopard frogs from Sponseller Lake or the buffered stocking complex. This area includes numerous habitats that have not been surveyed; however, four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and northern leopard frogs were not observed (Figure 14, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is likely that northern leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish, crayfish, and bullfrogs make the habitat less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Sponseller Lake that dispersed outside the buffered stocking complex is low, because Sponseller Lake is a closed basin. Although it is remotely possible for fish to swim towards Marshall and Ziegler Mountains, dispersing fish would be confined to those drainages and cannot disperse outside of the buffered complex.

Chiricahua leopard frog

Local Analysis: Although Sponseller Lake and the White Mountain buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Sponseller Lake is low. There are no historical records for Chiricahua leopard frogs from Sponseller Lake or the area within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984and 1994 and Chiricahua leopard frogs were not observed (Figure 14, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not yet been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish, crayfish, and bullfrogs make the habitat less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Sponseller Lake that dispersed outside the buffered stocking complex is low, because Sponseller Lake is a closed basin. It is remotely possible for fish to swim towards Marshall and

Ziegler Mountains; however, fish that escape are confined to those drainages and cannot disperse outside of the buffered complex.

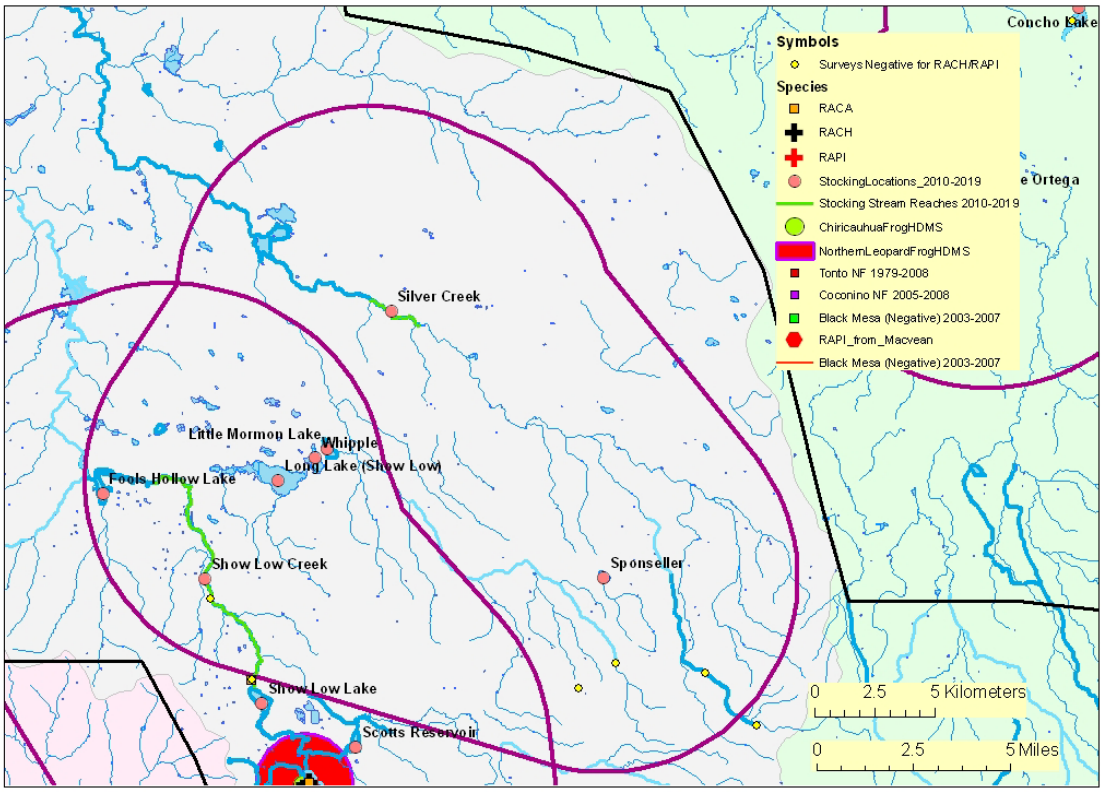


Figure 14. Map of White Mountain buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Northern Mexican Garter Snake
Analysis: See White Mountain Complex Analysis below.

Narrow-headed Garter Snake
Analysis: See White Mountain Complex Analysis below.

<u>Silver Creek</u>
Site Description

The Silver Creek stocking site is a 2.4 mile reach of upper Silver Creek on Department property, located immediately below the Silver Creek Fish Hatchery (Figure 15). The stocking site is located approximately 7 miles northeast of Show Low at an average elevation of approximately 6100 feet. This portion of Silver Creek has permanent flow. This stocking site is located at the very upper end of Silver Creek, although the headwater tributary of Brown Creek, a mostly dry drainage, enters at the upper end near the hatchery raceways.

The property is accessed by paved road year around, with a dirt parking area near the lower section of the 2.4 miles. Restroom and picnic benches are also located at the parking area. Anglers can hike to other parts of the stream on Department property.

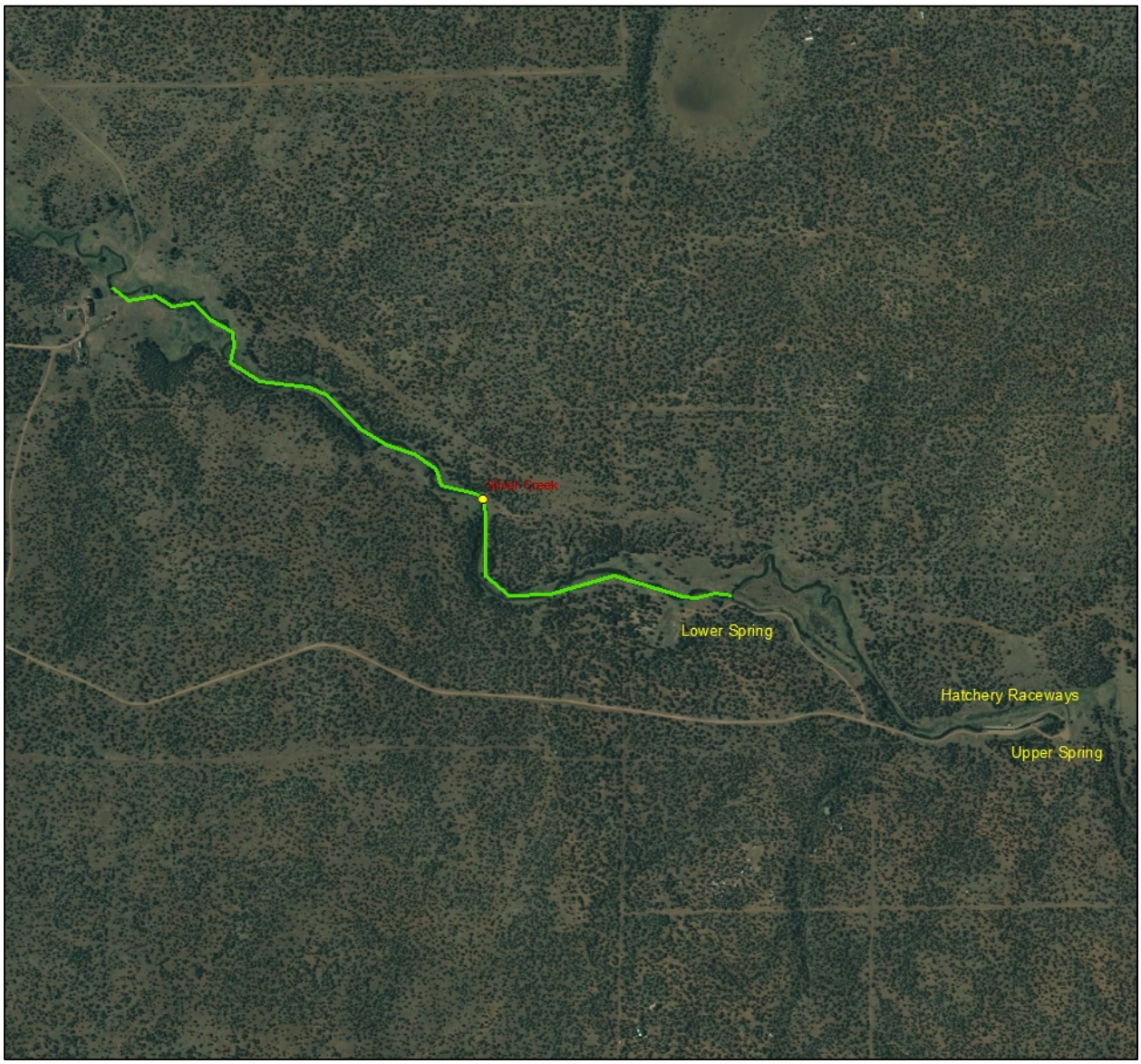


Figure 15. Image of the Silver Creek stocking reach located in the White Mountain complex (©2009 ESRI, i-cubed, GeoEye)

Silver Springs Hatchery raceways are located at the upstream most end just below the upper spring.

Management of Water Body
Primary fishery is a cold water intensive use put-and-take during the summer, and a cold water featured species catch-and-release fishery during the winter. *Table 51* provides a summary of stocking activity for Silver Creek. Catchable Apache and rainbow trout are stocked weekly from May through September, and several times from October through January. The Department also hosts numerous fishing clinics at this stream throughout the spring and summer.

Table 51. Stocking history in Silver Creek.

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Apache trout	1999	2009	130	68,457
Rainbow trout	1937	2009	388	535,145
Brown trout	1934	1963	14	194,830
Black Mt. Spotted Trout	1920	1921	2	6,000
Channel catfish	1969	1984	7	16,500
Total			541	820,932

Silver Creek is stocked with trout through 1.5 miles of stream on Department property just below the hatchery. Upper Silver Creek is a spring-fed creek, coming out of the spring at a constant 15.7 – 16.0 degrees Celsius, which is suitable to support stocked trout, but unsuitable for reproduction because trout generally spawn in water temperatures below 10 degrees Celsius. The water chemistry changes quickly as it flows and is slowly exposed to sunlight in this moderate elevation climate. White Mountain Lake, approximately 3.0 miles downstream of the Department's property, is a warm water lake, and unsuitable to support trout during the warm season. Silver Creek continues to warm as it flows downstream towards the Little Colorado River (LCR), becoming even more unsuitable for trout. Trout are only stocked in the upper (near

the lower spring and just downstream) and lower sections of the reach in the open meadow areas due to access; the middle section of the stream reach is not accessible by stocking truck.

The Department owned hatchery consists of "raceways" developed within the channel just below the large upper spring, plus another off-channel smaller (lower) spring. These hatchery areas are closed to fishing. Also, the upper 0.7 mile of stream, immediately below the main hatchery raceways, is closed to fishing during the summer and opens to fishing only during the winter. Silver Creek has a split season and management, open to bait fishing and 6 trout daily bag limit during the summer, from April 1 through September 30, then changes to catch-and-release regulations with artificial fly and lure only with barbless hooks.

Silver Creek has become a very popular location to fish, with different users depending upon the season. The creek is fished intensively during the summer and bait fishing season (April 1 – September 30 – no live baitfish) when the creek is stocked weekly from May through September. The intent of this stocking is to provide intensive use put-and-take cold water fishing, especially when children are out of school as this is an ideal place to interest children in fishing. The Department holds numerous fishing clinics for children, including handicapped and challenged children at Silver Creek. After summer fishing ends, winter stocking provides a fly fishing opportunity for larger trout when trout streams in higher elevations are inaccessible due to snow and freezing. Because the spring produces water at a constant temperature, the stocking site does not freeze.

During the winter catch-and-release season, Silver Creek has become popular with fly fishermen, attracting many anglers from the Tucson and Phoenix metro areas, as well as from other states.

The use of both rainbow and Apache trout has been a fishing success at Silver Creek. Rainbow trout are much easier to catch and grow more quickly than Apache trout, while Apache trout provide an opportunity to catch a unique native species during the winter when Apache trout waters in higher elevations are not accessible.

On site angler creel surveys were conducted at upper Silver Creek in 2001 and 2004-05, reporting 2,482 AUDs and 4,872AUDs, respectively (AGFD unpublished data). A statewide mailed questionnaire reported 3,167 AUDs at Silver Creek in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identified a management emphasis of intensive use put-and-take and featured species sport fish, with an overall desired species assemblage of Apache trout, Little Colorado spinedace, bluehead sucker, roundtail chub, Little Colorado sucker, and speckled dace in upper Silver Creek. The proposed action of stocking Apache trout and rainbow trout partially deviates from the management plan in the species assemblage, because rainbow trout are stocked to make up for the shortage of Apache trout. The 2001 plan recommends evaluating a winter catch and release fishery, which

has been implemented. The Lakeside Area Fisheries Management Plan (Meyer et al. 2008) recommended stocking both Apache trout and rainbow trout, and to manage a put-and-take summer fishery and a trophy catch-and-release winter fishery, which is consistent with the proposed action.

Proposed Action

Apache and rainbow trout are proposed for the period covered by this consultation. Catchable Apache and rainbow trout would be stocked weekly from May to September each year, and then up to several times from October through January to support the catch-and-release season; numbers of trout stocked may be from 0 to 15,000 fish annually.

Water Distribution/Connectivity

Silver Creek begins at Silver Springs on Department property, then immediately flows through the Silver Creek Fish Hatchery main raceways. From the main raceways, this water flows into the 2.4 mile reach of stream that makes up the stocking site. A major tributary, Brown Creek, enters just below the main raceways and at the upper end of the stocking reach. Brown Creek is 18.8 miles in length but is nearly dry most of the year, with a few permanent pools at its origin at Brown Spring, and a couple of pools at the confluence with Silver Creek. During the spring snowmelt runoff, Brown Creek supplies a substantial flow into upper Silver Creek from this large watershed. Also within Department property, a minor spring, with minor hatchery raceways, enters into Silver Creek approximately 0.4 miles downstream from the top of the stocking reach. This minor tributary is permanent because of the spring, but is only 0.2 miles in length. The flows from Silver Spring and the minor spring are permanent through Department property, then along 3.0 miles of private property and into the private White Mountain Lake.

White Mountain Lake is a permanent irrigation lake that catches and stores water with irrigation water releases from April 15 through September 15 for use downstream in Shumway and Snowflake-Taylor. The lake does spill regularly in the spring during snowmelt runoff. During runoff, Silver Creek's flow is mostly perennial from White Mountain Lake downstream for 18.6 miles through Shumway, Taylor, and to Snowflake. Portions of this reach may dry when there are no irrigation releases or spills, but the reach can maintain perennial pools. A major tributary, Cottonwood Creek, enters Silver Creek in the town of Snowflake. This tributary is nearly dry, except during spring snowmelt runoff when it contributes a fair amount of snowmelt runoff from that large watershed, and for a large permanent pool created from a sand and gravel dredge business near the confluence with Silver Creek. There are numerous water diversions from Shumway through Snowflake used to irrigate hay fields, small farm crops, and orchards. From Snowflake, Silver Creek is mostly perennial for the next 22.5 miles to the confluence with the LCR. Silver Creek is 46.5 miles from its source to the LCR.

It is 43.3 miles downstream along the LCR from Silver Creek confluence to the confluence with Chevelon Creek, then another 9.1 miles to the confluence with Clear Creek, then another 154.1 miles to the confluence with the Colorado River. The LCR is mostly perennial from Silver Creek downstream towards Holbrook, where it becomes ephemeral and only flows during snowmelt runoff and heavy monsoon rain events. The LCR becomes perennial again from permanent flow coming in from Chevelon Creek for a short distance to Winslow, where the flows again sink into the sandy streambed during base flows. Upstream of the Silver Creek confluence, the LCR is intermittent for 54.2 miles to Zion Reservoir, then mostly dry with some perennial flow for 30.9 miles to just below Lyman Lake. Additional discussion on water flow is provided in the Complex analysis, below.

Fish Movement

Stocked trout in upper Silver Creek do persist in the stream reach where they are stocked, because it is suitable for trout year round; however, they do not reproduce in Silver Creek because the water temperature is too warm. The trout cannot swim far upstream in Silver Creek, before they are stopped by the screens on the bottom end of the hatchery raceways located at the upper end of the stocking reach. During spring runoff, fish could potentially swim up Brown Creek for many miles, but as the creek dries up they would likely die before reaching the few permanent pools at the headwaters of Brown Creek 18.8 miles upstream.

Stocked trout can swim downstream out of the stocking reach, and have the potential to reach White Mountain Lake. They could then be transported over or through the dam by spring spill or summer irrigation releases into middle and lower Silver Creek, and eventually into the LCR. However, conditions during the warmer months would make it unlikely that they would persist long enough to leave White Mountain Lake. White Mountain Lake is a turbid, warm lake that is unsuitable for trout during the summer. Silver Creek downstream of White Mountain Lake is silty, turbid and warm during the summer and, as such, mostly unsuitable for trout.

It is possible for trout to travel these waters during the winter and spring runoff when the water temperatures are colder; however, the multiple surveys in Silver Creek below White Mountain Reservoir have never documented a trout of any kind (See Table 3 for survey information). There have also been no records of trout collected in the LCR from the Navajo Reservation boundary (north of Winslow) upstream to Lyman Lake. The data suggest that trout are not moving into Silver Creek below White Mountain Reservoir, or if they do it is in low numbers and they persist for a very short period of time..

Community Description

Silver Creek on Department property contains stocked rainbow and Apache trout, which do not reproduce in the stream. This portion of Silver Creek lacks good spawning substrates, because it is composed mostly of silt, small cobble, boulder and bedrock. Constant water temperatures

might be a little too warm to be conducive for the development of viable eggs (J. Diehl, pers. comm.). This reach of Silver Creek also contains naturally reproducing populations of speckled dace, bluehead sucker, mosquitofish, golden shiner, green sunfish, and fathead minnow (Lopez et al. 1999a), plus bullfrogs, abundant crayfish, and tiger salamander.

Downstream of the stocked reach of Silver Creek is White Mountain Lake, which contains largemouth bass, green sunfish, bluegill, black crappie, channel catfish, yellow bullhead, fathead minnow, golden shiner, and common carp.

Between White Mountain Lake and Snowflake, Silver Creek a 2004 survey (McKell and Lopez 2005) found fathead minnow, golden shiner, green sunfish, common carp, Little Colorado sucker, and crayfish during, and fathead minnow, Little Colorado sucker, crayfish, and bullfrog tadpoles during a survey in 2009 (AGFD unpublished data). However, it likely also contains other species such as yellow bullhead and bluehead sucker in low numbers because these species can be found above and below this reach.

Downstream of Snowflake, Silver Creek was found to contain Little Colorado sucker, bluehead sucker, yellow bullhead, green sunfish, common carp, fathead minnow, largemouth bass, channel catfish, bullfrog tadpoles, and abundant crayfish (Lopez et al. 1999a; McKell and Lopez 2005; Weiss 2007d). Fifteen Little Colorado spinedace were found in intensive surveys in 1997, but have not been found in annual surveys since then. They also had not been found prior to that for 30 years, with the previous record in 1967 (Lopez et al. 1999a; McKell and Lopez 2005).

Table 52 summarizes the numerous surveys in lower Silver Creek below White Mountain Lake, considered to be the occupied habitat of Little Colorado spinedace. No trout have been captured in lower Silver Creek in any of these surveys. The 1991 and 1993 surveys were conducted with backpack electroshockers in August of each year (Dorum and Young 1995). The 1992 survey was conducted with a seine in May (AGFD unpublished data). The 1997 survey was conducted with a backpack electroshocker and seine in July; the 1999 survey was conducted with a backpack electroshocker in November-December; and the 2000, 2002 and 2003 surveys were conducted with seines in May, July and April, respectively (McKell and Lopez 2005). The 2004 (McKell and Lopez 2005) and 2006 (AGFD unpublished data) surveys were conducted with a backpack electroshocker in June-August and June, respectively. The 2007 surveys were conducted in March and October with a backpack electroshocker, seine, and hoop nets (Weiss 2007d), and the 2009 surveys were conducted with a backpack electro shocker and seine in June (AGFD unpublished data).

Although narrow-headed garter snakes are not known from the LCR, there are historical and recent (but unverified) records of northern Mexican garter snakes from the watershed (see analysis below).

Table 52. Summary of fish surveys in lower Silver Creek below White Mountain Lake.

Year	**Species**									
	LC spinedace	LC sucker	Bluehead sucker	Fathead minnow	Green sunfish	Yellow bullhead	carp	Largemouth bass	Golden shiner	Channel catfish
1991				19	9	2	2			
1992				22	6		13		1	
1993		4	64	106	12	1	5			
1997	15	142	2	2180	48	11	63			
1999		18	7	578	63	17	167	13		
2000		3		611	12	11	91			1
2002		present		present	present	present	present	present		
2003		3		516	55	35	24			
2004		58	1	898	314	25			3	
2006				present						
2007		3		369	59	26	77	3		
2009		40		502	55	6	25			

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Apache trout, Chiricahua and Northern leopard frogs (analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur), along with northern Mexican and narrow-headed garter snakes are discussed below. The Complex analysis includes discussion of Little Colorado spinedace and critical habitat.

Apache trout

Apache trout are raised in the hatchery raceways to catchable size and stocked into the stream for a recreational put-and-take fishery, but they are not expected to establish a viable population, because of the lack of suitable habitat and stream temperature, as well as the expectation that the management of the put-and-take fishery will result in significant harvest of the stocked Apache trout. Rainbow trout are not expected to reproduce in the stream for the same reasons as for Apache trout. Both are stocked for recreational fishing and eventual harvest. The majority of trout stocked on a weekly basis through the summer months are caught within the first couple of days following stocking. Those trout stocked in the catch-and-release season during the winter persist longer, but are mostly harvested out of the stream once it opens to bait and harvest again in the spring.

Potential impacts

Stocked Apache trout co-stocked with other species

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with co-stocked rainbow trout. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Northern Leopard Frog

Local Analysis: Although Silver Creek and the White Mountain buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Silver Creek is low. There are no historical records for northern leopard frogs from Silver Creek or within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and northern leopard frogs were not observed (Figure 14, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm,). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish, bullfrogs and crayfish make the habitat less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Silver Creek that dispersed outside the buffered stocking complex is low because it is likely northern leopard frogs no longer occupy sites outside of the stocking complex where fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Chiricahua leopard frog

Local Analysis: Although Silver Creek and the White Mountain buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Silver Creek is low. There are no historical records for Chiricahua leopard frogs from Silver Creek or the area within the buffered stocking complex.. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and Chiricahua leopard frogs were not observed (Figure 14, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish, bullfrogs and crayfish make the habitat less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Silver Creek that dispersed outside the buffered stocking complex is low. Two surveys at 1 site along lower Silver Creek (downstream of the Silver Creek stocking site and outside the buffered stocking site area) reported one Chiricahua leopard frog in 1960. Chiricahua leopard frogs were not observed during a subsequent survey in 1987. It is likely that Chiricahua leopard frogs no longer occupy sites outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Mexican Garter Snake
Analysis: See White Mountain Complex Analysis below.

Narrow-headed Garter Snake
Analysis: See White Mountain Complex Analysis below.

Little Mormon Lake

Site Description

Little Mormon Lake is a 70 acre irrigation reservoir built in the 1950s on the Apache-Sitgreaves National Forest (Figure 12; Figure 16). It is located approximately 2.5 miles northeast of Show Low at an elevation of 6343 feet. Little Mormon Lake is one of 3 closely grouped lakes that are somewhat connected to Silver Creek via Rocky Arroyo, a creek which drains into White Mountain Lake. There are no boat launch ramps, restrooms, or picnic facilities at Little Mormon Lake. Primitive camping is allowed, but not often practiced because of its proximity to Show Low.

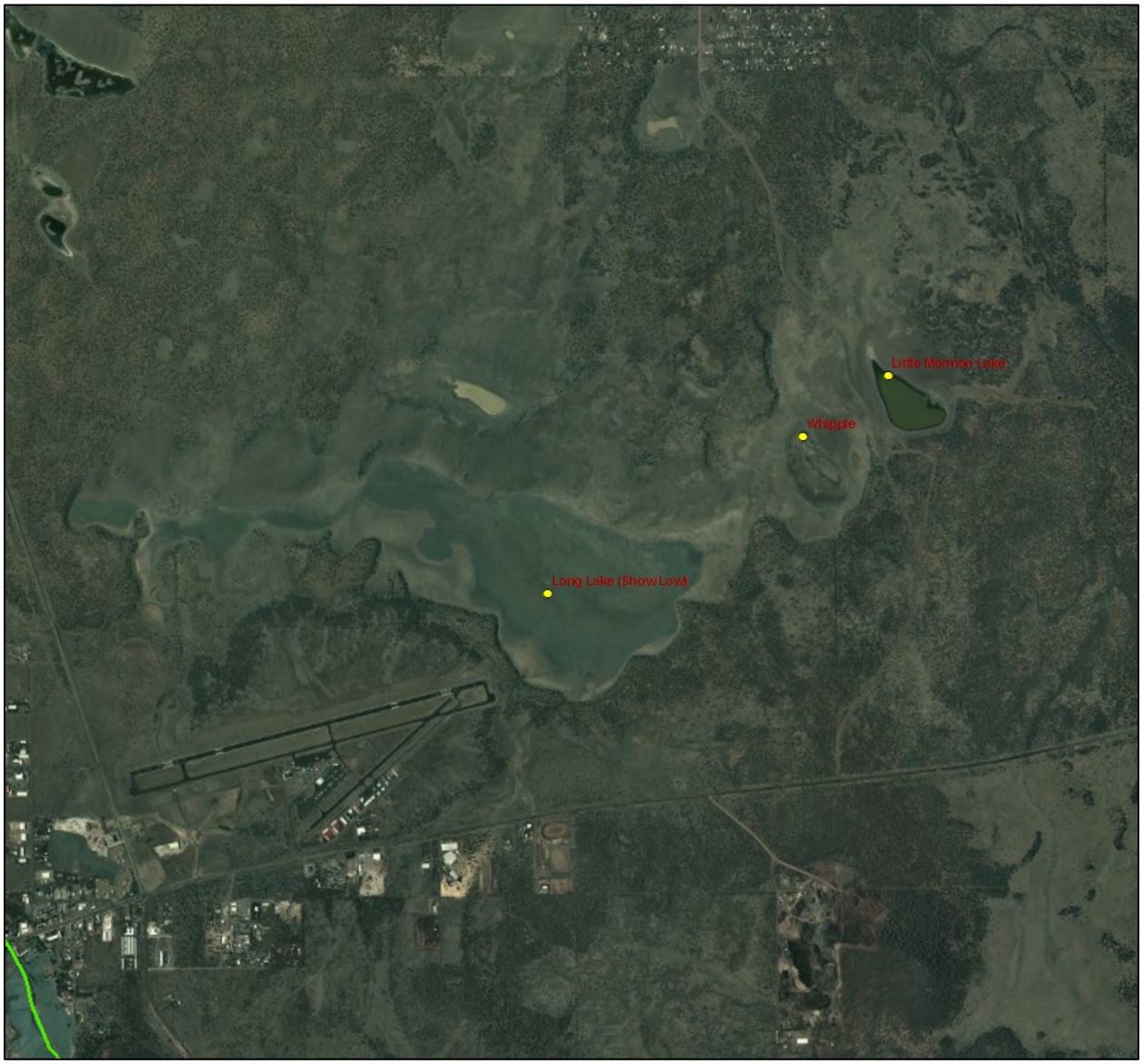


Figure 16. Image of Long Lake, Whipple Lake and Little Mormon Lake located in the White Mountain complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

The primary fishery is a warm water put-and-take channel catfish fishery when the lake has sufficient water to support fish. Catchable channel catfish are stocked opportunistically through the stocking season when the lake has enough water.

Little Mormon Lake has been stocked (*Table 53*) more frequently than Whipple Lake or Long Lake. Little Mormon Lake was stocked with brown trout and rainbow trout in 1949, with bullfrog tadpoles in 1967, and with channel catfish in18 separate years from 1965 through 2008.

The channel catfish stocked into Little Mormon Lake were mostly of fingerling size, ranging in numbers from 1250 to 18,000. Because of the grate size on the irrigation release structure, the Department proposes to stock only catchable size catfish, so that stocked fish cannot escape the lake.

Table 53. Stocking history in Little Mormon Lake.

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Rainbow trout	1949	1949	1	5,000
Brown trout	1949	1949	1	10,000
Channel catfish	1960	2008	19	97,660
Bullfrog tadpoles	1967	1967	1	5,000
Total			22	117,660

Little Mormon Lake is filled by a diversion off Rocky Arroyo, which is an intermittent drainage that flows into White Mountain Lake on Silver Creek. Rocky Arroyo flows only during snowmelt runoff and is dry the rest of the year; it has a low dirt diversion and a large gate structure that can release water into a ditch running approximately 1.6 miles to Little Mormon Lake. Runoff in Rocky Arroyo flows naturally over the low dirt diversion and continues down Rocky Arroyo to White Mountain Lake when the large gate structure is closed. The Silver Creek Irrigation District owns water rights and operates Little Mormon Lake along with White Mountain Lake. White Mountain Lake is their main irrigation storage. When White Mountain Lake fills and is ready to spill, the diversion to Little Mormon Lake is opened on Rocky Arroyo to store water in Little Mormon Lake that would otherwise go over the spillway at White Mountain Lake. Water in Little Mormon Lake can later be released out through a headbox located on the east side of the lake, back into Rocky Arroyo and into White Mountain Lake during the summer, for irrigation. A screen on the outlet structure has openings about 1-1.5 inches in diameter.

The ditch leading from the diversion on Rocky Arroyo to Little Mormon Lake was developed by constructing a large dirt berm on the north side of the ditch, approximately 6 feet high. The drainage connection indicated on a 7.5 minute USGS topo map (Silver Springs, AZ) approximately ½ mile upstream from Little Mormon is in fact not a hydrologic connection. That small tributary to Rocky Arroyo flows north towards White Mountain Lake and the large dirt berm on the north side of the ditch prevents any hydrologic connection with that drainage.

When Little Mormon Lake fills enough to spill, which means White Mountain Lake is also full, the water flows out of Little Mormon Lake over Forest Road 251 and into Whipple Lake. Pete Shumway, water manager with the Silver Creek Irrigation District and lifelong resident of the area for 75 years, says that Little Mormon Lake spills into Whipple approximately 2-3 times every 10 years, but has not spilled into Whipple since the early 1990s.

The outlet screen at Little Mormon Lake is at an elevation that leaves a minimum pool of unknown depth in the lake. When water is released from Little Mormon Lake, it is transferred back into Rocky Arroyo, which flows into White Mountain Lake. From White Mountain Lake, the irrigation company releases water into lower Silver Creek which is diverted further downstream in Shumway, Taylor, and Snowflake.

There have been no angler creel surveys conducted at Little Mormon Lake. The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis of warm water sport fish in Little Mormon Lake, with a desired species assemblage of channel catfish and bluegill. This management recommendation is mostly consistent with the proposed action, except for the bluegill, which is not part of this proposed action. The Lakeside Area Fisheries Management Plan (Meyer et al. 2008) recommends managing channel catfish in Little Mormon Lake, which is consistent with the proposed recommendation.

Proposed Action

The Department proposes to stock channel catfish for the period covered by this consultation. Catchable channel catfish will be stocked May to September, opportunistically when the lake has sufficient water; numbers of channel catfish stocked may be from 0 to 10,000 fish annually.

Water Distribution/Connectivity

Little Mormon Lake is filled by a diversion off Rocky Arroyo, which is normally dry and only runs during spring snowmelt runoff and possibly during extreme monsoon events. The diversion has a gate that has to be manually opened for water to flow towards Little Mormon Lake. This gate is normally closed, and water is diverted and stored in Little Mormon Lake only when White Mountain Lake at the end of Rocky Arroyo is full or nearly full. The ditch leading to Little Mormon Lake is 1.6 miles long from the diversion structure on Rocky Arroyo.

Water in Little Mormon Lake is released during the irrigation season through an outlet structure and into a pipeline leading back to Rocky Arroyo and eventually into White Mountain Lake. It is approximately 6 miles from Little Mormon Lake to White Mountain Lake, via the outlet structure, a pipeline, and Rocky Arroyo. For water connectivity downstream from White Mountain Lake, see the detailed description in the Silver Creek analysis.

When Little Mormon Lake fills, which occurs 2-3 times every 10 years according to Pete Shumway, it spills into Whipple Lake on the west side of the road. Water or fish in Whipple

Lake cannot get back up into Little Mormon Lake because of the 10 foot vertical drop coming from Little Mormon Lake. When Whipple Lake does fill, it can only spill into Long Lake through a swale between the two lakes. Water and fish in Long Lake cannot escape, except back into Whipple Lake when Long Lake and Whipple Lake are full enough to be connected. Thus, water can spill from Little Mormon Lake into Whipple and Long Lake, and water cannot be released from either lake

Little Mormon Lake occasionally goes dry when water is not diverted into the lake for several years. It usually holds some water, although is not always deep enough to stock with catfish. The diversion ditch and Rocky Arroyo go dry every year after spring runoff has ended. Rocky Arroyo may flow ephemerally with extreme monsoon events.

Fish Movement

Catfish stocked into Little Mormon Lake likely do not escape. However, it is possible for a small fish to escape out the outlet structure, through mesh that is 1.5 inches in diameter, down into Rocky Arroyo and be transported to White Mountain Lake when water is released. A catchable size catfish could not fit through the outlet mesh.

Catfish are not likely to move upstream during the cold conditions that are present during spring snowmelt runoff when water would be coming down the diversion ditch. Channel catfish are a warm water species and tend to be very lethargic during cold conditions. The diversion gate is also somewhat of a barrier. The downstream side of the gate slopes down a concrete pad with a vertical drop of about 1 foot; however, the width of each gate is about 10 feet wide. If the flow of water was slow enough down the concrete pad for a catfish to swim upstream in that temperature of water, the laminar flow 10 feet wide would be too shallow to allow a catfish to swim uphill. If the gate were opened enough to allow enough depth for a catfish to swim, the flow would be too fast for a catfish at those water temperatures. It would be extremely difficult for a stocked catfish in Little Mormon Lake to get up into Rocky Arroyo when it is flowing with snowmelt runoff, because they are not extremely strong swimmers like trout, especially during the cold conditions that would be present.

It is not known if catfish spawn in Little Mormon Lake. If they do, the fry and subcatchables could be transported through the outlet screen into Rocky Arroyo and then to White Mountain Lake. Because of their small size, most of them would likely be lost to predation in the warm water aquatic community of White Mountain Lake.

Community Description

Little Mormon Lake contains stocked channel catfish. Historically it has also been occupied by green sunfish and bluegill (Table 5). Channel catfish can persist in the lake if it holds enough water for a long enough length of time, although it is unknown if they can reproduce in the lake.

Rocky Arroyo does not support any fish because it regularly goes dry after the spring runoff has ended.

Table 54. Survey history at Little Mormon Lake using experimental gillnets

Species	**May 21, 1969**	**August 29, 1977**	**April 18, 1984**	**March 16, 1993**
Channel catfish	3		9	3
Green sunfish			3	
Bluegill		3		

White Mountain Lake, a privately owned lake, contains largemouth bass, bluegill, green sunfish, black crappie, channel catfish, fathead minnow, common carp, and bullfrogs. The channel catfish in White Mountain Lake are naturally reproducing, thus it may be likely that they can reproduce in Little Mormon Lake, although Little Mormon Lake has virtually no spawning habitat for channel catfish, which prefer cover in which to lay and protect their eggs.

For species composition in Silver Creek upstream and downstream of White Mountain Lake, refer to the Silver Creek analysis. Channel catfish could likely survive and persist in the cool water in upper Silver Creek, although catfish have not been documented there in the last two decades of surveys. Channel catfish could and likely do survive in lower Silver Creek, because it gets fairly warm, is silty and turbid, and has permanent pools that are capable of holding catfish. Only 1 channel catfish, in 2000, has been collected in lower Silver Creek in 19 years of surveys: 1991, 1992, 1993, 1997, 1999, 2000, 2002, 2003, 2004, 2006, 2007, and 2009. Yellow bullheads, which share the same habitat preferences as catfish, are consistently caught and are locally common in portions of lower Silver Creek, thus the habitat is suitable for catfish; however, channel catfish have not become established, based on the 1 record in 19 years.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in

Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Chiricahua and Northern leopard frogs (analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur), along with northern Mexican and narrow-headed garter snakes are discussed below. The Complex analysis includes discussion of Little Colorado spinedace and critical habitat.

Northern Leopard Frog

Local Analysis: Although Little Mormon Lake and the White Mountain buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Little Mormon Lake is low. There are no historical records for northern leopard frogs from Little Mormon Lake or the area within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and northern leopard frogs were not observed (Figure 14, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish and crayfish make the habitat less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Little Mormon Lake that dispersed outside the buffered stocking complex is low, because it is likely that northern leopard frogs no longer occupy areas outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Chiricahua leopard frog

Local Analysis: Although Little Mormon Lake and the White Mountain buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Little Mormon Lake is low. There are no historical records for Chiricahua leopard frogs from Little Mormon Lake or the area within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and Chiricahua leopard frogs were not observed (Figure 14, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish and crayfish make the habitat less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Little Mormon Lake that dispersed outside the buffered stocking complex is low. Two surveys at 1 site along lower Silver Creek (downstream of the Silver Creek stocking site and outside the buffered stocking site area) reported one Chiricahua leopard frog in 1960. Chiricahua leopard frogs were not observed during a subsequent survey in 1987. It is likely that Chiricahua leopard frogs no longer occupy sites outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Mexican Garter Snake
Analysis: See White Mountain Complex Analysis below.

Narrow-headed Garter Snake
Analysis: See White Mountain Complex Analysis below.

Whipple Lake

Site Description

Whipple Lake is a 50 acre lake, when full, in a natural depression on the Apache-Sitgreaves National Forest. It is located approximately 2.0 miles northeast of Show Low at an elevation of 6324 feet. Whipple Lake is one of two lakes, the other being Long Lake, that are connected during high water through a natural depression that has no outlet and is therefore considered a closed system. These two lakes receive overflow water from Little Mormon Lake, which is somewhat connected to Silver Creek via Rocky Arroyo and White Mountain Lake.

Whipple Lake is accessed by paved Forest Road 251. There are no boat launch ramps, restrooms, or picnic facilities at Whipple Lake. Primitive camping is allowed, but not often practiced because of its proximity to Show Low and the lake's usually dry condition.

Management of Water Body

Whipple Lake is opportunistically managed for channel catfish during wet climactic cycles; it is normally dry, and only collects enough water during extreme wet winters to allow stocking.

Primary fishery is a warm water put-grow-and-take channel catfish fishery, when the lake has enough water to support fish through the summer. Catchable and sub-catchable channel catfish are stocked opportunistically when the lake has enough water, with stockings potentially occurring throughout the stocking season.

Whipple Lake has been dry or nearly dry for many years. It was last stocked in 1995, and experienced a large fish kill in 1999 when it dried up. It has not held fish since then. Whipple has been stocked only 9 years in its history, with cutthroat trout in 1952, rainbow trout in 1966, and with fingerling channel catfish in 1983, 1985, 1987, 1988, 1989, 1990, 1993, and 1995 (*Table 55*).

Table 55. Stocking history for Whipple Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Cutthroat trout	1952	1952	1	2,000
Rainbow trout	1966	1966	1	990
Channel catfish	1983	1995	12	37,461
Total			14	40,451

There have been no angler creel surveys conducted at Whipple Lake.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identified a management emphasis of basic yield put-grow-and-take sport-fish with a desired species assemblage of rainbow trout, which is not consistent with this proposed action. However, trout were last stocked into Whipple Lake in 1966, but channel catfish were stocked regularly from 1983 through 1995. The Lakeside Area Fish Management Plan (Meyer 2008) recommended managing Whipple Lake for channel catfish when it has enough water, which is consistent with this proposed action.

Proposed Action

The Department proposes to stock channel catfish for the period covered by this consultation. Catchable, sub-catchable, and fingerling channel catfish will be stocked from May to September if the lake has sufficient water levels; numbers of catfish stocked may be from 0 to 8,000 catfish annually.

Water Distribution/Connectivity

Whipple Lake receives water only when Little Mormon Lake spills from the east or when Long Lake spills from the west. When Little Mormon Lake spills, the water spills into Whipple Lake. Pete Shumway, manager for the Silver Creek Irrigation Company and longtime resident for 75 years, stated that Little Mormon would spill 2-3 times within 10 years on average, but has not spilled into Whipple since the early 1990s; he also says that Whipple has spilled into Long Lake only about 5-6 times in his lifetime, and that once water entered Whipple and Long lakes, there was no mechanism for the irrigation district to get that water out. Therefore, there is also no way for fish to escape out of Whipple and Long lakes.

Whipple and Long lakes are located in a natural depression and are connected at high water over a shallow pass between the two, but together have no natural outlet. Water cannot get back

through the spill structure and back into Little Mormon Lake because of the 10 foot drop structure coming from Little Mormon Lake.

Whipple Lake and Long Lake often go dry. Whipple Lake has been dry or nearly dry since 1999, and was last stocked in 1995. Long Lake goes dry regularly, but does receive a little more water than Whipple Lake. Long Lake was last stocked in 2008.

Fish Movement
Fish stocked into Whipple Lake may persist in the lake if it retains water long enough. It is currently dry. It is unknown if the stocked fish will spawn in the lake. The only escape for stocked fish or their progeny is into Long Lake when both lakes are connected during high water, but there is no outlet or outflow for fish to escape from Whipple Lake or Long Lake. Fish are not able to get up the spill structure and into Little Mormon Lake because of the 10 foot vertical drop in a concrete spillway box coming from Little Mormon Lake.

When Whipple Lake fills, it spills over a small pass and into Long Lake. It is possible for Whipple and Long Lake to be connected with fish moving between the two, but only in very extreme wet periods.

Community Description
Whipple Lake currently contains no fish because it went dry in 1999 and has not collected enough water since then to be stocked. Historically this lake has supported, for unknown periods of time, the following species: largemouth bass, channel catfish, carp, green sunfish, and rainbow trout (*Table 56*). In the future it will only be stocked with channel catfish.

Table 56. Survey history at Whipple Lake using experimental gillnets.

Species	**April 1985**	**March 1989**	**March 1993**	**April 1994**	**March 1997**
Largemouth bass		9			8
Channel catfish	9	5	35	3	15
Carp		5		8	15
Green sunfish	2	1			
Rainbow trout				5	

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Chiricahua and Northern leopard frogs (analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur), along with northern Mexican and narrow-headed garter snakes are discussed below. The Complex analysis includes discussion of Little Colorado spinedace and critical habitat.

Northern Leopard Frog

Local Analysis: Although Whipple Lake and the White Mountain buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Whipple Lake is low. There are no historical records for northern leopard frogs from Whipple Lake or the area within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and northern leopard frogs were not observed (Figure 14, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish and crayfish make the habitat less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Whipple Lake that dispersed outside the buffered stocking complex is low, because dispersing fish can only reach Long Lake which has no outlet. In addition, it is likely that northern leopard frogs no longer occupy areas outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Chiricahua leopard frog

Local Analysis: Although Whipple Lake and the White Mountain buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Whipple Lake is low. There are no historical records for Chiricahua leopard frogs from Whipple Lake or the area within the buffered stocking

complex. Four sites have each been surveyed once within the buffered stocking complex from 1984-1994.and Chiricahua leopard frogs were not observed (Figure 14, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish and crayfish make the habitat less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Whipple Lake that dispersed outside the buffered stocking complex is low, because dispersing fish can only reach Long Lake which has no outlet. In addition, it is likely that Chiricahua leopard frogs no longer occupy areas outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Mexican Garter Snake
Analysis: See White Mountain Complex Analysis below.

Narrow-headed Garter Snake
Analysis: See White Mountain Complex Analysis below.

Long Lake (Show Low)

Site Description

Long Lake is a 200 acre lake, when full, in a natural depression on the Apache-Sitgreaves National Forest (Figure 17). It is located approximately 0.8 miles northeast of Show Low at an elevation of 6324 feet. Long Lake is one of two lakes; the other is Whipple Lake. They are connected at high water in a natural depression with no outlet and are therefore considered a closed sysem. These two lakes receive overflow water from Little Mormon Lake, which is somewhat connected to Silver Creek via Rocky Arroyo and White Mountain Lake.

Long Lake is accessed by a primitive and rough dirt road off paved Highway 77. The roads are often impassible during wet seasons due to very slick mud. There are no boat launch ramps, restrooms or picnic facilities at Long Lake. Camping is permitted, but usually not practiced because of its proximity to Show Low and usual dry condition. Long Lake receives very little angler use, even when it does hold water, due to the primitive conditions.

Figure 17. Long Lake (near Show Low) photograph.

Management of Water Body

Long Lake is opportunistically managed for put-grow-and-take rainbow trout during very wet climactic cycles.

Long Lake has been stocked only 4 years in the history of managing the lake; in 1981, 1993 (2), 2005, and 2008 (Table 57). The stocking in 1993 is the only one that lasted for any length of time. The trout grew large, because the lake is shallow and very productive. The lake has been historically stocked with catchable, fingerling, or subcatchable rainbow trout, attempting a put-grow-and-take opportunity because of the high productivity. However, the lake persists for so short of a period that it may be better to manage a put-and-take opportunity and not have to rely on trout persisting in the lake for a full year before they are catchable size, unless the lake collects sufficient water to persist.

Long Lake has not provided a fishery in many years because it does not normally receive enough water to allow fish to persist. In 2005 and 2008 the lake was stocked in the spring, but dried up by the end of each summer. The lake will be evaluated in the spring to determine the amount of water that has collected through the winter and spring snowmelt and to evaluate whether the lake might persist long enough to provide some fishing opportunities.

Table 57. Stocking history for Long Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Rainbow trout	1981	2008	5	147,062
Total			5	35,135

There have been no angler creel surveys conducted at Long Lake. The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) and the Lakeside Area Fish Management Plan (Meyer et al. 2008) identify a management emphasis of put-grow-and-take cold water fishery with a desired species assemblage of rainbow trout, which are consistent with the proposed action.

Proposed Action

The Department proposes to stock rainbow trout are proposed for the period covered by this consultation. Catchable, sub-catchable, and fingerling rainbow trout would be stocked opportunistically from March to June when the lake has sufficient water levels; numbers of trout may be from 0 to 40,000 fish annually.

Water Distribution/Connectivity

Long Lake is normally dry and catches water only in very high precipitation winters. Long Lake is in a natural depression and can receive water from Whipple Lake in extreme wet periods, and it also receives snowmelt runoff from a very small and normally dry drainage from the south; this small dry drainage is not connected to any other waters, and it flows only during spring runoff during high snowpack years. There is no opportunity for water or fish to get back into Little Mormon from Whipple Lake and Long Lake because of the 10 foot vertical drop in the concrete spillway box coming from Little Mormon. For a detailed description, see the Little Mormon water distribution section.

Fish Movement

Trout stocked into Long Lake can only escape into Whipple Lake when the two are connected during extreme wet cycles, but cannot escape out of the two. There is no outlet or outflow from Long and Whipple lakes. Fish cannot get back into Little Mormon from Whipple Lake and Long Lake because of the 10 foot vertical drop in the concrete spillway box coming from Little Mormon Lake discussed above.

Community Description

Long Lake has no fish since it went dry late in the summer of 2008. Rainbow trout are stocked only when there is enough water to make it feasible. Normally it is dry and is used as a cattle pasture. Historically, it has supported several species of fish (Table 9).

Table 58. Survey history at Long Lake using experimental gillnets.

Species	April 1982	October 1993	April 1994	March 1995
Channel catfish		17	16	12
Rainbow trout	15	66	92	22
Largemouth bass			1	
carp		26	18	35

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Chiricahua and Northern leopard frogs (analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur), along with northern Mexican and narrow-headed garter snakes are discussed below. The Complex analysis includes discussion of Little Colorado spinedace and critical habitat.

Northern Leopard Frog

Local Analysis: Although Long Lake and the White Mountain buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Long Lake is low. There are no historical records for northern leopard frogs from Long Lake or the area within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and northern leopard frogs were not observed (Figure 14, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the White

Mountain buffered stocking complex because the presence of non-native fish and crayfish make the habitat less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Long Lake that dispersed outside the buffered stocking complex is low. Dispersing fish can only reach Whipple Lake and cannot escape into Little Mormon Lake or back into Long Lake. In addition, it is likely that northern leopard frogs no longer occupy areas outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Chiricahua leopard frog

Local Analysis: Although Long Lake and the White Mountain buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Long Lake is low. There are no historical records for Chiricahua leopard frogs from Long Lake or the area within the buffered stocking complex. Four sites have each been surveyed once within the buffered stocking complex between 1984 and 1994 and Chiricahua leopard frogs were not observed (Figure 14, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the White Mountain buffered stocking complex because the presence of non-native fish and crayfish make the habitat less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Long Lake that dispersed outside the buffered stocking complex is low, because dispersing fish can only reach Whipple Lake and cannot escape into Little Mormon Lake or back into Long Lake. In addition, it is likely that Chiricahua leopard frogs no longer occupy areas outside of the stocking complex where fish can disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Mexican Garter Snake

Analysis: See White Mountain Complex Analysis below.

Narrow-headed Garter Snake

Analysis: See White Mountain Complex Analysis below.

WHITE MOUNTAIN COMPLEX ANALYSIS

Of the five stocking locations in White Mountain Complex, only Silver Creek and Little Mormon Lake have the potential to impact listed species downstream of the stocking sites. Sponseller, Whipple and Long Lakes are closed systems.

Water Distribution / Connectivity

Water flow in this drainage (above and below White Mountain Lake) is discussed in the site-specific sections, as is the hydrography of the Little Colorado River, downstream from the confluence with Silver Creek. The potential exists for a hydrologic connection between the LCR and into the Colorado River but there is no certainty about how often it connects or the condition of transport when it connects. Additional discussion is provided in a watershed summary impacts analysis in the LCR chapter.

Fish Movement
Rainbow and Apache trout could move from the Silver Creek stocking site into White Mountain Lake and downstream in Silver Creek. Fingerlings and subcatchables could be transported through the screen at the outlet of Little Mormon Lake, into Rocky Arroyo and finally to White Mountain Lake and downstream in Silver Creek.

As with the water connectivity, fish movement through Silver Creek, into and through White Mountain Lake and into the Little Colorado River is possible but the number of stocked fish that may move is not known. The fish would face impediments such as condition of transport, warm water, and drying pools of water and drying stream reaches. Schoens Complex also feeds into Silver Creek below White Mountain Lake.

Community Description
A comprehensive summary of the aquatic community in Silver Creek above the LCR confluence is provided in the site specific discussions. For the purpose of the complex discussion, the relevant information is that only one catfish and no trout have been found in Silver Creek below White Mountain Lake in surveys conducted from 1991 to 2009 (Table 3).

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to northern Mexican garter snake and narrow-headed garter snake as well as Little Colorado spinedace and critical habitat are described below.

Chiricahua Leopard Frog

See Local and Broad Scale analyses under each stocking location.

Northern Leopard Frog

See Local and Broad Scale analyses under each stocking location.

Northern Mexican Garter Snake

Stocking complex analysis: It is unknown whether northern Mexican garter snakes occupy the White Mountain Stocking Complex, though there have been no systematic surveys for the species in this area (USFWS 2008, Holycross et al. 2006). Within the 20 km buffer established for this stocking complex there are historical records of northern Mexican garter snakes from and near Lake of the Woods (1942, 1949) SE of Show Low, but none have been detected since then (Holycross et al. 2006). Those are the only records for northern Mexican garter snakes in the Little Colorado River watershed. Current habitat quality for northern Mexican garter snakes at Lake of the Woods is low. Silver Creek also supports a community of non-native fishes, crayfish and bullfrogs, thus making the habitat less suitable for northern Mexican garter snakes. Two recent (2004) but unverified northern Mexican garter snake records have been reported from the Fort Apache Indian Reservation, outside of the 20 km buffer, near White Paradise Creek and ~28 air km SE of Lake of the Woods. The likelihood that northern Mexican garter snakes will be exposed to fish stocked in Sponseller Lake, Silver Creek, Little Mormon Lake, Whipple Lake, and Long Lake (Show Low) is low.

Downstream analysis: Sponseller Lake, Whipple Lake and Long Lake are closed basins from which fish cannot escape. If fish were to disperse from Little Mormon Lake when waters are diverted back into White Mountain Lake they could enter Silver Creek. Any stocked fish moving downstream in Silver Creek would not likely encounter northern Mexican garter snakes. There are no northern Mexican garter snake records downstream of these sites and none elsewhere in the Little Colorado River watershed, thus it is unlikely that northern Mexican garter snakes will be exposed to stock sport fish (HDMS, AGFD Riparian Herpetofauna Database).

Narrow-headed Garter Snake

Stocking complex analysis: Narrow-headed garter snakes are not known to occupy the Little Colorado River or its tributary streams; therefore, it is unlikely the species will be exposed to fish stocked into Sponseller Lake, Silver Creek, Little Mormon Lake, Whipple Lake, and Long Lake (Show Low). The nearest historical (1965) narrow-headed garter snake record is on the Fort Apache Indian Reservation, about 4 km SE of McNary along the North Fork of the White River (Salt River drainage). Narrow-headed garter snakes are not known to move overland beyond about 200 m from a stream edge (Nowak 2006a) and therefore if they occur elsewhere in the North Fork of the White River watershed they are highly unlikely to move overland and disperse to the proposed stocking sites. In addition, the four lakes in this stocking complex are

closed basin, largely ephemeral lakes and therefore do not provide narrow-headed garter snake habitat. Silver Creek supports a community of non-native fishes, crayfish and bullfrogs, thus making the habitat less suitable for narrow-headed garter snakes.

Downstream analysis: Sponseller Lake, Whipple Lake and Long Lake are closed basins from which fish cannot escape. If fish were to disperse from Little Mormon Lake when waters are diverted back into White Mountain Lake they could enter Silver Creek. Any stocked fish moving downstream in Silver Creek would not likely encounter narrow-headed garter snakes. There are no narrow-headed garter snake records downstream of these sites, and none elsewhere in the Little Colorado River watershed, thus it is unlikely that narrow-headed garter snakes will be exposed to dispersing fish (HDMS, AGFD Riparian Herpetofauna Database).

Little Colorado Spinedace

Lower Silver Creek is considered occupied habitat for Little Colorado spinedace; however spinedace have not been collected in Silver Creek in nearly 12 years. The last known location was in Silver Creek approximately 33 miles below White Mountain Lake. This last record of spinedace in lower Silver Creek was in 1997, and they were not found in surveys conducted in 1999, 2000, 2002, 2003, 2004, 2006, 2007, and 2009 (*Table 52*). It is believed that changes to the habitat since 1997 have likely increased habitat for non-native fishes. If spinedace are still present in Silver Creek, it may be that they exist at such low numbers that current sampling techniques are insufficient to detect them in this altered habitat.

In 1997, the habitat in Silver Creek consisted primarily of shallow riffle/run habitat with occasional relatively small pools. The same area now consists of almost exclusively deep, wide pool habitat due to extensive beaver dams. In addition, the extensive pool habitat, which extends for miles has created prime habitat for non-native warm water fish and crayfish.

Potential impacts

It is conceivable that an occasional stocked Apache or rainbow trout could reach White Mountain Lake and even lower Silver Creek, although no trout have been documented in the surveys completed in lower Silver Creek. If an occasional trout did access spinedace occupied habitat in lower Silver Creek, it would not persist in the warm, silty water. However, if either Apache or rainbow trout did reach a population of Little Colorado spinedace the impacts would be infrequent and short-term, because the trout could not persist. Although trout are stocked year round, fishing pressure, condition of transport, distance from the stocking site to the occupied habitat, unsuitable water temperature and piscivory on the trout by warm water fishes in White Mountain Lake, would limit the opportunity for trout to access Silver Creek below White Mountain Lake.

It is not possible for stocked channel catfish to leave Little Mormon Lake, however, if catfish are reproducing in the lake, subcatchables and fry could be transported through the outlet screen and finally into Little Mormon Lake and to the lower Silver Creek. If the impacts discussed below occur, their magnitude is most likely ameliorated by the predation of the escaped progeny of the stocked fish by the warm water assemblage at White Mountain Lake. Survey data show that channel catfish are likely not established in large numbers in lower Silver Creek. This may be because they are bottom dwellers and would be less likely than other species to be transported from White Mountain Lake when it overflows.

Little Colorado Spinedace Critical Habitat

The nearest spinedace critical habitat is located in lower Chevelon Creek, which is 84.3 miles away, via 3 miles of Silver Creek, through White Mountain Lake, through 38.0 miles of lower Silver Creek, then downstream in the LCR for 43.3 miles to the confluence with Chevelon Creek.

Potential impacts

An escaped trout reaching critical habitat is extremely unlikely because of the unsuitable conditions of lower Silver Creek, the LCR, and lower Chevelon Creek for trout, and the lack of trout collections in lower Silver Creek, the LCR, and in lower Chevelon Creek (additional discussion on Chevelon Creek and fish distribution and critical habitat is provided in the Chevelon Creek complex section later in the Chapter).

No impacts are anticipated to critical habitat from stocked trout. The closest critical habitat is over 83 miles from the stocking site and stocked rainbow or Apache trout would not persist in the system long enough to reach critical habitat. Fishing pressure, condition of transport, unsuitable water temperature and piscivory on the trout by warm water fishes in White Mountain Lake and below the lake, and unsuitable habitat in Silver Creek below the lake would likely preclude the movement of trout from the stocking site to critical habitat.

No impacts are anticipated to critical habitat from channel catfish. The closest critical habitat is over 83 miles from the stocking site, fingerling and subcatchable channel catfish would likely not persist in White Mountain Lake in large numbers, and their habitat preferences in lotic habitats would make it unlikely that they would be transported from White Mountain Lake. For these reasons channel catfish stocked at Little Mormon Lake are not believed to ever reach critical habitat.

SCHOEN'S COMPLEX

Physical Geographic Description

Schoen's Complex is located in the Silver Creek drainage in the Little Colorado River watershed (Figure 18). The Schoen's Complex consists of 7 stocking sites that are located on Show Low

Creek; on tributaries of Show Low Creek, which are Walnut Creek and Porter Creek; or waters which drain into a tributary of Show Low Creek (Figure 19). Three of the stocking sites, Fools Hollow Lake, Show Low Lake, and Show Low Creek, are located on Show Low Creek. Scott Reservoir is located on Porter Creek, which is a tributary. Rainbow Lake and Woodland Lake are located on another tributary, Walnut Creek. The Mountain Meadow Recreation Complex is on an un-named drainage that drains into tributary Walnut Creek.

There are 3 main headwater tributaries that join to form Show Low Creek: Walnut, Porter and Billy Creeks. Porter Creek originates at Porter Springs on private property with perennial flow for 1.2 miles to Scott Reservoir, flowing through several private ponds. From Scott Reservoir, Porter Creek flows for 1.4 miles to the confluence with Billy Creek, where Show Low Creek is formed.

Walnut Creek originates at Pine Lake, a private pond in Pinetop-Lakeside, although it does receive spill from private golf course ponds further up in the watershed 0.4 miles away, during heavy spring runoff. From Pine Lake, Walnut Creek flows downstream for 0.8 miles to Fred's Lake, a private fee-for-fishing business. From Fred's Lake, Walnut Creek flows for 0.8 miles to Woodland Lake. From Woodland Lake, it flows for 2.4 miles to Rainbow Lake. Within this reach between Woodland Lake and Rainbow Lake, significant flows from Big Springs enter at 0.4 miles upstream of Rainbow Lake. The Mountain Meadow Recreation Complex is located on an intermittent drainage that flows into Big Springs, 0.3 miles away. From Rainbow Lake, Walnut Creek immediately flows through a small private pond below Rainbow Lake dam, then into private Lake of the Woods, 0.2 miles down from Rainbow Lake. From Lake of the Woods, Walnut Creek flows for 0.3 miles to its confluence with Billy Creek, then down Billy Creek for 0.5 miles to the confluence with Porter Creek, where Show Low Creek is formed.

Billy Creek originates at Pinetop Springs, although it does receive spill from several private ponds further up in the watershed during heavy spring runoff. From Pinetop Springs, Billy Creek flows perennial for 0.4 miles to a diversion that takes nearly all of the base flows through a ditch and pipeline system and into Walnut Creek approximately 1.1 miles away; Billy Creek enters in the reach between Fred's Lake and Woodland Lake. Also, another diversion operates only part time just below Pinetop Springs that diverts water into the Pinetop State Fish Hatchery, but returns flows to Billy Creek above the main diversion that goes to Walnut Creek. Any flows that make it over the main diversion flow for 0.6 miles to the confluence with interrupted perennial Thompson Creek, then for 4.7 miles to the confluence with Walnut Creek, then for 0.5 miles to the confluence with Porter Creek, where Show Low Creek is formed.

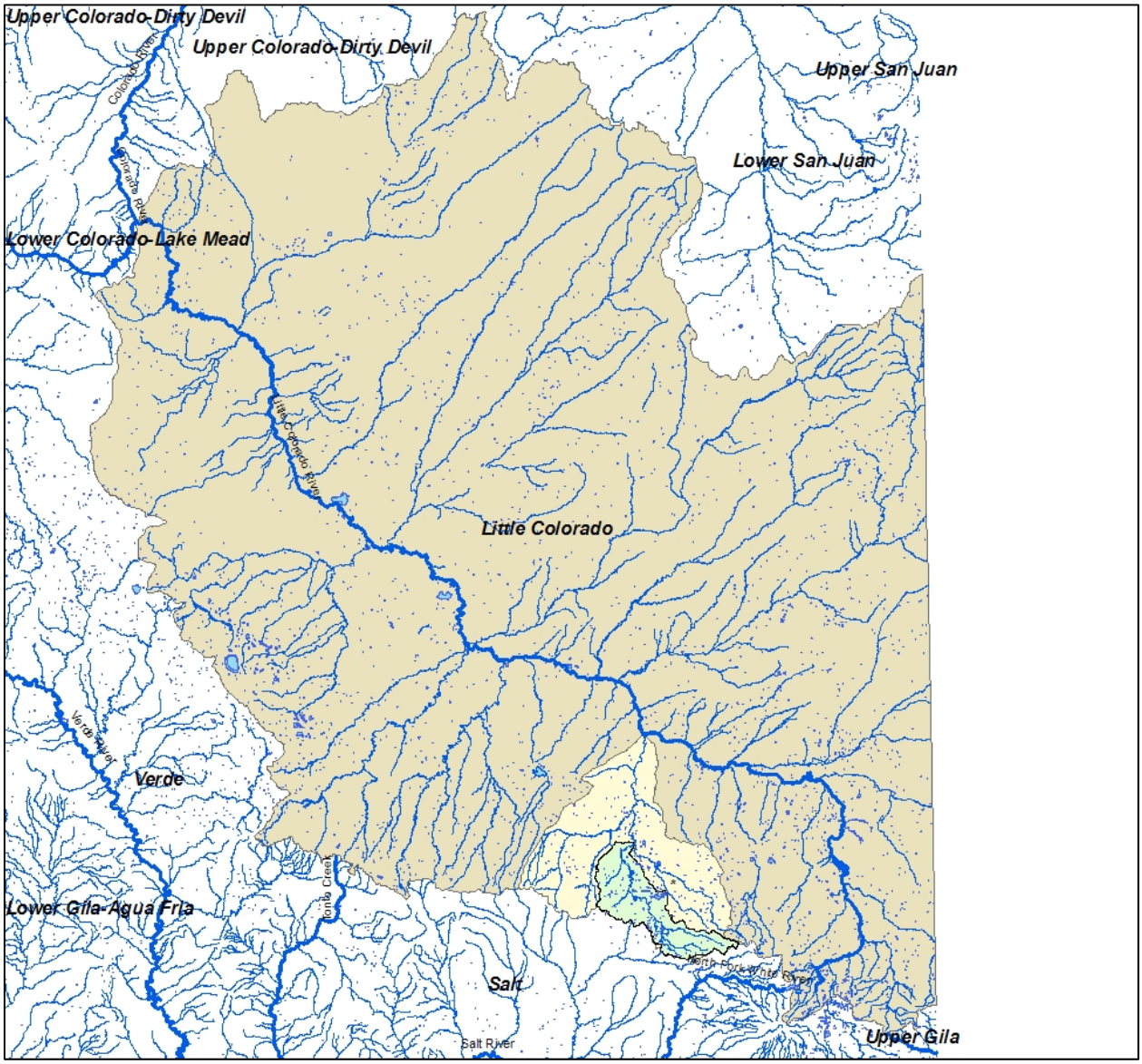


Figure 18. Map of Schoen's Complex (green) located within the Silver Creek drainage (yellow) in the Little Colorado River watershed (brown).

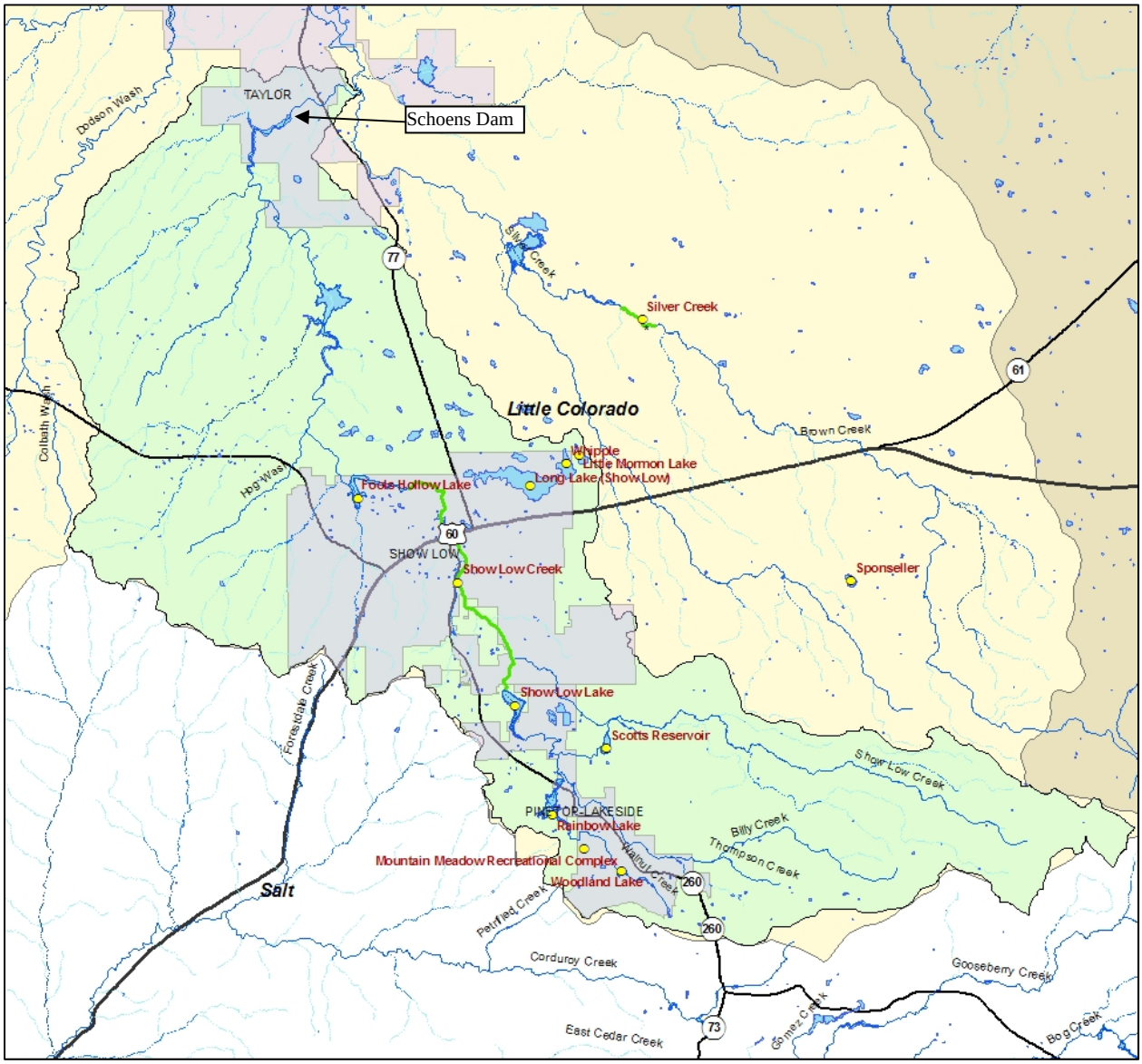


Figure 19. Overview map of Schoen's Complex within the Silver Creek drainage, depicting Show Low, Pinetop-Lakeside and Schoen's Dam.

Three of the lakes shown as being in the same watershed (Whipple, Little Mormon and Long) actually drain into the watershed to the east and not into Show Low Creek as a result of man-made dams and diversions.

From the confluence where Show Low Creek is formed, it flows for 2.4 miles to Show Low Lake, then from Show Low Lake for 7.7 miles to Fools Hollow Lake. The Show Low Creek stocking reach is located between Show Low Lake and Fools Hollow Lake. Fools Hollow Lake is the lowest stocking site in this complex, with all connected waters in this complex flowing through Fools Hollow Lake. From Fools Hollow Lake, Show Low Creek runs for 15.0 miles to

Schoen's Dam, a flood control structure, then for 2.7 miles to the confluence with Silver Creek, approximately 8.1 miles downstream of private White Mountain Lake; see White Mountain Complex for stocking sites upstream of White Mountain Lake. From the confluence, Silver Creek flows north for 10.5 miles to the town of Snowflake, then another 19.4 miles to the confluence with the Little Colorado River (LCR).

From the confluence with Silver Creek, the LCR flows downstream for 43.3 miles to the confluence with Chevelon Creek, then another 9.1 miles to the confluence with Clear Creek, then for 73.1 miles to Grand Falls. From Grand Falls, the LCR runs downstream for 81.0 miles to Blue Springs, then for 13.1 miles to the confluence with the Colorado River. Upstream of the confluence with Silver Creek, the LCR runs 85.1 miles from Lyman Lake.

Woodland Lake

Site Description

Woodland Lake is a small reservoir located on the Apache-Sitgreaves National Forest at an elevation of 6893 feet on the headwaters of Walnut Creek, a tributary of Show Low Creek, in the Town of Pinetop-Lakeside. The dam was constructed in 1914, creating a lake 18 surface acres in size, with a maximum of 20 feet (Figure 20). The lake is filled by Walnut Creek, which originates at very small springs on the east side of town, and is also supplemented with diverted water from upper Billy Creek. The diversion on Billy Creek is located at the bottom end of AGFD property in Pinetop and owned/operated by Woodland-Show Low Irrigation Company, which administers the privately held water rights in Woodland Lake. The diverted water is piped from Billy Creek under Highway 260 and drains into upper Walnut Creek and ultimately into Woodland Lake.

Woodland Lake is intensively used for all types of recreation, including angling. It is located on the Apache-Sitgreaves National Forest, but is cooperatively managed by the Town of Pinetop-Lakeside through a special use permit. A city park was built around Woodland Lake with many facilities, and is more of an urban lake than most other lakes in the White Mountains. A paved walking trail travels the perimeter of the lake and is heavily used in all seasons by residents and visitors. Several ball fields and tennis courts are located on the south side of the lake, including restrooms, a playground, and dirt parking. An American’s With Disabilities Act-accessible fishing pier and boat launch ramp are also located on the north side of the lake near the spillway. Numerous picnic areas are located on the north side of the park with several armadas, restrooms, parking, and another playground. There is also a network of hiking trails beginning at Woodland Park. Many events are held at the park and lake. Woodland Lake is managed as a city park, and the park and lake close to public use at night. Several fishing clinics are held at Woodland Lake each year because of the easy access, numerous facilities, and good fishing in early summer.

Boats are restricted to electric motors only, and a reduced bag limit for trout of 4 per day is in effect on the lake. The lake is accessed year around by paved town roads. The lake ices over for a month or two during the winter, but receives no ice fishing use because the ice is too thin to safely support a person. Camping is not permitted at the lake; however, town amenities are nearby.

Figure 20. Image of Woodland Lake located in the Schoen's complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

The primary fishery is a cold water rainbow trout intensive use put-and-take fishery nearly year around, with a secondary warm water fishery. Bluegill and largemouth bass are naturally reproducing, and channel catfish are supplementally stocked. Catchable rainbow trout are stocked multiple times during the stocking season. Catchable, sub-catchable, and fingerling channel catfish are stocked opportunistically during the stocking season.

Woodland Lake has been stocked extensively since the 1930s (Table 59). In the last 10 years, it has been stocked annually with catchable rainbow trout from May through early July and opportunistically in the fall if water quality is good. It has also been supplementally stocked with subcatchable channel catfish twice in the last 10 years, in 2000 and 2008.

Table 59. Stocking history for Woodland Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1986	1990	2	1,200
Brook trout	1933	1937	3	102,720
Brown trout	1941	1995	9	44,053
Channel catfish	1978	2008	19	15,290
Largemouth bass	1979	1991	3	2,035
Rainbow trout	1936	2009	231	537,077
Tadpole	1968	1968	1	2,000
Total			268	704,375

Several fishing clinics are held at Woodland Lake each year because of the easy access, numerous facilities, and good fishing in early summer. Supplemental stocking of bluegill is being considered to boost the sunfish populations and improve fishing in the mid summer when kids are out of school and the trout fishing declines in Woodland Lake. It would also help to support special fishing clinics if they were held during poor trout fishing conditions.

Walnut Creek, below the lake and at Big Springs, is being managed for native fishes because of the naturally occurring speckled dace population and the recently repatriated bluehead sucker. Woodland Lake will be managed with species that are not considered a threat to those non-listed native fishes. Rainbow trout have been stocked in Woodland Lake since 1936 and have not established in Walnut Creek, although an occasional individual is detected; the escaped trout do not persist. Despite being present in Woodland Lake since the late 1970s, channel catfish and largemouth bass have not established in Walnut Creek below the lake, thus are also not considered a major threat to the non-listed native fishes in the stream. Improving the fishing during the summer months will also discourage people from illegally stocking a species into

Woodland Lake that might be a greater threat to Big Springs (such as green sunfish or bullheads) than the species proposed for stocking.

Woodland Lake fills each year in the winter and spring, having good water quality in the spring and early summer. However, the lake experiences aggressive algae growth in the warm summer months in addition to being drawn down for irrigation use, which limits trout stocking and trout fishing in the summer. Depending upon the water level, the water quality usually improves in the fall. The lake receives a high amount of angling use for its size, especially from May through July, then the anglers thin out as the trout fishing becomes poor in the summer months. The lake is centrally located in town and easily accessible to visitors and local children who can get to the lake on their bikes or by walking. It is also a place where families feel comfortable dropping off older kids for an afternoon of fishing and using the park.

The current lake management plan identifies an emphasis on kids' fishing, where any beginner angler can stay interested by catching any fish, regardless of species and size. The most recent angler creel surveys were conducted on-site at Woodland Lake in 1992 and 2007, reporting 31,853 angler hours (21,057 AUDs) and 14,186 angler hours, respectively. A statewide mail-out creel survey reported 18,550 AUDs in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis at Woodland Lake; a primary intensive use put-and-take cold water sport fish with rainbow trout, and a secondary warm water sport fishery with largemouth bass, channel catfish of basic yield, and bluegill, which is consistent with the proposed action. The Lakeside Area Fish Management Plan (Meyer et al. 2008) identifies an emphasis of promoting kids' and family fishing, with trout stocking in spring and early summer, and channel catfish and bluegill as an alternative to trout from July to September when the water quality is too poor for trout stocking, to maintain good catch rates through the fishing season. This is also consistent with the proposed action.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, and bluegill for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from April to September each year; numbers of trout stocked may be from 0 to 20,000 fish annually.

Channel catfish (fingerling, sub-catchable, catchable) may be supplementally stocked from April to September each year; numbers of catfish stocked may be from 0 to 2,000 fish annually.

Catchable bluegill sunfish may be stocked annually from April to September in support of fishing clinics; numbers of bluegill stocked may be from 0 to 5,000 fish annually.

Water Distribution / Connectivity
See the explanation of the Schoen's Complex for a detailed description of water connectivity at Woodland Lake within the complex and beyond. Walnut Creek is mostly perennial coming into the lake, as it captures the flow coming down Walnut Creek from Pine and Fred's lakes, plus diverted water from upper Billy Creek. Walnut Creek coming into Woodland Lake is occasionally dry during drought years.

Woodland Lake fills and spills every year in the winter and spring and occasionally in the late summer and fall if the monsoon rains are heavy. This small lake is the only reservoir in the area that can be influenced by heavy monsoon rains. Water is also released out of Woodland Lake for irrigation, either directly into a ditch and pipeline system, or into Walnut Creek to be used further downstream, with the water rights entirely managed by the Woodland-Show Low Irrigation Company. The spill and some irrigation water flows down Walnut Creek, through Big Springs, and into Rainbow Lake, also located on Walnut Creek. Walnut Creek is occasionally dry above Woodland Lake and supports no fish; no surveys have been conducted because it goes dry and is on private property, except in private ponds in the upper drainage. Walnut Creek is often dry immediately below Woodland Lake when not spilling or releasing irrigation water, until Walnut Spring creates a permanent flow. Adaire Spring and Big Springs add to this permanent flow down into Rainbow Lake. See the section in Rainbow Lake for information below Woodland Lake in Walnut Creek.

Woodland Lake experiences water level fluctuations with the irrigation releases during the summer. The irrigation releases can occur during the irrigation season from April 15 to September 15, and is used to irrigate grazing pastures, gardens, orchards, and a private pond.

Fish Movement
Fish are able to move upstream into upper Walnut Creek during higher flows during spring runoff and extreme monsoon events, but the base flows are usually too small for fish larger than a few inches in size to move upstream. Fish that do move upstream may persist until the creek dries during a drought year, and likely would not get beyond the dam at private ponds a short distance upstream.

Fish are also able to disperse downstream into Walnut Creek, as the lake spills every winter and spring, and occasionally in the late summer, plus water is occasionally released into Walnut Creek for irrigation use downstream. Water is also released into a ditch and pipeline system for use further downstream where it is diverted out of the channel. A fish could disperse into the ditch and pipeline system and may end up in someone's garden, or potentially into Edler Lake, which is a private pond fed by the irrigation system. The only place a fish could persist in the irrigation ditch and pipeline system is in Edler Lake, but the outflow of Edler Lake goes back into the network of ditch and pipelines to gardens and orchards. A fish escaping directly into Walnut Creek could persist if it reaches larger pools downstream of Walnut Spring and around

Big Springs, but most escapees do not appear to persist. A survey in July 2009 in Walnut Creek found numerous speckled dace and low numbers of fathead minnow, largemouth bass, green sunfish, and black bullhead (Table 60). The fathead minnow, largemouth bass, and green sunfish likely were escapees from Woodland Lake. The fathead minnow and green sunfish have the potential to establish in Walnut Creek, although numbers are very low and they were not detected in the previous survey in 1997. Additional monitoring will be necessary to determine if these species will establish. The largemouth bass were all young-of-the-year size, which are more likely to disperse over the spillway or through irrigation releases, but will likely not establish because the base flows are low and the habitat is very limiting for them. However, additional monitoring would be necessary to confirm this.

Table 60. Summary of Walnut Creek survey in July 2009 with a backpack electroshocker.

Species	**Num. Collected**	**Size**
Speckled dace	94	Various sizes
Fathead minnow	6	Not measured
Largemouth bass	5	~70-100 mm (not measured)
Green sunfish	2	Largest was 131 mm TL
Black bullhead	12	85-153 mm TL
Total	119	-

A dispersing fish could potentially continue down through Rainbow Lake, into Show Low Creek, then Show Low Lake, then Show Low Creek again and into Fools Hollow Lake. From Show Low Creek, a fish could also swim upstream into Porter Creek, but could go no further upstream than the dam at Scott Reservoir. See the following site discussions for additional information downstream of Woodland Lake.

Community Description

Woodland Lake contains stocked rainbow trout, plus naturally reproducing populations of largemouth bass, bluegill, green sunfish, fathead minnow, crayfish, and bullfrogs (Table 61). The lake also contains occasionally-stocked channel catfish. Rainbow trout do not reproduce in the lake or in Walnut Creek (M. Lopez pers. comm.). It is unknown if channel catfish reproduce in Woodland Lake. If channel catfish are naturally reproducing in the lake, it is at very low recruitment levels. Bluegills reproduce naturally in Woodland Lake, but would likely not persist in Walnut Creek. No fish are present in Walnut Creek above Woodland Lake, although this reach has not been surveyed because it occasionally goes dry and is on private property. See the following stocking site sections for information on the aquatic community downstream of Woodland Lake.

There are native fish present in Walnut Creek downstream of the lake, self-sustaining speckled dace and recently re-introduced bluehead sucker, but no consultation species.

Table 61. Survey history at Woodland Lake with experimental gillnets.

Species	2001	2002	2003	2006	2008
Rainbow trout	34	27		36	
Largemouth bass	1	7	5	5	15
Channel catfish		1	1	3	1
Green sunfish		2	4		
Bluegill			1		

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Northern Leopard Frog

Local Analysis: Although Woodland Lake and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Woodland Lake is low. There are no historical records for northern leopard frogs for the Woodland Lake stocking site; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Lake of the Woods (Lake of the Woods Resort (1942) and Rainbow lake (= Boat Ramp) (1972) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 site records and surveys at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted from 1984-2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) and Rainbow Lake (= Boat Ramp) (1994) (Figure 21, AGFD Riparian

Herpetofauna Database, M. Sredl pers. comm.) Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Woodland Lake that dispersed outside the buffered stocking complex is low because subsequent surveys suggest northern leopard frogs no longer occupy surrounding lakes or stream where fish could disperse and habitats are less suitable for northern leopard frogs due to the presence of crayfish, bullfrogs and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Woodland Lake and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Woodland Lake is low. There are no historical records for Chiricahua leopard frogs at the Woodland Lake stocking complex; however, there is 1 historical record for Chiricahua leopard frogs from 1 site in the buffered stocking complex; Rainbow Lake (= Boat Ramp) (1972) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted from 1984-2001. Chiricahua leopard frogs were not observed at any sites, including Rainbow Lake (= Boat Ramp) in 1994 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and habitats in the buffered complex have crayfish, bullfrogs and non-native fish, making it less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Woodland Lake that dispersed outside the buffered stocking complex is low because subsequent surveys suggest Chiricahua leopard frogs no longer occupy surrounding lakes or streams where fish could disperse. In addition, the habitat in these drainages is less suitable for Chiricahua leopard frogs due to the presence of crayfish, bullfrogs, and non-native fish.

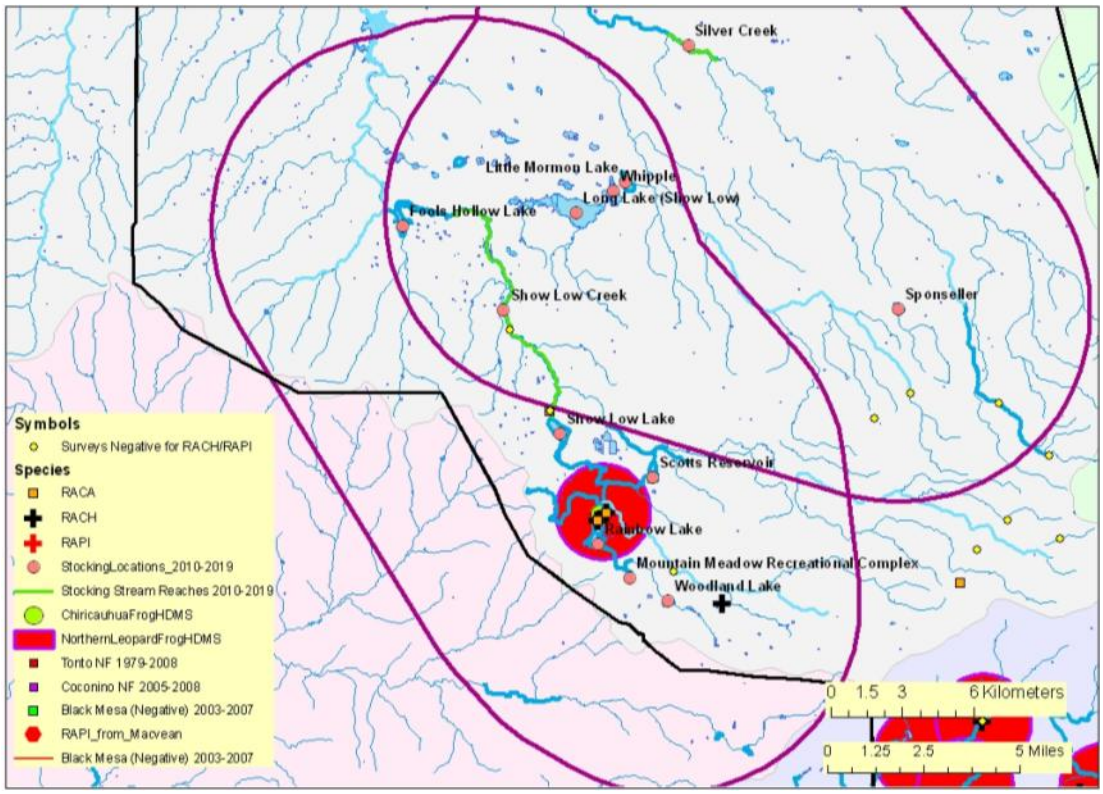


Figure 21. Map of Schoen's buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Mountain Meadow Recreation Complex

Site Description

The Mountain Meadow Recreation Complex (actual name of the facility, not a "complex" of proposed stocking sites) consists of one artificial pond constructed for irrigation purposes at the Town of Pinetop-Lakeside's recreational ball fields, at an elevation of 6730 feet. The pond is very small, measuring 40 x 60 yards, and is fairly shallow (Figure 22). The pond is mostly filled with well water that the city uses to irrigate the ball fields. The pond is located on a small ephemeral drainage and captures some runoff. The pond has a spillway and connects with Big Springs on Walnut Creek upstream of Rainbow Lake; however the drainage is usually dry and runs only during snowmelt runoff or extreme monsoon events. The pond is frequently drained

for irrigation and refilled during the summer months; therefore, this stocking site would only be utilized very short term to support particular special events like fishing clinics.

The pond can be accessed year around by paved town roads. It is located at the edge of a series of soccer and baseball fields that receive very high use during the warmer months. There is no boat launch ramp or fishing pier because the pond is so small and primary purpose of watering the fields. However, there are restroom, snack concession facilities, paved parking, and a playground, at the recreational complex. Camping is not permitted at the complex or pond; however town amenities are only a short distance.

Figure 22. Image of Mountain Meadow Recreation Complex located in the Schoen's complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body
The pond is currently used exclusively to water the adjacent soccer and baseball fields and there is currently no fishery. However, because of its easy access and likely decent water quality, and because it is replenished frequently from a well, the Department desires to stock the pond in conjunction with special events like fishing clinics. It is anticipated that the fish would not persist very long in the pond because it is drained frequently for irrigation use. Because the pond drains down into Big Springs/Walnut Creek, it is desired to utilize species that are considered low threat to the native fish being managed in Big Springs; thus the proposed action only includes catchable rainbow trout and bluegill.

There is no stocking history. This is a fairly new pond, only constructed several years ago, and would be a new stocking site. The angling use would be very short term and associated with special events.

Proposed Action
The Department proposes to stock rainbow trout and bluegill for the period covered by this consultation.

Catchable rainbow trout and catchable bluegill may be stocked annually from March through November in conjunction with special events such as fishing clinics, total numbers of fish stocked would be from 0 to 5,000 fish annually.

Water Distribution / Connectivity
For most of the year, the Mountain Meadow Recreation pond is isolated, being filled primarily with well water from the Town of Pinetop-Lakeside. During spring snowmelt runoff and heavy monsoon events, the pool does catch water coming down an intermittent drainage; it spills into an intermittent drainage for 0.3 miles, where it enters Big Springs. Big Springs is a large permanent spring that flows into Walnut Creek upstream of Rainbow Lake. From the Big Springs-Walnut Creek confluence, the stream flows perennial for 0.4 miles to Rainbow Lake. For water distribution downstream of Rainbow Lake, refer to the Rainbow Lake detailed analysis.

Fish Movement
Stocked fish may move up the intermittent drainage from the pond during heavy runoff, but will die when it dries. Stocked fish will also have the ability to move down into Big Springs when there is a heavy enough spill. Rainbow trout and bluegill may persist for a short period in Big Springs and/or Walnut Creek, but not for long because the spring pool is too shallow and without suitable habitat. Once in Big Springs, an escaped fish could move up Walnut Creek, but only to

the base of Woodland Lake dam, or it could move down Walnut Creek and into Rainbow Lake. For fish movement from Rainbow Lake, refer to the Rainbow Lake detailed analysis. Woodland Lake, upstream of Big Springs, has been stocked with rainbow trout since 1936 and bluegill have been present since their stocking in 1986 (Table 59) and have not established in Big Springs.

Surveys in 1997 found 3 rainbow trout and naturally reproducing speckled dace downstream of Woodland Lake in Walnut Creek and below Big Springs (Lopez et al. 1998c; Table 3). The trout were located in the canyon just below the lake and the native dace were distributed throughout all perennial portions of this reach. This population of speckled dace is the first of only 2 populations of dace known from the area above Fools Hollow Lake, and was the only remaining native fish species in the entire Show Low Creek sub-watershed until, native bluehead suckers were recently repatriated in Big Springs in 2008. The trout do not appear to be established or persisting, as they were not detected in a recent survey in 2009 (see below); all 3 trout were fingerling size and likely escaped during a spill event from Woodland Lake, as fingerling rainbow trout were stocked into Woodland Lake at that time. They were all found at the same station high in the reach just below Woodland Lake. They likely did not persist in the small base flow of Walnut Creek. Fingerling trout are no longer stocked in Woodland Lake which may reduce the chance of escapement, as most spill events are slight and not likely to move a catchable size trout (M. Lopez pers. comm.). Trout are not known to reproduce in Woodland Lake or Walnut Creek, so there is limited potential dispersal of trout progeny.

Table 62. Summary of Walnut Creek survey in 1997 with a backpack electroshocker.

Species	**Num. Collected**	**Size Range (mm TL)**
Speckled dace	94	28-80
Rainbow trout	3	74-80
Total	97	-

The survey in July 2009 in Walnut Creek found numerous speckled dace and low numbers of fathead minnow, largemouth bass, green sunfish, and black bullhead (Table 4). The fathead minnow, largemouth bass, and green sunfish likely were escapees from Woodland Lake. The fathead minnow and green sunfish have the potential to establish in Walnut Creek, although numbers are very low and they were not detected in the previous survey in 1997. Additional monitoring will be necessary to determine if these species will establish. The largemouth bass were all young-of-the-year size, which are more likely to disperse over the spillway or through irrigation releases, but will likely not establish because the base flows are low and the habitat is very limiting for them. However, additional monitoring would be necessary to confirm this. The black bullhead are believed to be illegally stocked, as a small wildcat dam of rocks was placed

on National Forest land where the bullheads were collected, and a 5 gallon bucket discovered on the bank. Several passes were made to remove as many bullheads as could be found in an effort to keep them from becoming established. Black bullheads are not known to exist in Woodland Lake or previously in Walnut Creek. Black bullheads are very numerous downstream in Rainbow Lake; however, an old concrete structure hydroelectric dam is an effective fish barrier to species that are not proficient jumpers, like black bullhead. Swarms of young bullheads are easily observed in the shallows in Rainbow Lake in mid-summer.

Community Description
The pond is currently fishless because it is relatively new and has not yet been stocked. Information on aquatic assemblage in Big Springs and Walnut Creek downstream of Mountain Meadow was previously discussed to describe fish movement through this area. Several rainbow trout were found in Walnut Creek in 1997, but none in 2009. Additionally, no bluegill has been found in Walnut Creek during surveys in 1997 and 2009. Crayfish and bullfrogs are present in Walnut Creek and Big Springs between Woodland and Rainbow lakes.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Northern Leopard Frog

Local Analysis: Although Mountain Meadow Recreation Complex and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Mountain Meadow Recreation Complex is low. There are no historical records for northern leopard frogs for the Mountain

Meadow Recreation Complex stocking site; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Lake of the Woods (Lake of the Woods Resort (1942) and Rainbow lake (= Boat Ramp) (1972). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) and Rainbow lake (= Boat Ramp) (1994) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Schoen's buffered complex, because they have not been detected during subsequent surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Mountain Meadow Recreation Complex that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest northern leopard frogs no longer occupy surrounding lakes or stream where fish could disperse and the habitats are less suitable for northern leopard frogs due to the presence of crayfish, bullfrogs and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Mountain Meadow Recreation Complex and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Mountain Meadow Recreation Complex is low. There are no historical records for Chiricahua leopard frogs at the Mountain Meadow Recreation Complex stocking complex; however, there is 1 historical record for Chiricahua leopard frogs from 1 site in the buffered stocking complex; Rainbow Lake (= Boat Ramp) (1972). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Chiricahua leopard frogs were not observed at any sites, including Rainbow Lake (= Boat Ramp) (1994) (Figure 21; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and crayfish, bullfrogs and non-native fish make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Mountain Meadow Recreation Complex that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest Chiricahua leopard frogs no longer occupy

surrounding lakes or streams where fish could disperse and the habitats are less suitable for Chiricahua leopard frogs due to the presence of crayfish, bullfrogs, and non-native fish.

Rainbow Lake

Site Description

Rainbow Lake dam was built on Walnut Creek in the Town of Pinetop-Lakeside in 1903 as an irrigation reservoir, and the dam was rebuilt in 1963. It created a 116 surface acre lake with a maximum depth of 14 feet and an average depth of 7 feet (Figure 23). The water rights are entirely privately owned, and the lake is still operated as an irrigation reservoir by the Woodland-Show Low Irrigation Company. Most of the shoreline is privately owned, with high value homes surrounding the lake. A small piece of property near the spillway is owned by the Department and is managed to supply public access to the lake. The property has paved parking, an ADA accessible fishing pier/boat dock, and a boat launch ramp. No other public facilities are offered.

Most of the shoreline is privately owned with no public access. The Department owns a small piece of property near the spillway, offering public access the lake. The Department property is accessed year around by paved town roads. The lake freezes over for a month or two in the winter, but the lake receives no ice fishing use because the ice is too thin to safely support a person.

The lake receives a fair amount of recreational boat use, because many of the residents along the shoreline have their personal docks and a boat. The lake is restricted to a single gas motor no larger than 10 horsepower.

Camping is not permitted at the lake; however town amenities are nearby. A Forest Service campground is located along Hwy 260 within walking distance of the lake.

Figure 23. Image of Rainbow Lake located in the Schoen's complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Primary fishery is a cold water rainbow trout put-grow-and-take fishery nearly year around, with a secondary warm water fishery. Bluegill, green sunfish, and largemouth bass are naturally reproducing, and channel catfish are supplementally stocked. Table 63 provides a history of stocking activity at Rainbow Lake. Catchable and sub-catchable rainbow trout are stocked multiple times during the stocking season. Catchable, sub-catchable, and fingerling channel catfish are stocked opportunistically during the stocking season. Northern pike and black bullhead also inhabit the lake, but are planned to be removed by chemical treatment.

Table 63. Stocking history for Rainbow Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1986	1986	1	3,000
Brook trout	1933	1983	7	150,720
Brown trout	1934	1995	37	547,100
Channel catfish	1965	2009	31	222,541
Cutthroat trout	1972	1972	1	10,000
Rainbow trout	1933	2009	469	5,646,719
Total			546	6,580,080

Rainbow Lake is a very shallow lake with high nutrients, thereby creating perfect conditions for aggressive aquatic weed growth in the summer months. A Department weed harvester is used annually to thin the aquatic weeds, but usually cannot keep ahead of the growth. A Show Low Creek Watershed Committee is seeking to apply for grant funding to dredge the lake and remove much of the internally cycling nutrient load, as recommended by the Arizona Department of Environmental Quality in a report for Rainbow Lake (ADEQ 1999).

The lake fills and spills every year in the winter and spring and is used for irrigation. The irrigation company has been attempting to pull less water from Rainbow Lake because of complaining residents. The lake has good water quality in the spring and early summer, and consequently good trout fishing during this time. However, as water temperatures rise and water levels fall in the warm summer months, water quality and trout fishing declines. The weed growth also impacts warm water fishing by interfering with boats, the primary means of public angling on Rainbow Lake.

Recently, an illegal introduction of Northern pike has established in the lake, also impacting fishing by consuming stocked trout and recruiting sunfish and bass. The Department is currently proposing to treat the lake with piscicides to remove Northern pike and black bullhead. After the treatment, the lake will need to be restocked with desirable sport fish such as largemouth bass, bluegill, channel catfish, and rainbow trout. Largemouth bass would only need to be restocked following a complete loss of the population; however, rainbow trout and channel catfish would be stocked on a regular basis. Bluegill would be stocked either to restart the fishery following a piscicide treatment, and/or opportunistically for fishing clinics. While pike are present in the lake, only catchable rainbow trout would be stocked, to reduce the level of predation. However, if pike were eradicated, sub-catchable trout could be stocked to return to a put-grow-and-take management scheme that was present prior to the pike introduction.

On-site angler creel surveys were completed in 1992, 2006, and 2007, reporting 15,781 angler hours (9953 AUDs), 18,166 angler hours, and 16,786 angler hours, respectively (Meyer et al. 2008). A statewide angler mail-out survey reported 17,289 AUDs in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a primary management emphasis of intensive use cold water sport fish with rainbow trout, and a secondary emphasis on warm water sport fish with largemouth bass, bluegill, and basic yield channel catfish, which is consistent with the proposed action. The Lakeside Area Fish Management Plan (Meyer et al. 2008) identifies managing for intensive use rainbow trout, self-sustaining largemouth bass and sunfish, and to resume stocking channel catfish, which is also consistent with the proposed action.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, and bluegill are proposed for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked from April to September each year; numbers of trout stocked may be from 0 to 30,000 fish annually.

Channel catfish (fingerling, sub-catchable, catchable) may be opportunistically stocked depending on water quality and fish availability from April to September each year; numbers of catfish stocked may be from 0 to 15,000 fish annually.

Catchable bluegill may be stocked annually from April to September in support of fishing clinics; numbers of bluegill sunfish stocked would be from 0 to 5,000 fish annually.

Largemouth bass (fingerling, sub-catchable, catchable) and bluegill (fingerling, sub-catchable, catchable) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Rainbow Lake is fed by perennial Walnut Creek, and permanent springs under the lake surface. Walnut Creek flows down to Rainbow Lake from Woodland Lake, picking up significant flow from Adaire Spring and Big Springs prior to reaching Rainbow Lake. Much of the water filling the lake comes during the spring snowmelt runoff, although Walnut Creek flows year-round into the lake.

Rainbow Lake fills and spills every year, flowing down into Walnut Creek and through a small private pond immediately below the dam, then through privately owned Lake of the Woods and down lower Walnut Creek where it joins Billy Creek. Billy Creek meets with Porter Creek to

form Show Low Creek, which then flows into Show Low Lake. Additional information on water connectivity can be found in subsequent site sections below.

Rainbow Lake is an irrigation reservoir and water is released during the irrigation season from April 15 to September 15. Irrigation water can be released into Walnut Creek and taken out into an irrigation ditch about 200 yards downstream. Water can also be sent downstream into Show Low Lake, where it can be stored or released again for irrigation below Show Low Lake. The irrigation water is used to irrigate grazing pastures, gardens, and orchards. Irrigation water can also come into Rainbow Lake from releases from Woodland Lake. Irrigation releases during the summer from Rainbow may drop the lake level only 3-5 feet, but that can have an impact on the lake because the average depth is only 7 feet. Fish kills, however, are not usually an issue at Rainbow Lake.

Fish Movement

Stocked fish may try to swim upstream into Walnut Creek towards Big Springs; however, they immediately come up against the obstacle of a concrete structure across the entire width of lower Walnut Creek right at the junction with Rainbow Lake. This concrete structure was an old hydroelectric dam and is approximately 3 feet high. This structure is likely not an effective fish barrier to upstream movement of trout during moderate or higher flows, but would be for warm water fishes such as channel catfish, bluegill and largemouth bass that are not prone to leaping high over barriers. Once above this barrier, trout could navigate the perennial flow of this reach of Walnut Creek, get into Big Springs, and/or swim up towards Woodland Lake. They could not get upstream of the dam at Woodland Lake though.

Because Rainbow Lake spills annually, and water is released regularly for irrigation use, stocked fish could disperse downstream. They could go down into the small private pond, then into Lake of the Woods, then down lower Walnut Creek, into lower Billy Creek, down into Show Low Creek, and into Show Low Lake. They could also swim upstream once in Billy Creek, likely only during high flows, and potentially get into the headwaters of Billy Creek, although they would not impact anything there. There are two concrete dam structures on Department property on Billy Creek that would preclude any upstream moving fish from reaching the springs and diversion into the hatchery. They could also swim upstream once at the confluence with Porter Creek, but could only get as far as Scott Reservoir dam.

From Show Low Lake, they could continue downstream during more infrequent spills, or by regular irrigation releases into perennial Show Low Creek, where they could continue down into Fools Hollow Lake. For a description of escape and movement of fish downstream of Fools Hollow Lake, see the Fools Hollow Lake analysis.

Community Description

Rainbow Lake currently contains stocked rainbow trout and channel catfish. Naturally reproducing populations of Northern pike, black bullhead, largemouth bass, bluegill, green sunfish, fathead minnow, and bullfrog tadpoles are also present (Table 64). Walleye and golden shiner are occasionally found, but not considered to be established in the lake. Stocked trout could persist year-round in Rainbow Lake if it were not for the high predation by pike, and they are expected to persist after pike are eradicated. Rainbow trout reproduction has not been documented in the lake or in the Walnut Creek upstream. Channel catfish have the opportunity to reproduce in the lake, although it has not been documented through the presence of offspring. Black bullhead, largemouth bass, bluegill, green sunfish, and fathead minnow reproduce naturally in the lake. The private ponds immediately downstream of Rainbow Lake, such as Lake of the Woods, contain the same species as Rainbow Lake, with the exception that northern pike have not been documented.

Table 64. Survey history of Rainbow Lake using experimental gillnets.

Species	**Apr. 2004**	**Mar. 2005**	**Apr. 2006**	**Mar. 2007**	**Mar. 2008**
Rainbow trout	1	37	11	1	1
Largemouth bass	9	25	13	3	5
Channel catfish	10	2	3	2	
Black bullhead	254	134	89	62	61
Northern pike	5	70	23	9	9
Bluegill	3	1	1		2
Green sunfish	2	2			
Golden shiner			1		
Walleye	2	1			

Billy Creek is a tributary to Walnut Creek, joining it just downstream from Rainbow Lake. In June-July 1997, Billy Creek contained green sunfish, golden shiner, fathead minnow, and brook trout (Lopez et al. 2000a; Table 65). The sunfish, shiner and fatheads are likely reproducing in the stream, however the brook trout likely are not. The larger sizes of the trout and collection location (all found in the headwaters of the creek on AGFD property near the old AGFD Pinetop hatchery outflow), indicate that they were likely escapees from that hatchery when it was operational. Crayfish and bullfrogs are also present in lower Billy Creek. Porter Creek is another tributary to Show Low Creek downstream from Rainbow Lake. Additional discussion on Porter Creek is provided in the Scott Reservoir sections, below.

Table 65. Summary of Billy Creek survey in June-July 1997 with a backpack electroshocker.

Species	Num. Collected	Size Range (mm TL)
Green sunfish	351	48-218
Golden shiner	12	65-115
Fathead minnow	123	32-79
Brook trout	6	194-315

Show Low Creek between Rainbow Lake and Show Low Lake contained green sunfish, largemouth bass, fathead minnow, rainbow trout, and brown trout based on surveys conducted in June 1996 (Lopez et al. 1998b; Table 66). The green sunfish and fathead minnow are likely reproducing in the stream. However the largemouth bass, rainbow trout, and brown trout are likely migrants from Show Low Lake, Rainbow Lake, or Scott Reservoir. The bass reproduce in these lakes; however the trout are not known to reproduce in these lakes or connecting streams. Crayfish and bullfrogs are present in upper Show Low Creek.

Table 66. Summary of Show Low Creek (upstream of Show Low Lake) in June 1996 with a backpack electroshocker.

Species	Num. Collected	Size Range (mm TL)
Green sunfish	85	43-185
Largemouth bass	2	117-323
Fathead minnow	127	16-77
Rainbow trout	1	237
Brown trout	3	202-222

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Northern Leopard Frog

Local Analysis: Although Rainbow Lake and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Rainbow Lake is low. There is 1 historical record for northern leopard frogs from the Rainbow Lake stocking site; Rainbow Lake (=Boat Ramp) (1972) and 1 historical record for northern leopard frogs from 1 site in the buffered stocking complex; Lake of the Woods (Lake of the Woods Resort (1942) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) or Rainbow lake (= Boat Ramp) (1994) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy areas within the Schoen's buffered complex because frogs have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Rainbow Lake that dispersed outside the buffered stocking complex is low, because previous surveys suggest that northern leopard frogs no longer occupy sites where fish would disperse and habitats are less suitable for northern leopard frogs due to the presence of crayfish and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Rainbow Lake and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Rainbow Lake is low. There is 1 historical record for Chiricahua leopard frogs from the Rainbow Lake stocking site; Rainbow Lake (=Boat Ramp) (1972); however, Chiricahua leopard frogs were not observed during subsequent surveys at Rainbow Lake (= Boat Ramp) (1994). There are no historical records for northern leopard frogs from the buffered stocking complex (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and

2001. Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish make the habitat within the buffered stocking complex less suitable for northern leopard frogs

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Rainbow Lake that dispersed outside the buffered stocking complex is low, because previous surveys suggest that Chiricahua leopard frogs no longer occupy sites where fish would disperse habitats are less suitable for northern leopard frogs due to the presence of crayfish and non-native fish.

Scott Reservoir

Site Description

Scott Reservoir dam was constructed in 1928 on Porter Creek on the north side of Pinetop-Lakeside. The lake is located at an elevation of 6715 feet, is 80 surface acres in size, and has an average depth of 10 feet (Figure 24). The lake is located on the Apache-Sitgreaves National Forest, and is located upstream of Show Low Lake, in the upper portions of the stocking complex.

Scott Reservoir is accessed off an all-weather gravel spur road year-round off paved town roads. A Forest Service campground is located at the lake, with restrooms, picnic tables, and a boat launch ramp concentrated on the north side of the lake. The south and east sides of the lake are accessible only by hiking, therefore, most of the shoreline angler use is located on the north shore near the campground and along the dam on the west shore. The lake is restricted to electric motors only.

Figure 24. Image of Scott Reservoir located in the Schoen's complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Primary fishery is a cold water rainbow trout put-grow-and-take fishery nearly year around, with a secondary warm water fishery (Table 9). Bluegill, green sunfish, and largemouth bass are naturally reproducing, and channel catfish are supplementally stocked and likely naturally-reproducing. Catchable and sub-catchable rainbow trout are stocked multiple times during the stocking season. Catchable, sub-catchable, and fingerling channel catfish are stocked opportunistically during the stocking season.

Table 67. Stocking history for Scott Reservoir.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1986	1986	1	3,000
Brook trout	1983	1983	1	30,000
Brown trout	1948	1995	34	475,460
Channel catfish	1964	2008	30	191,291
Rainbow trout	1945	2009	243	2,192,252
Total			309	2,892,003

Scott Reservoir fills and spills every year and usually maintains good water quality throughout the year. It receives fairly low use despite its proximity to town because of its low profile, because it cannot be seen from well-used roads and there are few signs, and is used mostly by locals and seasonal visitors. The reservoir is used as an irrigation reservoir, with water releases primarily in the summer months, sometimes resulting in significant water level changes, particularly in very dry years. The lake freezes for a month or two during the winter but receives no ice fishing use because the ice is too thin to safely support people.

On-site angler creel surveys were completed in 1993 and 2007, reporting 32,798 angler hours (14,035 AUDs) and 20,701 angler hours, respectively (Meyer et al. 2008). A statewide angler mail-out survey reported 4,860 AUDs in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a primary management emphasis of put-grow-and-take cold water sport fish with rainbow trout, and a secondary emphasis on warm water sport fish with largemouth bass, bluegill, and basic-yield channel catfish. The Lakeside Area Fish Management Plan (Meyer et al. 2008) identifies managing primarily for catfish and trout fishing.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, and bluegill for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked from April to September each year; numbers of trout stocked may be from 0 to 30,000 fish annually.

Channel catfish (fingerling, sub-catchable, catchable) may be opportunistically stocked depending on fish availability from April to September each year; numbers of catfish stocked may be from 0 to 15,000 fish annually.

Catchable bluegill may be stocked annually from April to September in support of fishing clinics; numbers of fish stocked may be from 0 to 5,000 fish annually.

Bluegill (fingerling, sub-catchable, catchable) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Scott Reservoir is filled by perennial flowing Porter Creek coming into the lake. Porter Creek originates at Porter Springs on private property and flows perennial for 1.2 miles to Scott Reservoir. The lake fills and spills every year in the winter and spring, plus is managed as an irrigation reservoir, so water is also released into Porter Creek below the lake. Porter Creek below the lake flows mostly perennial for 1.4 miles down to the confluence with Billy Creek. The stream is known as Show Low Creek below and is perennial. Show Low Lake is 2.4 miles downstream of the Billy/Porter confluence. The stream below Show Low Lake flows perennially for 7.7 miles downstream to Fools Hollow Lake. Refer to Fools Hollow Lake for a description of the connectivity below Fools Hollow Lake.

Fish Movement

Fish likely move upstream and downstream of Scott Reservoir since Porter Creek is perennial above the lake and it spills annually. Additionally, water is released for irrigation from Scott Reservoir. Fish dispersing upstream may travel for less than a mile until they reach a dam for one of several private ponds on upper Porter Creek; thus dispersing fish cannot reach Porter Springs which is upstream of the private ponds. Porter Springs supports a population of native speckled dace. Most fish species in the lake, even trout, could persist in upper Porter Creek, as it is perennial and maintains good water quality. Upper Porter Creek may be the only location in the entire Show Low Creek watershed where trout have the potential to reproduce because good water quality, flow and spawning habitat are available at the appropriate times of year. However, this has not been documented through surveys or detection of offspring. (See Table 11.)

Stocked species escaping from Scott Reservoir could travel through lower Porter Creek to the confluence with Billy Creek. They could continue down into Show Low Creek, then through Show Low Lake, then down to Fools Hollow Lake and beyond as will be discussed later. Alternately, stocked fish could move upstream in Billy Creek. In Billy Creek, they could likely only move upstream during high flows because of the very low base flows in that stream and potentially get into the headwaters of Billy Creek. However, there no consultation species present in that area. There are two concrete dam structures on Department property on Billy Creek that would prevent any escaped fish from reaching the springs and diversion into the hatchery. Fish moving upstream could also go into lower Walnut Creek, but only as far as Lake of the Woods dam, which is a barrier.

Most species in Scott Reservoir could persist in lower Porter Creek and upper Show Low Creek, although trout, bass, and channel catfish likely do not reproduce in the stream. Trout are not known to reproduce in the lakes, but bass, sunfishes, and channel catfish do.

For a description of fish movement downstream of Fools Hollow Lake, refer to the analysis for Fools Hollow Lake.

Community Description
Scott Reservoir currently contains stocked rainbow trout, plus naturally reproducing largemouth bass, bluegill, green sunfish, fathead minnow, crayfish, and bullfrogs, plus supplemental stocked and likely naturally reproducing channel catfish (Table 68). One northern pike was captured recently, but subsequent surveys have not found additional pike.

Table 68. Survey history for Scott Reservoir using experimental gillnets.

Species	**Apr. 2004**	**Apr. 2005**	**Mar. 2006**	**Apr. 2007**	**Mar. 2008**
Rainbow trout	17	10	63	39	18
Channel catfish	17	6	10	12	7
Largemouth bass	4	2	8	16	15
Bluegill				1	
Northern pike				1	

Based on surveys conducted in July 1998, upper Porter Creek upstream of Scott Reservoir contained green sunfish, largemouth bass, and fathead minnow (Lopez et al. 2000b; Table 69). The sunfish and fatheads likely reproduce in the stream and in the lake; however, the largemouth bass likely spawn only in the lake, with these small bass either coming upstream from Scott Reservoir, or downstream from the private ponds. This reach also contained crayfish.

Table 69. Summary of Porter Creek survey (upstream of Scott Reservoir) in July 1998 with a backpack electroshocker.

Species	**Num. Collected**	**Size Range (mm TL)**
Green sunfish	29	31-51
Largemouth bass	45	64-148
Fathead minnow	39	49-67

A population of native speckled dace, one of only 2 populations of native fish in the entire Show Low Creek watershed, is present at Porter Spring on private property. Although rainbow trout exist in the ponds on the same private property, a survey of the spring area in March 2002 found

only speckled dace and crayfish. Largemouth bass and green sunfish are also present in the lowermost private pond (M. Lopez pers. comm.).

Based on surveys conducted in July 1998, lower Porter Creek, downstream of Scott Reservoir, contained green sunfish, largemouth bass, rainbow trout, and fathead minnow (Lopez et al. 2000b; Table 70). The sunfish and fathead minnows are likely reproducing in the stream; however, the largemouth bass and rainbow trout are more likely escapees from Scott Reservoir, because they have not been documented to reproduce in the stream. The largemouth bass reproduce in Scott Reservoir, and Rainbow Lake, and progeny could easily escape the reservoirs. Rainbow trout are not known to reproduce in these lakes or connecting stream, but were more likely escapees of stocked fingerling trout into Scott Reservoir. Crayfish and bullfrogs are present in lower Porter Creek.

Table 70. Summary of Porter Creek survey (downstream of Scott Reservoir) in July 1998 with a backpack electroshocker.

Species	**Number Collected**	**Size Range (mm TL)**
Green sunfish	84	22-108
Largemouth bass	14	77-171
Rainbow trout	6	66-150
Fathead minnow	4	68-80

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Northern Leopard Frog

Local Analysis: Although Scott's Reservoir and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Scott's Reservoir is low. There are no historical records for northern leopard frogs for the Scott's Reservoir stocking site; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Lake of the Woods Resort (1942) and Rainbow Lake (= Boat Ramp) (1972). There have been 7 surveys at 5 sites within the buffered stocking complex between 1942 and 2001 with most surveys conducted between 1984 and 2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) and Rainbow lake (= Boat Ramp) (1994) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Scott's Reservoir that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest northern leopard frogs no longer occupy surrounding lakes or stream where fish could disperse and habitats are less suitable for northern leopard frogs due to the presence of crayfish, bullfrogs and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Scott's Reservoir and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Scott's Reservoir is low. There are no historical records for Chiricahua leopard frogs at the Scott's Reservoir stocking complex; however, there is 1 historical record for Chiricahua leopard frogs from 1 site in the buffered stocking complex; Rainbow Lake (= Boat Ramp) (1972). There have been 7 surveys or site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Chiricahua leopard frogs were not observed at any sites, including Rainbow Lake (= Boat Ramp) (1994) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Scott's Reservoir that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest Chiricahua leopard frogs no longer occupy surrounding lakes or streams where fish could disperse and habitats are less suitable for Chiricahua leopard frogs due to the presence of crayfish, bullfrogs, and non-native fish.

Show Low Lake

Site Description

Show Low Lake dam was constructed in 1953 on Show Low Creek in the town of Show Low to create the 100 surface acres (Figure 25). The lake is located at an elevation of 6542 feet, has a maximum depth of 50 feet, and an average depth of 33 feet. The water rights are currently owned by Show Low and cooperatively managed with the Woodland-Show Low Irrigation Company. Phelps Dodge owns most of the shoreline at Show Low Lake and there is no development on the shoreline. The Department owns a small portion of property on the west side of the lake at the boat ramp, and a portion of the upper arm of the lake is located on the Apache-Sitgreaves National Forest. Show Low Lake is located upstream of Fools Hollow Lake and downstream of Scott Reservoir and Rainbow Lake within the Schoen's Complex.

Show Low Lake is accessed year around by paved town roads. A dirt road accesses the north side of the lake by driving over the spillway and dam, and is accessible in good weather only. Another dirt road accesses the very upper end on the lake at the site of an old Phelps Dodge pump station. The Department owns a small portion of property on the west side of the lake, offering paved parking, a boat launch ramp, a fishing pier, soon-to-be-installed boat courtesy dock, restrooms, and some camping spots. The main access and most of the shoreline angler use is at this west side location. Show Low operates a campground, boat rentals, tackle/snack shop, and another fishing pier on the north side of the lake. Shoreline anglers also concentrate on the north side of the lake, especially because there is now a fishing pier. The lake is close to town, with nearby non-visible residences from the west shoreline of the lake. A Wal-Mart superstore is located just down the stream about 2 miles away.

Boats are restricted to the use of a single gas motor no larger than 10 horsepower. The lake freezes over for several weeks during the winter, but the lake receives no ice fishing use because the ice is too thin to safely support a person.

Figure 25. Image of Show Low Lake located in the Schoen's complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Show Low Lake has been managed primarily for a put-grow-and-take cold water fishery utilizing all sizes and numbers of rainbow trout. It has been managed secondarily for a cool water fishery of naturally reproducing walleye, and warm water fishery of naturally reproducing largemouth bass, smallmouth bass, sunfish and black crappie, and supplementally stocked and likely naturally-reproducing channel catfish (Table 71). Trout fishing is fairly good, with carryover trout surviving through the winter and putting on growth. The species of trout could be expanded to provide additional opportunity, but mostly to give Department hatcheries some

flexibility when there infrequently is excess stocks of brook, cutthroat, and Apache trout that are difficult to stock out into the very few places approved for those species. Show Low Lake is a predator dominated lake, especially with the underutilized walleye. The numbers of largemouth and smallmouth bass, black crappie, and sunfish are fairly low, likely due to heavy predation by walleye.

Catchable, sub-catchable, and fingerling rainbow trout are stocked multiple times throughout the stocking season, and the Department is proposing to add brook, cutthroat, and Apache trout of multiple sizes. Catchable, sub-catchable, and fingerling channel catfish are supplementally stocked opportunistically throughout the stocking season.

Table 71. Stocking history for Show Low Lake

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	1969	1	5,000
Bluegill	1986	1986	1	3,000
Brook trout	1982	1989	5	138,725
Brown trout	1976	1994	37	555,311
Channel catfish	1976	2009	31	233,080
Cutthroat trout	1976	1972	1	15,000
Kokanee	1960	1960	1	20,000
Northern pike	1966	1970	3	125,024
Rainbow trout	1954	2009	706	5,872,600
Walleye	1975	1975	1	750,000
Total			787	7,717,740

On-site angler creel surveys were completed in 1993 and 2007, reporting 38,771 angler hours (23,032 AUDs) and 50,722 angler hours, respectively (Meyer et al. 2008). A statewide angler mail-out survey reported 44,714 AUDs in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a primary management emphasis of put-grow-and-take cold water sport fish with rainbow trout, and a secondary emphasis on warm water sport fish with largemouth bass, bluegill, walleye, and basic yield channel catfish, which is mostly consistent with the proposed action. Additional trout species have been added to the proposed action to add angling diversity and also to give flexibility to the state hatcheries in stocking locations for surplus trout. The Lakeside Area Fish Management Plan (Meyer et al. 2008) identifies managing for family fishing with high catch rates of any species, and for a quality walleye fishery.

Proposed Action

The Department proposes to stock rainbow trout, brook trout, cutthroat trout, Apache trout, channel catfish, and bluegill sunfish are proposed for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow trout, would be stocked from April to September each year depending on suitable water levels and quality as well as fish availability; numbers of trout would be up to 250,000 fish annually. The primary goal would be to stock rainbow trout, however if other species including Apache trout, brook trout or cutthroat trout became available, they may be stocked opportunistically; no more than a total of 250,000 trout would be stocked annually.

Channel catfish (fingerling, sub-catchable, catchable) may be opportunistically stocked depending on fish availability from April to September each year; numbers of catfish stocked may be from 0 to 15,000 fish annually.

Catchable bluegill may be stocked annually from April to September in support of fishing clinics; numbers of fish stocked would be from 0 to 5,000 fish annually.

Bluegill sunfish (fingerling, sub-catchable, catchable) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Show Low Creek is perennial flowing into the lake as discussed in previous sections. Show Low Lake fills and spills only during good precipitation winters, but water is released into Show Low Creek below the lake for downstream irrigation. Water has been released a couple times at the request of the City of Show Low and the State Park, to supplement the low water level at Fools Hollow Lake. Phelps Dodge previously held some water rights in Show Low Lake and pumped water into Forest Dale Canyon, but this is no longer practiced after water rights were transferred to the City of Show Low. Show Low Creek below the lake drains 9 miles downstream into Fools Hollow Lake, and occasionally has dry sections between the lakes during dry years. Refer to Fools Hollow Lake for a description of connectivity below Fools Hollow dam.

The Show Low Lake water level fluctuates quite a bit, but because it is a deep lake with little vegetation, the water quality remains good year-round. This allows trout to be stocked through the warm summer months. The lake fills and spills infrequently and has only spilled 5 times in the last 14 years, as far back as the Department has records.

Table *72* shows the spill history of Show Low Lake during this period of time.

Table 72. Spill history for Show Low Lake.

Year	Spill	Timing
1996	No spill	
1997	No spill	
1998	Spilled	Mar.-Apr.
1999	No spill	
2000	No spill	
2001	Spilled	Feb-Apr.
2002	No spill	
2003	No spill	
2004	No spill	
2005	Spilled	Feb-Apr.
2006	No spill	
2007	No spill	
2008	Spilled	Jan-Feb
2009	Spilled	Feb-Apr.

Fish Movement

Fish, including stocked species, likely move upstream and downstream from Show Low Lake. Fish dispersing upstream into Show Low Creek could either swim up Porter Creek or up Billy creek and then into Walnut Creek as was previously described. Stocked species could disperse downstream during infrequent spills or by regular irrigation releases into perennial Show Low Creek, where they could continue down into Fools Hollow Lake. For a description of escape and movement of fish downstream of Fools Hollow Lake, see the Fools Hollow Lake analysis.

Show Low Lake and Fools Hollow Lake have the ability to support all fish species identified in this complex throughout the year. Portions of Walnut Creek, Billy Creek, Porter Creek, and upper and middle Show Low Creek have the ability to support most warm water species and trout for at least a good portion of the year.

Community Description

Show Low Lake currently contains stocked rainbow trout, which are not known to reproduce in the lake or the inflow stream. The lake also contains naturally reproducing largemouth bass, smallmouth bass, walleye, bluegill, green sunfish, black crappie, black bullhead, fathead minnow, crayfish, bullfrogs, and supplementally stocked and likely naturally-reproducing channel catfish (Table 73).

Table 73. Survey history on Show Low Lake using experimental gillnets.

Species	Apr. 2, 2004	Apr. 21, 2005	Mar. 31, 2006	Apr. 4, 2007	Mar. 26, 2008
Rainbow trout	24	9	22	33	41
Largemouth bass				2	2
Black crappie	1	1			1
Smallmouth bass	1				1
Channel catfish	9	1	2	3	3
Black bullhead			1		2
Walleye	103	19	12	32	14
Green sunfish				2	
Bluegill	1				

Fish assemblage information upstream from Show Lake was previously provided. Downstream of Show Low Lake, middle Show Low Creek to Fools Hollow Lake contained green sunfish, rainbow trout, brown trout, and walleye based on surveys conducted in May-June 1996 (Lopez et al. 1998b; Table 74). The green sunfish are likely the only species able to reproduce and persist long term in this reach of Show Low Creek. The trout and walleye are not known to reproduce in the stream, and the walleye likely don't persist long. Both walleye collected were large and found in a very large and uncharacteristic pool right below the Show Low Lake dam. Another large walleye was found dead on the bank further downstream where the base flows are very low. Two of the 3 rainbow trout were also found in this very large pool. Crayfish and bullfrogs are very abundant in this reach.

Table 74. Summary of Show Low Creek (downstream of Show Low Lake to Fools Hollow Lake) in May-June 1996 with a backpack electroshocker and gillnets.

Species	Number Collected	Size Range (mm TL)
Green sunfish	29	113-148
Rainbow trout	3	232-375
Brown trout	2	352-490
Walleye	2	655-700

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may

include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to stocked Apache trout are analyzed below. Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Apache Trout

Apache trout stocked opportunistically could disperse downstream during infrequent spills or by regular irrigation releases into perennial Show Low Creek, where they could continue down into Fools Hollow Lake. Apache trout dispersing upstream into Show Low Creek could either swim up Porter Creek or up Billy creek and then into Walnut Creek.

Apache trout are raised in the hatchery raceways to catchable size and stocked into the stream for a recreational put-and-take fishery, but they are not expected to establish a viable population in either the lake or downstream as stocked rainbow trout known are not known to reproduce in the lake, the inflow stream, or downstream. The primary goal would be to stock rainbow trout, however if other species including Apache trout, brook trout or cutthroat trout became available, they may be stocked opportunistically. Trout fishing is fairly good, with carryover trout surviving through the winter and putting on growth.

Potential impacts

Stocked Apache trout co-stocked with other species

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of

the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to Show Low Lake and downstream Show Low Creek and Fools Hollow Lake may include predation, hybridization with other trout and/or competition. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Northern Leopard Frog

Local Analysis: Although Show Low Lake and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Show Low Lake is low. There are no historical records for northern leopard frogs for the Show Low Lake stocking site; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Lake of the Woods (Lake of the Woods Resort (1942) and Rainbow lake (= Boat Ramp) (1972), (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys or site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) and Rainbow lake (= Boat Ramp) (1994) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Show Low Lake that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest northern leopard frogs no longer occupy surrounding lakes or stream where fish could disperse and habitats are less suitable for northern leopard frogs due to the presence of crayfish, bullfrogs and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Show Low Lake and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in the buffered stocking complex that includes is low. There are no historical records for Chiricahua leopard frogs at the Show Low Lake stocking complex; however, there is 1 historical record for Chiricahua leopard frogs from 1 site in the buffered stocking complex; Rainbow Lake (= Boat Ramp) (1972) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Chiricahua leopard frogs were not observed at any sites, including Rainbow Lake (= Boat Ramp) (1994) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Show Low Lake that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest Chiricahua leopard frogs no longer occupy surrounding lakes or streams where fish could disperse and habitats are less suitable for Chiricahua leopard frogs due to the presence of crayfish, bullfrogs, and non-native fish.

Show Low Creek

Site Description

Show Low Creek is a tributary of Silver Creek, with the confluence near Shumway. Silver Creek drains into the LCR south of Woodruff. The section of Show Low Creek proposed to be stocked is located between 2 managed reservoirs, upstream of Fools Hollow Lake and downstream of Show Low Lake. The stream flows from elevations 6530 to 6275 feet. This section of Show Low Creek between the reservoirs is approximately 7.7 miles long and located on a mix of city (Show Low), private, US Forest Service (Apache-Sitgreaves National Forest), and Department property (at inflow to Fools Hollow Lake). The stocking would be concentrated at two general sites, one located just below Show Low Lake and the other in the Show Low meadow area.

Management of Water Body
Currently the primary fishery is warm water naturally reproducing green sunfish fishery. The Department proposes to create a cold water rainbow trout summer intensive use put-and-take fishery. Catchable rainbow trout would be stocked multiple times during the stocking season.

Department records show that Show Low Creek was historically stocked, but not since 1974, and with no details of the specific stocking site. Bluegill and bass were stocked in 1937. Rainbow trout were stocked from 1943 to 1948. Brown trout were stocked from 1946 to 1974. This would be a new current stocking site.

This portion of Show Low Creek contains only non-native fish (Table 74). The reservoirs immediately above and below this section have been historically stocked and are proposed for future stocking with numerous trout and warm-water sport fish. Portions of Show Low Creek between Fools Hollow Lake and Show Low Lake can be accessed year around in several places. A reach just downstream of Show Low Lake dam is located on Forest Service land and is accessed by trail leading down from a dirt parking on the north side of Show Low Lake. Another portion of Show Low Creek, located in the Show Low Meadow area is owned by the City of Show Low and is accessed off paved Highway 260.

There are currently no facilities along Show Low Creek for anglers, although Show Low Lake does have facilities that anglers in that area can use. Also, the City of Show Low is proposing to make improvements and promote recreation along Show Low Creek in the Show Low Meadow area. Camping is allowed at the upper end of the stocking reach near the Show Low Lake dam, where campsites are available.

Water permanence along this section has improved since the City of Show Low acquired water rights in Show Low Lake from Phelps Dodge.

The stocking opportunities would depend upon permanence of the water and on water quality in the stream. The upper end of the stocking reach near Show Low Lake would not need any development and would remain primitive and low impact. The Show Low Meadow area could become a popular recreation area if the city follows through with plans to improve the site and access, and coordination between the Woodland-Show Low Irrigation Company and the City of Show Low result in improved conditions.

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked from April to September annually; numbers of trout stocked may be from 0 to 10,000 fish annually.

Water Distribution / Connectivity
Water flowing through this section of Show Low Creek comes directly out of Show Low Lake, either by spill when the lake is full, by irrigation releases through the outlet structure in the dam, or by seepage through the earthen dam.

Water flows into Show Low Lake from upper Show Low Creek, and headwater tributaries, Porter Creek, Billy Creek, and Walnut Creek as previously discussed. For a detailed description and distances of the upper watershed connectivity, refer to the explanation at the beginning of this section on the Schoen's Complex.

Irrigation releases from Show Low Lake occur regularly during the summer irrigation season from April 15 to September 15. This section of Show Low Creek between Show Low and Fools Hollow lakes is mostly perennial, although may have small sections that go dry when water is not being released for irrigation. For a complete description of water connectivity below Fools Hollow Lake, refer to the Fools Hollow Lake analysis.

Fish Movement
Fish will be able to move up and downstream within this section of Show Low Creek, but will not be able to get past the Show Low Lake dam on the upstream side. Downstream, fish will be able to move into Fools Hollow Lake, and have the potential to move below Fools Hollow Lake into lower Show Low Creek when Fools Hollow Lake spills. For a description of fish movement downstream of Fools Hollow Lake, refer to the Fools Hollow Lake analysis.

Community Description
The reach of Show Low Creek proposed for stocking middle Show Low Creek upstream of Fools Hollow Lake and below Show Low Lake was previously described in the Show Low Lake section. In 1996 it contained green sunfish, rainbow trout, brown trout, and walleye (Lopez et al. 1998b; *Table 74*). Brown trout were last stocked in Fools Hollow Lake and Show Low Lake in 1994. Brown trout are likely no longer present because reproduction in these systems has not been documented and are no longer being stocked. Stocked brown trout likely have died of old age by now. Crayfish and bullfrogs are very abundant in this reach of Show Low Creek.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in

Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to stocked Apache trout that may escape from Show Low Lake and move downstream into Show Low Creek are analyzed below. Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Apache Trout

Apache trout opportunistically stocked in Show Low Lake could disperse downstream during infrequent spills or by regular irrigation releases into perennial Show Low Creek. Apache trout are raised in the hatchery raceways to catchable size and stocked into the stream for a recreational put-and-take fishery, but they are not expected to establish a viable population in either the lake or downstream as stocked rainbow trout known are not known to reproduce in the lake, the inflow stream, or downstream.

Potential impacts

Stocked Apache trout co-stocked with other species

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to Show Low Creek may include predation, hybridization with other trout and/or competition. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Northern Leopard Frog

Local Analysis: Although Show Low Creek and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Show Low Creek is low. There are no historical records for northern leopard frogs for the Show Low Creek stocking site; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Lake of the Woods (Lake of the Woods Resort (1942) and Rainbow lake (= Boat Ramp) (1972), (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) and Rainbow lake (= Boat Ramp) (1994) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Show Low Creek that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest northern leopard frogs no longer occupy surrounding lakes or stream where fish could disperse and habitats are less suitable for northern leopard frogs due to the presence of crayfish, bullfrogs and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Show Low Creek and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Show Low Creek is low. There are no historical records for Chiricahua leopard frogs at the Show Low Creek stocking complex; however, there is 1 historical record for Chiricahua leopard frogs from 1 site in the buffered stocking complex;

Rainbow Lake (= Boat Ramp) (1972) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Chiricahua leopard frogs were not observed at any sites, including Rainbow Lake (= Boat Ramp) (1994) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Show Low Creek that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest Chiricahua leopard frogs no longer occupy surrounding lakes or streams where fish could disperse habitats are less suitable for Chiricahua leopard frogs due to the presence of crayfish, bullfrogs, and non-native fish.

Fools Hollow Lake

Site Description

Fools Hollow Lake is located on Show Low Creek near the town Show Low, and is the lower most of 5 managed reservoirs in the upper Show Low Creek watershed. The dam was constructed in 1957 to create a 150 surface acre reservoir at an elevation of 6256 feet, with an average depth of 23 feet (Figure 26). Water rights are owned by the Department and no water is released for irrigation or other uses. The lake is located on the Apache-Sitgreaves National Forest, but the lake is managed cooperatively as a State Recreation Area by the Arizona State Parks, Forest Service, Arizona Game and Fish Department, and Show Low. A small portion of the upper arm of the lake is owned by Arizona Game and Fish Department.

Fools Hollow Lake is accessed year around by paved town roads. The lake is managed as a State Recreation Area by Arizona State Parks and park rangers are on site 24 hours a day, 365 days a year. They offer well developed campsites, including RV hookups, 2 boat launch ramps, 2 fishing platforms, 4 ADA accessible fishing piers, fish cleaning stations, hiking trails, numerous restrooms, two playgrounds, special event sites, day use sites, an interpretive amphitheater, and an RV dump site. Fools Hollow Lake is heavily used most of the year, particularly through the summer. Much of the use is camping, boating, and swimming, but some fishing does occur.

Boats are restricted to the use of a single gas motor no larger than 10 horsepower. The lake freezes over for several weeks during the winter, but the lake receives no ice fishing use because the ice is too thin to safely support a person.

Figure 26. Image of Fools Hollow Lake located in the Schoen's complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Primary fishery is a warm water fishery, with a secondary cold water rainbow trout intensive use put-and-take fishery nearly year around (Table 75). Walleye, largemouth bass, smallmouth bass,

bluegill, green sunfish, black crappie, and carp are naturally reproducing. Channel catfish may reproduce in the lake, but the level of recruitment is not sufficient to maintain good catch rates; thus, catchable, sub-catchable, and fingerling channel catfish are supplementally stocked opportunistically throughout the stocking season from April to September, to keep up with demand. Catchable, sub-catchable, and fingerling rainbow trout are stocked multiple times throughout the stocking season. The proposed action will be adding brook, cutthroat, and Apache trout of multiple sizes to offer added opportunity and a variety of species, plus to give the state hatcheries more flexibility in available stocking locations when they have a surplus of a certain species.

Table 75. Stocking history for Fools Hollow Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1984	1986	2	1,000
Bluegill	1986	1989	2	25,000
Brown trout	1970	1994	35	525,249
Channel catfish	1961	2009	29	218,503
Cutthroat trout	1965	1972	4	93,000
Largemouth bass	1974	1985	3	23,100
Rainbow trout	1958	2009	259	1,763,444
Redear sunfish	1978	1978	2	20,000
Smallmouth bass	1987	1988	3	5,600
Walleye	1975	1985	2	259,700
Total			274	2,923,843

Fools Hollow Lake is a predator dominated system that is difficult to manage. Stocked trout provide an opportunity early in the year during spring and early summer, but return on trout during the summer peak season is low. Fools Hollow Lake is managed as a fee site, except for day-use anglers who can use the lake for free as long as they park in a designated parking area on the west side.

Fools Hollow Lake is also used frequently for kids' fishing clinics because of the excellent facilities and proximity to town. Often, trout are the target of most fishing clinics in the area and trout are stocked just prior to a clinic. However, trout often go into deep water in the summer months and are usually not caught during fishing clinics at that time. For this reason, the flexibility to stock a warm water species specifically for fishing clinics, such as bluegill, would greatly improve the success for kids participating in summer fishing clinics. The proposed action will include stocking catchable size bluegill for fishing clinics held at Fools Hollow Lake.

Northern pike have been illegally stocked into Fools Hollow Lake and threaten to impact recruitment levels of warm water sport fish, as well as preying on stocked trout. Efforts to control northern pike mechanically through gillnetting may be attempted. However, if mechanical methods are unsuccessful, piscicides may be considered. The Department would then want to restock with desirable warm water sport fish species, including largemouth bass, channel catfish, and bluegill to re-establish those populations, as well as to continue to stock regularly with rainbow trout, brook trout, cutthroat trout, Apache trout, and channel catfish, and stocking bluegill for fishing clinics. Thus, largemouth bass would only be stocked to re-establish the species following a catastrophic event or piscicide project that would result in the loss of the population.

On-site angler creel surveys were completed at Fools Hollow Lake in 1997 and 2006, reporting 34,425 angler hours (18,570 AUDs) and 39,778 angler hours, respectively (Meyer et al. 2008). A statewide angler mail-out survey reported 28,433 AUDs in 2001 (Pringle 2004).

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis of intensive use cold water sport fish with rainbow trout, and warm water sport fishery with largemouth bass, bluegill, walleye, channel catfish, and black crappie, which is mostly consistent with the proposed action. Additional trout species have been added to the proposed action to add angling diversity and also to give flexibility to the state hatcheries in stocking locations for surplus trout. Plus, walleye and black crappie were identified in the 2001 plan but not included in the proposed action primarily because of the outcome of a more recent planning effort. The Lakeside Area Fish Management Plan (Meyer et al. 2008) identifies managing for family fishing with high catch rates of any species, and for bass fishing, which is also consistent with the proposed action. Walleye have very low catch rates and likely prey upon the young of other sport fish, thus are not contributing to an emphasis of family fishing/high catch rates and bass fishing.

Proposed Action

Rainbow trout, brook trout, cutthroat trout, Apache trout, channel catfish, and bluegill are proposed for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow trout, would be stocked from April to September each year depending on suitable water levels and quality as well as fish availability; numbers of trout would be up to 200,000 fish annually. The primary goal would be to stock rainbow trout, however if other species including Apache trout, brook trout or cutthroat trout became available, they may be stocked opportunistically; no more than a total of 200,000 trout would be stocked annually.

Channel catfish (fingerling, sub-catchable, catchable) may be opportunistically stocked depending on water quality and fish availability from April to September each year; numbers of catfish stocked may be from 0 to 15,000 fish annually.

Catchable bluegill may be stocked annually from April to September in support of fishing clinics; numbers of fish stocked would be from 0 to 5,000 fish annually.

Bluegill (fingerling, sub-catchable, catchable) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Fools Hollow Lake is the end of a complex system of creeks and reservoirs in the Pinetop-Lakeside and Show Low area. Fools Hollow Lake may spill at about the same frequency as Show Low Lake (5 times in the last 14 years), but it does not release water for irrigation. When Fools Hollow Lake does spill water will travel through 15.0 miles of intermittent streambed through Lone Pine Dam to Schoen's Dam, located just above the confluence with Silver Creek. Additional discussion is located below in the Schoen's Complex analysis.

Fish Movement

Stocked fish in Fools Hollow Lake may move upstream into a perennial reach of Show Low Creek, but will only get as far as Show Low Lake dam, which is a barrier to natural upstream migration. Fish movement and assemblage information in Show Low Creek above Fools Hollow was previously provided. Movement of fish downstream of Fools Hollow Lake is discussed below in the Complex Analysis discussion.

Community Description

Fools Hollow Lake contains largemouth bass, smallmouth bass, walleye, northern pike, green sunfish, bluegill, black crappie, fathead minnow, channel catfish, black bullhead, common carp, crayfish, and bullfrogs (Table 76). Additional information on the aquatic community is provided in the Complex Analysis section below.

Table 76. Survey history on Fools Hollow Lake using experimental gillnets.

Species	**Apr. 2003**	**Apr. 2005**	**Apr. 2006**	**Apr. 2007**	**Mar. 2008**
Northern pike	2	8	1	3	4
Walleye	8	19	14	5	6
Largemouth bass	1	1	21	2	4
Smallmouth bass	1	1	8		2
Black crappie	1	2	25	10	6
Channel catfish	12	1	2	7	10

Species	Apr. 2003	Apr. 2005	Apr. 2006	Apr. 2007	Mar. 2008
Carp		7	4		1
Rainbow trout	5	7			6
Black bullhead	2				2
Bluegill	2	1	34	6	1
Green sunfish			18		

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts to stocked Apache trout are analyzed below. Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed in the complex analysis.

Apache Trout

Apache trout stocked opportunistically in Fools Hollow Lake may move upstream into a perennial reach of Show Low Creek, but will only get as far as Show Low Lake dam, which is a barrier to natural upstream migration. There is a possibility for stocked Apache trout to wash down into Show Low Creek, which flows continuous when Fools Hollow Lake spills, but is normally dry below the seepage area. There are no irrigation releases from Fools Hollow Lake. When Fools Hollow Lake does spill, it is generally in the spring during spring runoff, and usually not much water is lost at a time, mostly less than an inch over the wide spillway.

Apache trout are raised in the hatchery raceways to catchable size and stocked into the stream for a recreational put-and-take fishery, but they are not expected to establish a viable population in either the lake or downstream as stocked rainbow trout known are not known to reproduce in the lake or downstream. The primary goal would be to stock rainbow trout, however if other species

including Apache trout, brook trout or cutthroat trout became available, they may be stocked opportunistically.

Potential impacts

Stocked Apache trout co-stocked with other species

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Impacts from wild populations on stocked Apache trout

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to Fools Hollow Lake and downstream may include predation, hybridization with other trout and/or competition. Likelihood of hybridization is extremely unlikely since trout are not expected to reproduce due to lack of suitable habitat and stream temperature.

Northern Leopard Frog

Local Analysis: Although Fools Hollow Lake and the Schoen's buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in Fools Hollow Lake is low. There are no historical records for northern leopard frogs for the Fools Hollow Lake stocking site; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Lake of the

Woods (Lake of the Woods Resort (1942) and Rainbow lake (= Boat Ramp) (1972), (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Northern leopard frogs were not observed at any sites, including Lake of the Woods Resort (1994) and Rainbow Lake (= Boat Ramp) (1994) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Fools Hollow Lake that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest northern leopard frogs no longer occupy surrounding lakes or stream where fish could disperse and habitats are less suitable for northern leopard frogs due to the presence of crayfish, bullfrogs and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Fools Hollow Lake and the Schoen's buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in Fools Hollow Lake is low. There are no historical records for Chiricahua leopard frogs at the Fools Hollow Lake stocking complex; however, there is 1 historical record for Chiricahua leopard frogs from 1 site in the buffered stocking complex; Rainbow Lake (= Boat Ramp) (1972) (Figure 21, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 7 surveys and site records at 5 sites within the buffered stocking complex between 1942 and 2001, with most surveys conducted between 1984 and 2001. Chiricahua leopard frogs were not observed at any sites, including Rainbow Lake (= Boat Ramp) (1994) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy sites within the Schoen's buffered complex because they have not been detected during subsequent surveys and crayfish, bullfrogs and non-native fish, make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to fish stocked at Fools Hollow Lake that dispersed outside the buffered stocking complex is low, because subsequent surveys suggest Chiricahua leopard frogs no longer occupy surrounding lakes or streams where fish could disperse and habitats are less suitable for Chiricahua leopard frogs due to the presence of crayfish, bullfrogs, and non-native fish.

SCHOEN'S COMPLEX ANALYSIS

Water Distribution / Connectivity

All seven stocking sites within the Schoen's Complex are connected and flow downstream through Fools Hollow Lake as previously described. No irrigation water is released from Fools Hollow Lake. When Fools Hollow Lake does spill, water flows downstream over the concrete spillway. Show Low Creek immediately below the dam is perennial and is maintained by seepage through the earthen dam. Further downstream, Show Low Creek then flows during high flow events to Lone Pine Dam and on to Schoen's Dam, which is 15 miles downstream of Fools Hollow Lake, and which are two normally dry flood control structures.

Lone Pine Dam (Figure 27) is an earth fill flood control dam, owned and formerly operated by Navajo County for irrigation uses. It is located where Forest Road 134 crosses the creek several miles downstream from Fools Hollow Lake. As per the County Public Works Department's Floodplain Management Section, the reservoir does not maintain a permanent pool of water, and has a permanently open outlet because it is has been classed as an unsafe dam. Lone Pine has not been breached; however, there is concern over the failure of the fill material, for which reason it has only been allowed to fill once. Currently, Lone Pine Dam acts as a silt trap for Schoen's Dam further downstream. Similar concerns apply to Schoen's Dam, as it may not handle a potential failure of Lone Pine Dam. Both dam structures are made of and located on an unstable geologic formation. Schoen's Dam is a newer irrigation and flood control dam located downstream of Lone Pine Dam on Show Low Creek. The reservoir is used for flood control, recreation, and irrigation; it is owned and operated by the Silver Creek Irrigation District.

Figure 27. Lone Pine Dam aerial photograph.

The Schoen's Dam area is normally dry (Figure 28) but does receive water during very high precipitation years, and when Fools Hollow Lake spills significantly. The structure is operated by Navajo County and the Silver Creek Irrigation District under an emergency flood control plan. The dam will capture water coming down lower Show Low Creek and a few other minor

tributaries, and water is released only at certain fill levels. The dam can capture water in a sediment storage stage, up to 3,000 acre-feet of water, or a surface elevation of 5,740 feet. At this elevation, the pool of water is approximately 35 feet deep. Water is not released until the pool exceeds this capacity, which normally is not reached; the water captured up to 5,740 feet elevation that is not released evaporates and seeps into the ground, killing any fish stranded there when the pool dries out. The area above Schoen's dam on Show Low Creek is dry 75% of time according to the manager of Silver Creek Irrigation District, who is a long time resident of the area for 75 years (P. Shumway, pers. comm.). Any water in storage between top of minimum pool at 5,740 feet and flood stage at 5754' is held and released down to minimum pool by Silver Creek Irrigation during the summer months through the irrigation tower. Any level over flood stage (5,754 feet?) is released down to below flood stage through the tower release structure under a flood control plan. Navajo County steps in and releases water, to bring the pool back down to irrigation level during flood stage at the dam. The amount of release depends upon how much water is flowing through Snowflake and Taylor from upper Silver Creek and other drainages because the creek through these towns can't be allowed to exceed 2,500 cfs total flow. The operation of Schoen's Dam during flood stage is controlled by Navajo County Flood Control.

Figure 28. Schoen's Dam aerial photograph.

When the pool at Schoen's Dam exceeds 3,000 acre feet or 5,740 feet elevation, it enters the irrigation storage, which can be released slowly during the summer months by the Silver Creek Irrigation Company through a headgate in the dam down into Silver Creek. It is diverted out in Snowflake and Taylor for irrigation until the level drops back down to the sediment storage

stage, then the releases are shut off. The irrigation storage capacity ranges from 3,000 to 6,000 acre feet, or an elevation between 5,740 and 5,754 feet, and can be released down into Silver Creek for irrigation where it is diverted out of the stream.

From the confluence with Show Low Creek, about 2.5 miles below Schoen's Dam, Silver Creek flows north for 10.5 miles to the town of Snowflake, then another 19.4 miles to the confluence with the LCR. From the confluence with Silver Creek, the LCR flows downstream for 43.3 miles to the confluence with Chevelon Creek, then another 9.1 miles to the confluence with Clear Creek, then for 73.1 miles to Grand Falls. From Grand Falls, the LCR runs downstream for 81.0 miles to Blue Springs, then for 13.1 miles to the confluence with the Colorado River. Upstream of the confluence with Silver Creek, the LCR runs 85.1 miles from Lyman Lake. Additional discussion on areas downstream and upstream of the Silver Creek confluence with the LCR is provided in the Lyman Lake and Chevelon Creek Complex respectively.

Fish Movement

It is unknown how often Fools Hollow Lake spills but it is anticipated to spill occasionally within the next 10 years. The 15 miles of Show Low Creek below Fools Hollow Lake is normally dry except the first several hundred meters; fish could only navigate this reach during high flow events.

If trout do not make it all the way to Schoen's Dam during a spill event, they will not persist long in the intervening stream reach. It is low elevation, silty, and warm, and it goes dry on a regular basis. However, trout could get through to Silver Creek during irrigation releases or during flood level releases when Schoen's Dam is filled. Even if they do make it to Silver Creek, they are unlikely to persist there either due to poor habitat conditions. Many irrigation diversions occur in Taylor and Snowflake, and as a result Silver Creek gets very warm. There has never been a trout of any kind collected in Silver Creek downstream of White Mountain Lake in many years of survey: 1991, 1992, 1993, 1997, 1999, 2000, 2002, 2003, 2004, 2006, 2007, 2009, illustrating that if trout do make it to Silver Creek, it is in extremely low numbers and they do not persist.

There is a possibility for stocked species to wash down into Show Low Creek, which flows continuous when Fools Hollow Lake spills, but is normally dry below the seepage area. There are no irrigation releases from Fools Hollow Lake. When Fools Hollow Lake does spill, it is generally in the spring during spring runoff, and usually not much water is lost at a time, mostly less than an inch over the wide spillway. Sometimes the lake spills for longer periods when it has higher lake levels, but will always be at very low spill rates outside of spring season. At these spill levels, it is unlikely any fish would go over the spillway. Observational experience of AGFD biologists is that the lake has to spill heavily before fish would go over the spillway, especially warm water species. This spill rate has happened approximately 4-5 times in the last 15 years.

When stocked fish are able to go over, it is likely this would be limited to trout, sunfish, and bass. Catfish tend to be very sluggish in the spring because of the cold water temperatures and are along the bottom. The Department has not seen evidence of channel catfish moving downstream of lakes with spillways similar to Fools Hollow Lake, where there isn't a gradual incline to the spillway; however, it is still possible. Once in the pool above Schoen's Dam, fish would not have the opportunity to reach Silver Creek until the pool level reaches the irrigation level, which is at 3,000 acre feet, or an elevation of 5,740 feet (MSL). The irrigation company cannot release water through Schoen's Dam until the pool level reaches this elevation, which is about 35 feet deep at the dam and the top of the irrigation tower. The pool does not reach this depth often and usually dries up before releases occur, resulting in mortality of all the fish trapped in the pool.

When it does reach the irrigation level or higher, fish have the opportunity to escape down into Silver Creek when water is released for irrigation. The grate on the outlet structure is fairly large, approximately 6-7 inches wide. The outlet pipe through the dam is also very large, approximately 4 feet in diameter. However, some species would be more prone than others to escape because of the raised outlet; the bottom of the outlet grate is situated on the vertical tower approximately 25 feet above the lake bottom. Open water fishes like trout, if they were to persist in the pool, would be the most likely to go through. Bottom dwellers, like channel catfish, are not likely to come off the bottom of the lake to find the outlet, thus, they would be very unlikely to end up in Silver Creek from the Schoen's Complex. Only one channel catfish has been found in lower Silver Creek during surveys over the last 20 years. In addition, there are other sources of warm water fishes contributing to the Silver Creek assemblage. White Mountain Lake is located right on Silver Creek upstream of Shumway, spills nearly every year, has good flow from Silver Springs, and a very large watershed in Brown Creek and Rocky Arroyo. Bluegills have never been found in lower Silver Creek, likely because they do not persist in these stream environments. Green sunfish are common, being well suited to conditions like Silver Creek, but not bluegill. Ten bluegill reported in a recent survey (2007) were likely misidentified; that survey found 10 sunfish, all identified as bluegill by a new biologist not familiar with the area, who did not think to distinguish between sunfish species. Every other survey in Silver Creek has found all green sunfish and no bluegill; this one survey biologist found 10 bluegill but no green sunfish. Largemouth bass and sunfishes prefer cover, such as the brush, rocks, and debris present along the shorelines of the pool, away from the outlet in open water. Some bass and sunfish will likely use the tower in Shoens Lake itself for structure; however, these numbers are likely to be low especially due to the nature of flows during times when water levels would be high enough to result in release through the outflow structure and also due to the nature of the release structure (located in center area of Schoen's). It is possible for largemouth bass and sunfish to get through during irrigation and flood releases. Largemouth bass are only proposed to be stocked in Rainbow Lake which is located upstream of Scott Reservoir, Show Low Lake and Fools Hollow

Lake, all of which have naturally reproducing largemouth bass populations. Recently, largemouth bass have been more numerous in the collections in Silver Creek (see Table 19); however, these were more likely to have come from White Mountain Lake, which has thriving populations of warm water fishes, including largemouth bass, bluegill, and green sunfish, and it spills every year directly into Silver Creek.

If the pool behind Schoen's Dam ever reaches flood stage, which is defined as a capacity of over 6,000 acre feet or above 5,754 feet elevation, Navajo County steps in and releases water, to bring the pool back down to irrigation level. The amount of release depends upon how much water is flowing through Snowflake and Taylor from upper Silver Creek and other drainages because the creek through these towns can't be allowed to exceed 2,500 cfs total flow. The operation of Schoen's Dam during flood stage is controlled by Navajo County Flood Control.

Community Description

Show Low Creek immediately below Fools Hollow Lake contains green sunfish, fathead minnow and bullfrog tadpoles in several large beaver ponds that are supplied by seepage through the earthen dam (M. Lopez pers. comm.). Below these beaver ponds, the 15 miles of stream to Schoen's Dam is fishless because it is normally dry. Schoen's Dam pool, when there is water, sometimes contains an occasional largemouth bass, sunfish, or channel catfish before it dries up based on conversations with local anglers (M. Lopez pers. comm.). Schoen's Dam pool has never been surveyed.

Silver Creek between White Mountain Lake and Snowflake was found to contain fathead minnow, golden shiner, green sunfish, common carp, Little Colorado sucker, bullfrogs and crayfish during a survey in 2004 (McKell and Lopez 2005), and fathead minnow, Little Colorado sucker, crayfish, and bullfrog tadpoles during a recent survey in 2009 (AGFD unpublished data).

Downstream of Snowflake, Silver Creek was found to contain Little Colorado spinedace, Little Colorado sucker, bluehead sucker, yellow bullhead, green sunfish, common carp, fathead minnow, largemouth bass, channel catfish, bullfrogs, and abundant crayfish (Lopez et al. 1999a; McKell and Lopez 2005; Weiss 2007d). Fifteen Little Colorado spinedace were found in intensive surveys in 1997, but have not been found in nearly annual surveys since then: 1999, 2000, 2002, 2003, 2004, 2006, 2007, and 2009. They also had not been found prior to that for 30 years, with the previous record in 1967 (Lopez et al. 1999a; McKell and Lopez 2005).

Table 77 summarizes the numerous surveys in lower Silver Creek below White Mountain Lake in the last 20 years. Surveys sampled the stream both above and below the Show Low Creek confluence. Surveys show that trout and bluegill have not been captured in lower Silver Creek. The 1991 and 1993 surveys were conducted with backpack electroshockers in August of each year (Dorum and Young 1995); the 1992 survey was conducted with a seine in May (AGFD unpublished data); the 1997 survey was conducted with a backpack electroshocker and seine in

July; the 1999 survey was conducted with a backpack electroshocker in November-December; and the 2000, 2002, and 2003 surveys were conducted with seines in May, July, and April, respectively (McKell and Lopez 2005). The 2004 (McKell and Lopez 2005) and 2006 (AGFD unpublished data) surveys were conducted with a backpack electroshocker in June-August and June, respectively; the 2007 surveys were conducted in March and October with a backpack electroshocker, seine, and hoop nets (Weiss 2007d); and the 2009 surveys were conducted with a backpack electroshocker and seine in June (AGFD unpublished data).

Table 77. Summary of fish collection data from Silver Creek below White Mountain Lake since 1991.

Year	**Species**									
	LC spinedace	**LC sucker**	**Bluehead sucker**	**Fathead minnow**	**Green sunfish**	**Yellow bullhead**	**carp**	**Largemouth bass**	**Golden shiner**	**Channel catfish**
1991				19	9	2	2			
1992				22	6		13		1	
1993		4	64	106	12	1	5			
1997	15	142	2	2180	48	11	63			
1999		18	7	578	63	17	167	13		
2000		3		611	12	11	91			1
2002		present		present	present	present	present	present		
2003		3		516	55	35	24			
2004		58	1	898	314	25			3	
2006				present						
2007		3		369	59 *	26	77	3		
2009		40		502	55	6	25			

* Ten of these sunfish were originally reported as bluegill by a beginning biologist, however were considered to be mis-identified green sunfish when the situation was evaluated closely (Weiss 2007d).

Open-water fishes like trout, if they were to persist in the pool, would be the most likely to go through. Bottom dwellers, like channel catfish, are not likely to come off the bottom of the lake

that far to find the outlet, and thus would be very unlikely to end up in Silver Creek from the Schoen's Complex. Only one channel catfish has been found in lower Silver Creek in the last 20 years of surveys. This one catfish record more likely came from White Mountain Lake, which is located right on Silver Creek upstream of Shumway and spills nearly every year, has good flow from Silver Springs, and has a very large watershed in Brown Creek and Rocky Arroyo.

Largemouth bass and sunfishes prefer cover, such as the brush, rocks and debris present along the shorelines of the pool, away from the outlet in open water. Some bass and sunfish will likely use the tower itself for structure; however, these numbers are likely to be low. It is possible for largemouth bass and sunfish to get through during irrigation and flood releases, but likely in low numbers because of the location and elevation of the outlet above the bottom of the pool. Bluegill has never been found in lower Silver Creek, likely because they do not persist in these stream environments. Green sunfish are common, being well suited to conditions like Silver Creek. Recently largemouth bass have been more numerous in the collections in Silver Creek; however, these were more likely to have come from White Mountain Lake, which has thriving populations of warm water fishes, including largemouth bass, bluegill, and green sunfish, and spills every year directly into Silver Creek.

Once in Silver Creek, fish could move upstream, but can get no further upstream than at the dam at White Mountain Lake. Numbers of low diversions would likely be barriers to upstream movement of warm water species. Fish could also move downstream in to lower Silver Creek. At the bottom end of Silver Creek, just up from the confluence with the LCR, is Woodruff Dam, with a vertical drop of approximately 15 feet. This is a barrier to upstream movement of fish, but not downstream movement. Once in the LCR, fish could possibly move upstream to the dam at Lyman during high flows, or downstream towards Chevelon Creek confluence and beyond.

As mentioned before, escaped trout would not persist very long at all in the Schoen's Dam pool or in Silver Creek.

Although narrow-headed garter snakes are not known from the LCR, there are historical and recent (but unverified) records of northern Mexican garter snakes from the watershed (see analysis below).

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen

or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts due to the proposed action to Chiricahua and Northern leopard frogs are analyzed above at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake, narrow-headed garter snake, as well as Little Colorado spinedace located downstream in Silver Creek and Little Colorado critical habitat in lower Chevelon Creek are addressed below in the complex analysis.

Little Colorado Spinedace and Critical Habitat

Little Colorado spinedace were collected in Silver Creek in 1997, three miles upstream of Woodruff Dam, near the confluence with the LCR (Lopez et al. 1999a) and about 23 miles downstream of Schoen's Dam.

Six spinedace were collected in Cottonwood Wash, near the confluence with Silver Creek, in 1974 (Dorum and Young 1995). The confluence is approximately 38 miles downstream from Fools Hollow Lake. Cottonwood Wash flows into Silver Creek immediately north of Snowflake. Spinedace were collected in a single stagnant isolated pool below State Highway 77. The area has been heavily modified by sand and gravel mining in and around lower Cottonwood Wash since 1974 and is no longer suitable habitat for spinedace. Cottonwood Wash is an intermittent system and it is likely the 1974 collection location was in a pool more influenced by the water table in Silver Creek than the Cottonwood Wash system itself. Efforts to collect spinedace in Silver Creek, including attempts at this site, have occurred frequently (Table 77).

The Silver Creek spinedace population was considered extirpated until fish were collected from lower reaches of the creek in 1997, about 14 miles downstream from the 1974 collections. Although the Department has extensively surveyed suitable locations along Silver Creek in subsequent years, including the area spinedace were collected, no spinedace have been located since 1997. Extensive surveys were conducted in Silver Creek in 2004, and no spinedace were located; however, very few native fish were found at the sites surveyed (Table 77). Recent surveys were conducted in 2006, 2007, and 2009 without finding spinedace. Very heavy flows through lower Silver Creek in 2005 scoured out many of the beaver dams, making it difficult to survey the stream. While the habitat looked in much better shape, with good mix of run, riffle, and pools instead of miles of back-to-back beaver pools, the 2006 survey found very few fish using electrofishing equipment; only a small number of fathead minnow. It may be likely that the flood flows also flushed out many of the fish in the stream. The Department hopes this would create an opportunity for any native fishes that persisted through the flooding to re-establish

quicker in the absence of hoards of non-native fish. The 2007 and 2009 surveys did not detect that trend, again finding non-native fish to be dominating, with no evidence of spinedace.

The collection of spinedace in lower Silver Creek in 1997 is considered the closest occurrence of spinedace to the proposed stocking sites in the Schoen's Complex. Spinedace also occur in the LCR near St. Johns, approximately 66 miles upstream of the Silver Creek and LCR confluence.

Potential Impacts

Potential impacts from these stocked species: rainbow, brook, cutthroat, and Apache trout, channel catfish, largemouth bass, and bluegill, could be predation on young of the year or adult spinedace as a result of transport out of Fools Hollow Lake and into in Silver Creek. Competition for food and space between stocked and transported species may also occur. The historic survey data from Silver Creek (Table 77) indicate that spinedace may not be present anymore. The data also indicate that stocked trout species have not been detected in formerly occupied spinedace habitats. Additionally, the temporal nature of this stream system doesn't provide habitat suitable for trout persistence or reproduction through summer months.

Largemouth bass are only proposed to be stocked in Rainbow Lake which is located upstream of Scott Reservoir, Show Low Lake and Fools Hollow Lake, all of which have naturally reproducing largemouth bass populations. Fools Hollow Lake does spill in heavy precipitation years, allowing the opportunity for fish transport downstream, where they would end up in Schoen's Dam pool. Schoen's Dam presents a partial temporal barrier to further downstream movement of fish. The potential for fish to move out of Schoen's Dam pool is possible, although that potential is low and is expected to be infrequent for largemouth bass and bluegill when water is released at irrigation stage or flood stage. Largemouth bass may persist in Silver Creek, but not bluegill because there have been no verified records of bluegill in Silver Creek in numerous surveys (Table 77). Largemouth bass may prey directly upon adult or juvenile spinedace if the two species occur in the stream at the same time. However, this is unlikely to occur because spinedace are not likely to be present in the system anymore and few stocked fish get to this area. Numbers of escaped fish reaching Silver Creek is extremely low, and spinedace densities in Silver Creek are also extremely low, if they still exist there at all. Largemouth bass are not expected to reproduce in Silver Creek, thus progeny of these escaped fish are not likely to impact spinedace by predation or competition. Bryan et al. (2002) reported an increased potential for impacting habitat use of spinedace in the presence of multiple predators. Crayfish, green sunfish, and yellow bullhead are well established in lower Silver Creek. The US Fish and Wildlife Service (USFWS 2008e) states that the greatest non-native species threat to spinedace were green sunfish and smallmouth bass, two species not proposed for stocking.

Stocked trout may rarely reach Silver Creek and potentially impact Little Colorado spinedace through predation or competition. The probability of that event occurring and the events that

would need to happen for the interaction to occur was discussed previously. Lower Silver Creek and occupied spinedace habitat is very warm and unsuitable for trout during most months of the year. Twelve years of surveys (Table 77) have found no salmonids in Silver Creek downstream of White Mountain Lake, which is also downstream of Schoen's Dam. The steps needing to occur for trout movement to happen have also been discussed. The stocked species of trout are unlikely to have an opportunity to pass over the spillway at Fools Hollow Lake and make the trip to below Schoen's Dam most of the time. Many of the spill events are of very small flow (<1" over the wide spillway) and would not allow for passage of most fish. Warm water fish are not inclined to follow the current like trout, and are unlikely to have recently hatched fish at that time of year that could pass over a low spill event. It is only during the extreme flood events that fish have a realistic chance of getting moved around in connecting systems. Also, the operation and outlet works at Schoen's Dam present another obstacle for warm water fishes to reach Silver Creek, although it is still possible that largemouth bass and bluegill may reach Silver Creek. Bluegill will not persist, due to the fact that no verified records of bluegill in Silver Creek in 12 years of surveys, but bass could persist and have some effect.

Critical Habitat

The nearest designated critical habitat for spinedace is located in lower Chevelon Creek, approximately 90.9 miles downstream of Fools Hollow Lake, via 15.0 miles to Schoen's Dam, another 32.6 miles to the LCR-Silver Creek confluence, and another 43.3 miles to the LCR-Chevelon Creek confluence.

Potential Impacts

It is extremely unlikely for escaped stocked fish to impact critical habitat. The potential for escaped fish into Silver Creek is already extremely low, and would be even more unlikely, although possible, to further reach lower Chevelon Creek. Escaped fish could not reach designated critical habitat in East Clear Creek because of the dam at Clear Creek Reservoir in lower Clear Creek, or in Nutrioso Creek because of the dam at Lyman Lake on the LCR.

Trout would not persist in the Schoen's Dam pool or in Silver Creek, and have not been collected in Silver Creek in 12 years of surveys. Channel catfish would not be able to escape through Schoen's Dam outlet because of the configuration of the outlet approximately 25 feet above the lake bottom. Only 1 record of a channel catfish has been reported in Silver Creek in 12 years of survey, and this one record is likely from White Mountain Lake, which has a large population of channel catfish and other warm water species, and is located on and spills annually directly into Silver Creek upstream of Snowflake-Taylor.

Northern Mexican Garter Snake

Stocking complex analysis: It is unknown whether northern Mexican garter snakes occupy the Schoen's Complex, though there have been no systematic surveys for the species in this area (USFWS 2008, Holycross et al. 2006). Within the 20 km buffer established for this stocking complex there are historical records of northern Mexican garter snakes from and near Lake of the Woods (1942, 1949) SE of Show Low, but none have been detected since then (Holycross et al. 2006). Those are the only records for northern Mexican garter snakes in the Little Colorado River watershed. Current habitat quality for northern Mexican garter snakes at Lake of the Woods is low. Bullfrogs, crayfish and non-native fish communities occupy all of the proposed stocking sites, the creeks connecting them (Walnut Creek, Billy Creek, Porter Creek, Show Low Creek), as well as Silver Creek into which they drain. Therefore, it is unlikely that northern Mexican garter snakes persist at those sites. Two recent (2004) but unverified northern Mexican garter snake records have been reported from the Fort Apache Indian Reservation, outside of the 20 km buffer, near White Paradise Creek and ~28 air km SE of Lake of the Woods. The likelihood is low that northern Mexican garter snakes will be exposed to fish stocked in Woodland Lake, Rainbow Lake, Show Low Lake, Fools Hollow Lake, Scott Reservoir or Show Low Creek.

Downstream analysis: All seven stocking sites within Schoen's Complex are connected and flow downstream through Fools Hollow Lake. Because there are no northern Mexican garter snake records downstream of these sites and none elsewhere in the Little Colorado River watershed, it is unlikely that northern Mexican garter snakes will be exposed to dispersing fish (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.).

Narrow-headed Garter Snake

Stocking complex analysis: Narrow-headed garter snakes are not known to occupy the Little Colorado River or its tributary streams, therefore, it is unlikely the species will be exposed to fish stocked into Woodland Lake, Rainbow Lake, Show Low Lake, Fools Hollow Lake, Scott Reservoir or Show Low Creek. The nearest historical (1965) narrow-headed garter snake record is on the Fort Apache Indian Reservation, about 4 km SE of McNary along the North Fork of the White River (Salt River drainage). Narrow-headed garter snakes are not known to move overland beyond about 200 m from a stream edge (Nowak 2006a), and therefore if they occur elsewhere in the North Fork of the White River watershed they are highly unlikely to move overland and disperse to the proposed stocking sites. Bullfrogs, crayfish and non-native fish communities occupy all of the proposed stocking sites, the creeks connecting them (Walnut Creek, Billy Creek, Porter Creek, Show Low Creek), as well as Silver Creek into which they drain. Narrow-headed garter snakes are unlikely to disperse to any of the stocking sites, and they are not considered suitable habitat.

Downstream analysis: All seven stocking sites within Schoen's Complex are connected and flow downstream through Fools Hollow Lake. Because there are no narrow-headed garter snake

records downstream of these sites and none elsewhere in the Little Colorado River watershed, it is unlikely that narrow-headed garter snakes will be exposed to dispersing fish (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers.comm.).

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Little Colorado River Watershed, continued

MIDDLE LITTLE COLORADO RIVER

The Chevelon Canyon drainage contains five proposed stocking sites. These sites form two complexes: Black Canyon Lake Complex and Chevelon Creek Complex (Figure 1). Chevelon Canyon flows perennial and intermittent north into the Little Colorado River (LCR).

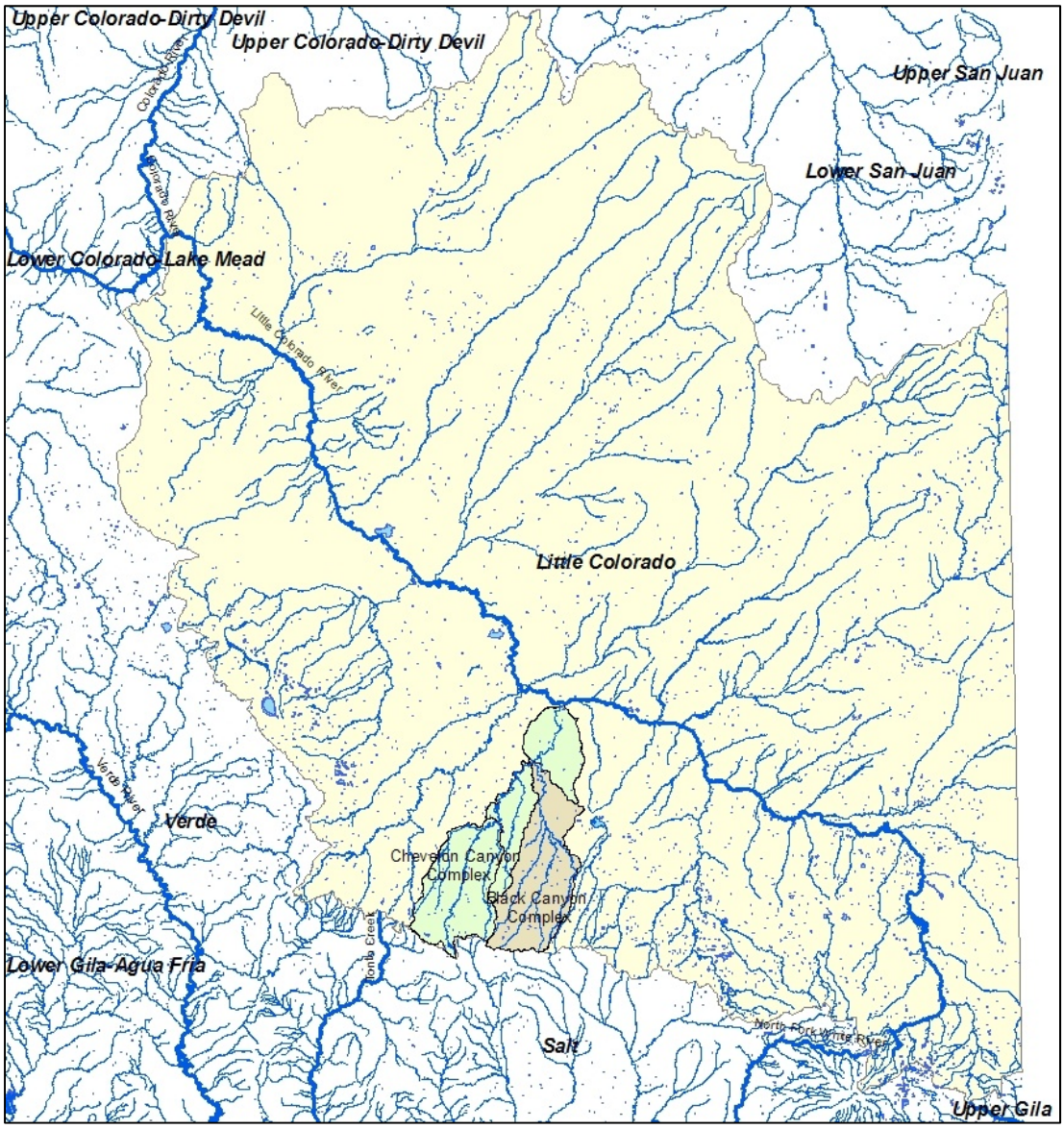

Figure 1. Chevelon Canyon sub-watershed location within the Little Colorado River watershed.

BLACK CANYON LAKE COMPLEX

<u>Black Canyon Lake</u>

Site Description

Black Canyon Lake is located in the headwaters of Black Canyon, an intermittent tributary of Chevelon Creek on the Apache-Sitgreaves National Forest, approximately 18 miles southwest of Heber. The dam was constructed in 1964, creating a lake 78 surface acres in size, with a maximum and average depth of 60 and 35 feet, respectively. The lake is located at an elevation of 7060 feet on West Fork Black Canyon.

Black Canyon Lake is accessed by an all-weather gravel road, Forest Road 86, from April through November. The lake ices over in the winter and is typically inaccessible by vehicle during that time. The lake receives little ice fishing use because snowmobiles that would have access prefer to ride to other destinations. The lake offers paved parking, restrooms, and a boat launch ramp on the southwest side of the lake. This spot is the only vehicle access to the lake and shore anglers must hike to other parts of the lake. Shore fishing is usually concentrated around the vehicle access point. Camping is not allowed at the lake, but a Forest campground is located close by at the junction of Forest Roads 300 and 86.

Management of Water Body

Primary fishery is a cold water put-grow-and-take fishery. Catchable and sub-catchable rainbow trout are stocked multiple times throughout the stocking season, and brook trout are being proposed for future stockings. This fishery supports angling use from spring through fall.

Black Canyon Lake was historically a good put-grow-and-take trout fishery until the long term drought started impacting water quality and lowering water levels. Then the lake turned into a put-and-take trout fishery, especially after largemouth bass were illegally stocked. Table 1 provides a summary of historical stocking in Black Canyon Lake. Ash runoff from the Rodeo-Chediski Fire in 2002 caused a complete fish kill, and the lake was monitored for several years following that event. Oxygen and primary productivity returned quickly to Black Canyon Lake and it was stocked with trout late that fall. For the next couple years the lake was very productive, partially because of the nutrient loading in the lake from the ash runoff, but also because most of the crayfish were also killed. Other benthic invertebrates, such as chironomids, exploded and led to rapid growth in stocked trout. As the crayfish slowly repopulated to original levels, the other benthic invertebrates crashed, and so did the trout growth. Currently, the lake is semi-productive, but best as a put-and-take trout fishery, particularly after the illegal stocking of largemouth bass plus green sunfish.

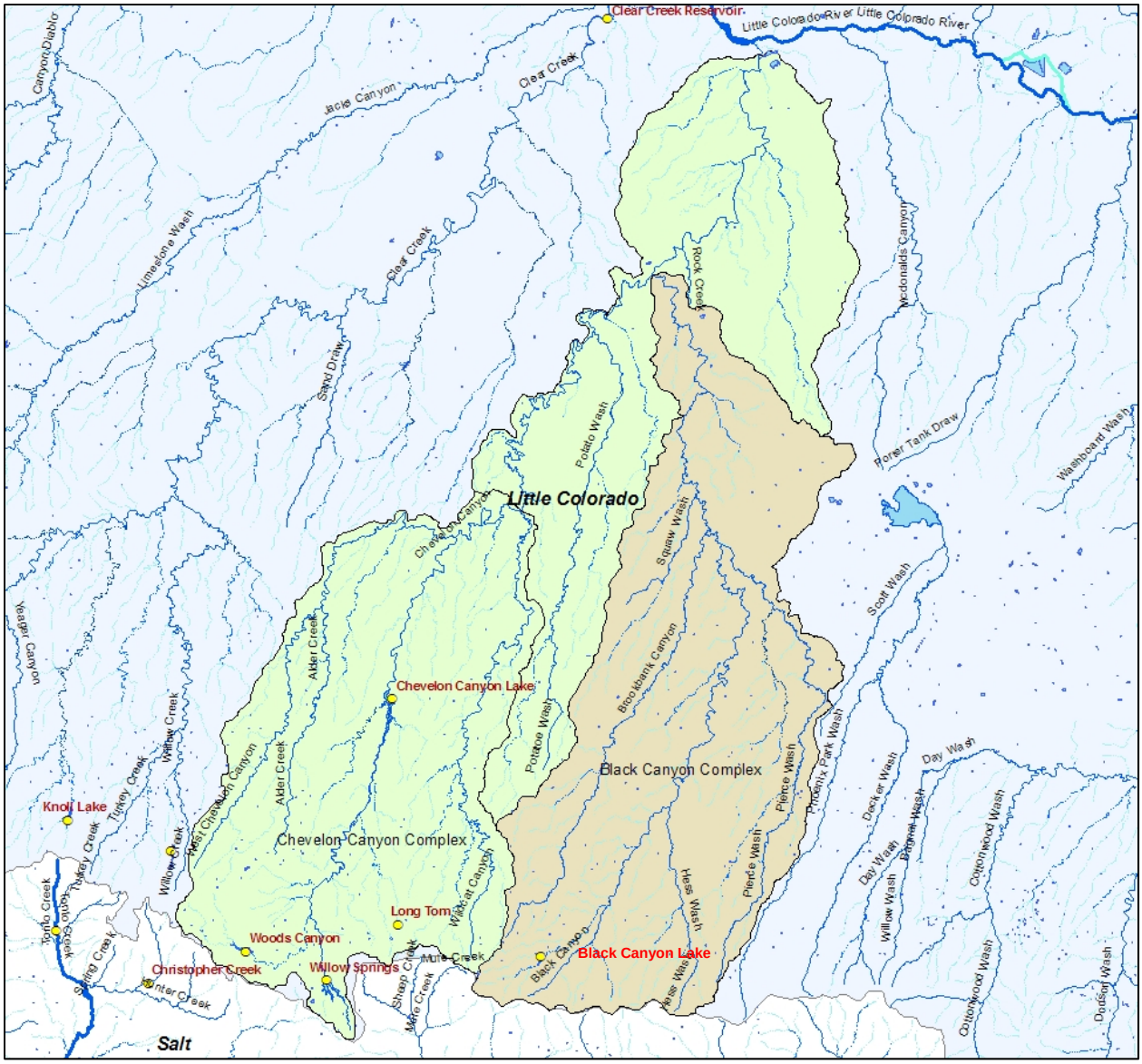

Figure 2. Chevelon Creek drainage which contains the Black Canyon Complex (Black Canyon Lake) and flows north into the Little Colorado River.

Table 1. Stocking history in Black Canyon Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1964	1990	12	160,786
Brown trout	1977	1994	20	164,403
Rainbow trout	1964	2009	258	1,796,983
Total			290	2,122,172

AGFD is planning to increase the size of the spillway on Black Canyon Lake for dam safety reasons, at which time the lake may have to be temporarily lowered to accommodate the construction. The new spillway will not increase the chance of spilling once it is completed; as it will be built at the same elevation as the current spillway, just wider to better handle possible extreme flood flows. The new spillway may result in a decreased potential for fish to go over the spillway during low and moderate spill events because the spill volume will be spread across a broader cross-sectional area, resulting in a shallower flow over the spillway.

Black Canyon Lake is managed exclusively for cold water trout fishing; however, illegal stockings of largemouth bass and green sunfish have impacted that management direction. Beginning on January 1, 2009, bag limits on warm water fishes were removed, allowing unlimited harvest of bass and catfish on all rim area lakes, as a first step to send the message to anglers that those area waters are managed only for trout.

Black Canyon Lake has been stocked with rainbow trout only since 1995; however, the Department would like to offer some diversity to the trout fishing opportunity. Brown trout were considered, but dropped because of their ability to survive warmer temperatures better than other trout species. Thus, brook trout were added to the proposal since they were considered to be of little to no threat of surviving in lower Chevelon Creek if they were to get out of Black Canyon Lake.

Black Canyon Lake supported 16,101 angler use days in 2001, as reported by mail-out survey (Pringle 2004), and 11,059 AUDs in 1985, as documented by on-site angler creel surveys.

The Integrated Fisheries Management Plan for the Little Colorado River (LCR) Watershed (Young et al. 2001) identifies a management emphasis of basic yield and intensive use sport fish, with a desired species assemblage of rainbow trout and bluehead sucker. The proposed action is consistent with this emphasis, except that brook trout, which will be managed as intensive use sport fish, have been added to provide additional diversity of angling opportunity, which will help deter anglers from illegally stocking much more harmful species when they are not satisfied with the fishing.

Proposed action

The Department proposes to stock rainbow trout and brook trout into Black Canyon Lake for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow will be stocked multiple times from April to September each year; numbers of trout stocked may be from 0 to 40,000 fish annually.

Catchable, sub-catchable, and fingerling brook trout will be stocked multiple times from April to September each year; numbers of trout stocked may be from 0 to 15,000 fish annually.

Water Distribution/Connectivity

Black Canyon Lake is located on the West Fork Black Canyon, which is intermittent both above and below the lake. Black Canyon Lake receives most of its water from spring snowmelt runoff or seasonal monsoon events. There are no permanent flows entering the lake. The small watershed, which is approximately 3400 acres, in upper West Fork Black Canyon above the lake, is the only contributing watershed. AGFD owns water rights in Black Canyon Lake and does not release water for irrigation or other uses downstream.

The lake fills and spills into West Fork Black Canyon only during years with heavy snowpack runoff or heavy winter precipitation. West Fork Black Canyon extends for 4.5 miles from the lake to its confluence with Black Canyon. Black Canyon extends for 51.6 miles to its confluence with Chevelon Creek at a point approximately 47.9 miles downstream of Chevelon Canyon Lake at an area called McCauley Sinks. Additional information about this area can be found in the Chevelon Creek Complex discussion. West Fork Black Canyon and Black Canyon are normally dry and flow when the lake spills during heavy spring snowmelt runoff and extreme monsoon events. Portions of Black Canyon downstream from the lake may flow during spring runoff and monsoon events even when the lake does not spill, because the Black Canyon watershed itself is large and also receives runoff from areas other than Black Canyon Lake. The lake can experience some drastic water level fluctuations, despite having no irrigation releases, due to the very small watershed when storms fail to replace water lost to evaporation and seepage during drought years.

The Black Canyon and Chevelon confluence area is dry most of the year, and flows regularly in the spring when Chevelon Lake spills on an annual basis. From the confluence area, the flow continues down Chevelon Creek for 5.1 miles to permanent flow in Chevelon Creek and the area that can support fish year around. From there it is another 3.5 miles downstream to occupied Little Colorado spinedace habitat, and another 2.4 miles downstream to the upper end of Critical Habitat for Little Colorado spinedace. Then it is another 8.6 miles downstream to the confluence with the LCR. Overall, Black Canyon Lake is located 51.6 miles upstream of Chevelon Canyon, 64.7 miles upstream of occupied Little Colorado spinedace habitat, 67.1 miles upstream of designated Little Colorado spinedace critical habitat, and 75.7 miles upstream of the confluence with the LCR.

The lower 14.5 miles of Chevelon Creek has permanent continuous flow, supporting fish populations year around; however, it is unsuitable for trout. This portion of Chevelon Creek gets very warm in the lower elevations (4900-5165 feet) and experiences extremely high conductivity. Some water is diverted from lower Chevelon Creek for waterfowl ponds on the Chevelon Wildlife Area, and also towards the city of Winslow at a large diversion dam 1.7 miles upstream of the LCR. From the confluence of Chevelon Creek and the LCR, the LCR runs downstream for 176.3 miles to the confluence with the Colorado River. The upper 12-15 miles of

this portion of the LCR runs perennial from flows coming from lower Chevelon Creek, at which point permanent flows disappear into the sand. Then, most of the LCR is dry down to permanent water entering the lower LCR at Blue Spring, approximately 13.1 miles upstream of the Colorado River.

The entire drainage is connected and can flow heavily from Black Canyon Lake to the Colorado River, via West Fork Black Canyon, Black Canyon, Chevelon Creek, and the LCR, when the lake is spilling during heavy spring snowmelt runoff. However, much of it dries up during the summer, including all 4.5 miles of West Fork Black Canyon, all 51.6 miles of Black Canyon, 5.1 miles of portions of Chevelon Creek, and much of the LCR from Winslow to Blue Spring. There are no physical barriers that would prevent downstream movement of trout when it is flowing continuously in the spring during wet years. Two USGS stream gauges exist in Chevelon Canyon, but none in Black Canyon; one near Winslow at the bottom of the stream system (Figure 3) and one below the confluence with Wildcat Canyon (Figure 4).

Fish Movement

Trout stocked into Black Canyon Lake cannot go far upstream when the drainage upstream is flowing in the spring; they will die when the drainage dries in the summer.

Trout can only escape downstream when the lake spills, because no water is released for irrigation. The lake does not spill every year; usually only during years with above average winter precipitation. When the lake does spill, it is possible for an escaped fish to travel down West Fork Black Canyon, Black Canyon, into Chevelon Creek, and down to Little Colorado spinedace occupied habitat. It is also possible for trout to continue down Chevelon Creek and into the LCR and beyond.

However, an escaped trout would have to travel the entire 51.6 miles to Chevelon Creek in the short period of spring runoff. If a trout did not make it all the way to Chevelon Creek before the summer months, it would die as the West Fork Black Canyon and Black Canyon dry up entirely.

If a trout did reach permanent water in Chevelon Creek, it would not persist, as the water temperatures warm to lethal levels for trout in the summer months, particularly downstream of Black Canyon confluence. Lack of persistence is supported by the lack of trout in the survey data in Chevelon Creek downstream of Black Canyon over many years of surveys (see Chevelon Canyon Complex analysis for survey information).

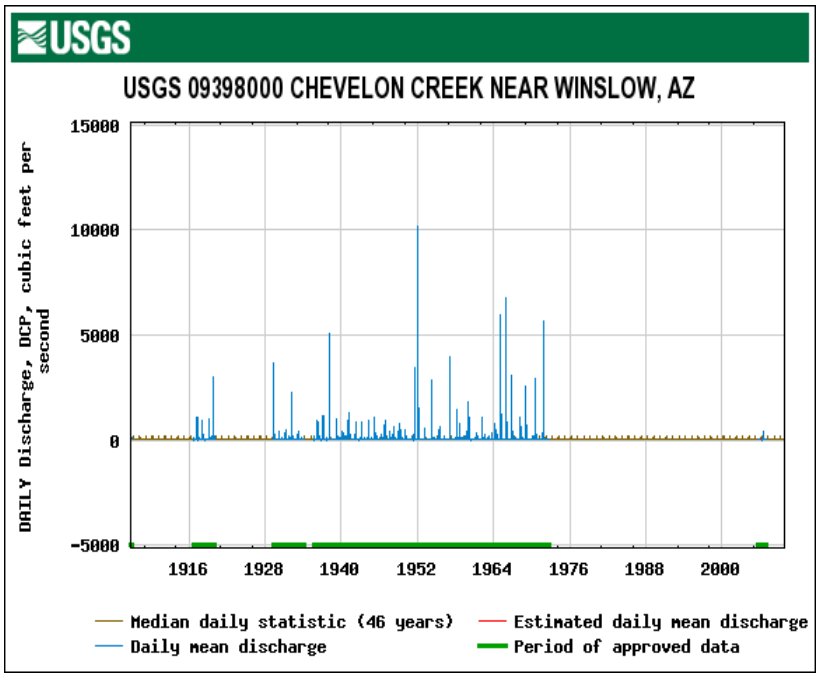

Figure 3. USGS Stream flow gauge flow for the period of record at Chevelon Canyon near Winslow.

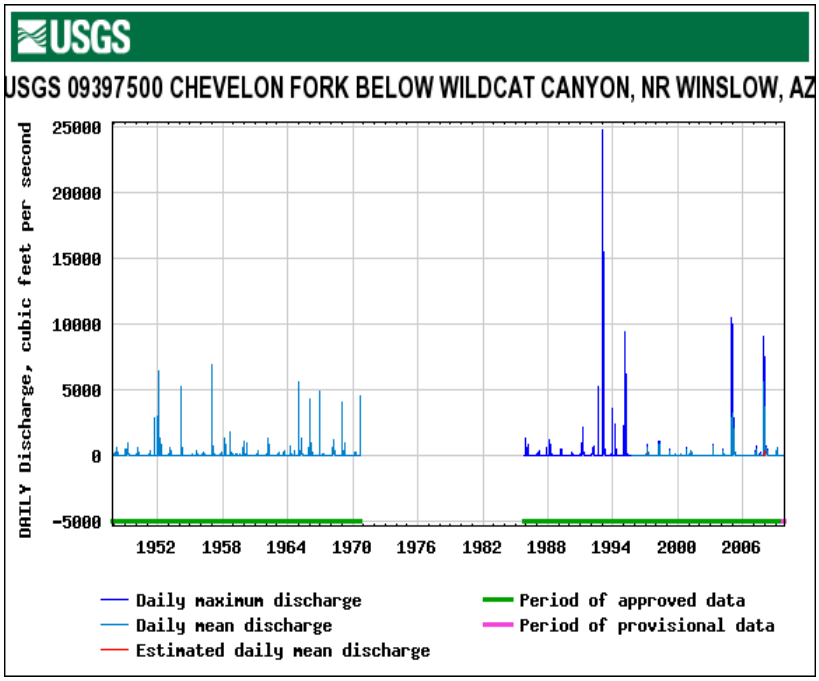

Figure 4. USGS Stream flow gauge data from Chevelon Canyon below Wildcat Canyon for the period of record.

In the unlikely event that trout did reach Chevelon Creek, it could also potentially swim upstream for 37.4 miles to the confluence with West Chevelon Canyon, and another 10.5 miles to the base of Chevelon Lake Dam during spring runoff. Most of this reach also dries up in the summer, although it does support isolated permanent pools that have the potential to hold fish. The isolated pools do get warm in the summer months and are not able to support trout long term, but could be temporary holding areas. Trout would likely not persist through to the next spring runoff because of high temperatures in the summer months. A trout could also potentially swim up West Chevelon Canyon for 26.1 miles during spring snowmelt runoff, to occupied Little Colorado spinedace habitat in the upper reaches. However, the trout would also have to make that journey during the short spring runoff, because a long portion of the lower reach dries entirely. The lack of trout in the survey data in West Chevelon, as well as the lack of any other non-native aquatic wildlife, including crayfish, indicates that the long stretch of normally dry stream is functioning as a fish barrier to upstream movement.

Although extremely unlikely, an escaped trout could potentially swim upstream in the LCR from the confluence with Chevelon Creek, for 43.3 miles to the confluence with Silver Creek during high flows. But the trout could not get upstream of the Woodruff Dam on the very lower portion of Silver Creek. It could continue up the LCR for an additional 85.1 miles to Lyman Lake dam, but also only during high flows. However, it is not expected that trout would ever make it into these habitats due to the distance and high water temperatures. No trout has ever been documented in the LCR in these reaches, or in lower Silver Creek below White Mountain Lake.

Although extremely unlikely, an escaped trout could also potentially swim downstream in the LCR from the confluence with Chevelon Creek during high flows. At Clear Creek, a trout could not get past the Clear Creek Reservoir dam in very lower Clear Creek, but could possibly get up into Jacks Canyon, or into Diablo Canyon, or even further downstream. Trout have never been found in lower Chevelon Creek below Black Canyon; it is even more unlikely they get beyond that habitat due to distance, high temperatures and dry stream..

Community Description

Black Canyon Lake currently contains stocked rainbow trout, naturally reproducing fathead minnow, crayfish, and illegally stocked largemouth bass and green sunfish, which are also naturally reproducing (Table 2). Trout do not reproduce in Black Canyon Lake.

Table 2. Survey history at Black Canyon Lake with experimental gillnets.

Species	**Mar 2004 5 GN**	**Apr 2005 4 GN**	**Apr 2006 3 GN**	**Apr 2007 3 GN**	**Apr 2008 3 GN**
Rainbow trout	63 (102-338)	56 (133-345)	29 (245-335)	22 (295-386)	12 (327-445)
Largemouth bass		4 (352-387)	2 (180-185)	27 (191-393)	32 (239-331)
Green sunfish	2 (77-84)	11 (111-142)	86 (135-205)	6 (140-157)	0

Sampling effort is listed as gillnet nights (GN). The size range of fish collected is provided in parentheses as Total length in mm.

The 56.1 miles of Black Canyon and West Fork Black Canyon dries every year during the summer and does not support fish. Isolated permanent pools in Chevelon Creek immediately below Chevelon Canyon Lake have been found to contain brown trout, rainbow trout, fathead minnow, golden shiner, roundtail chub, bluehead sucker, Little Colorado sucker, speckled dace, and numerous crayfish. Rainbow trout have been collected downstream of the Chevelon Canyon Lake on several occasions, with most collections between Chevelon Canyon Lake and West Chevelon Canyon, 10.5 miles downstream of the lake. Rainbow trout likely did not come from Black Canyon Lake because it does not spill every year; plus trout have 56.1 miles to travel before even reaching Chevelon Creek. However 1 isolated rainbow trout collection near Potato Wash was the lowest record of rainbow trout in Chevelon Creek over many years of surveys. Information on aquatic community assemblage in Chevelon Canyon downstream from Chevelon Canyon Lake is provided in the Chevelon Canyon Complex discussion, including potential impacts in that area. The origin of stocked species in that area may not be specifically attributable to the Chevelon Canyon Complex of stocking sites, or of Black Canyon Lake.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Additional discussion of the potential for impacts to consultation species is included in the Chevelon Creek Complex analysis because of the opportunity for fish from this site to reach areas coming from other stocking sites in that complex.

Northern Leopard Frog

Local Analysis: The Black Canyon Lake buffered stocking site is within the historical range of the northern leopard frog and the likelihood that northern leopard frogs could be exposed to stocked fish is high. There are no records for northern leopard frogs at Black Canyon Lake itself, in addition, crayfish and non-native fish have been documented at the reservoir, making it less suitable leopard frog habitat. However, there is a 2004 northern leopard frog record approximately 4 miles downstream of the lake in Black Canyon, within the 5 mile buffer (D. Groebner pers. comm.). There have been 18 surveys at 13 sites within the buffered stocking reach between 1984 and 1999 (Figure 5; HDMS; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are records for northern leopard frogs from 2 of these sites; Twin Lakes from 1984 and 1985 and Unnamed Tank (North of Walker Park) from1994 (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during later surveys at Unnamed Tank (North of Walker Park) (1995 and 1999) (HDMS, AGDF Riparian Herpetofauna Database). The Black Mesa Ranger District, Tonto National Forest, surveyed 8 additional sites within the buffered stocking complex in 2003, 2005, and 2006 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Although there are crayfish and non-native fish at Black Canyon Lake, in Black Canyon and its tributaries, due to the 2004 record in Black Canyon, it is likely that northern leopard frogs currently occupy portions of Black Canyon.

Broad Scale Analysis: It is likely that northern leopard frogs occupy the area downstream of the Black Canyon Lake buffered stocking site and nearby tributaries, in particular Buckskin Wash and its tributaries. Therefore the likelihood that northern leopard frogs could be exposed to dispersing fish from the Black Canyon Lake stocking site is high. If Black Canyon Lake spilled, stocked fish could disperse into West Fork Black Canyon and Black Canyon and its tributaries, where it is likely occupied by northern leopard frogs (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Chiricahua leopard frog

Local Analysis: Although the Black Canyon Lake buffered stocking site is within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to sport fish stocked in Black Canyon Lake is low because there are no historical records for Chiricahua leopard frogs at Black Canyon Lake or within the 5 mile buffer around the lake (Figure 5, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, crayfish and non-native fish have been documented at the reservoir, making it less suitable leopard frog habitat, therefore it is not likely that Chiricahua leopard frogs occupy this area.

Broad Scale Analysis: If fish were to disperse from Black Canyon Lake, the likelihood that Chiricahua leopard frogs could be exposed to them is low because there are no records for Chiricahua leopard frogs in the drainages that fish could disperse to (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

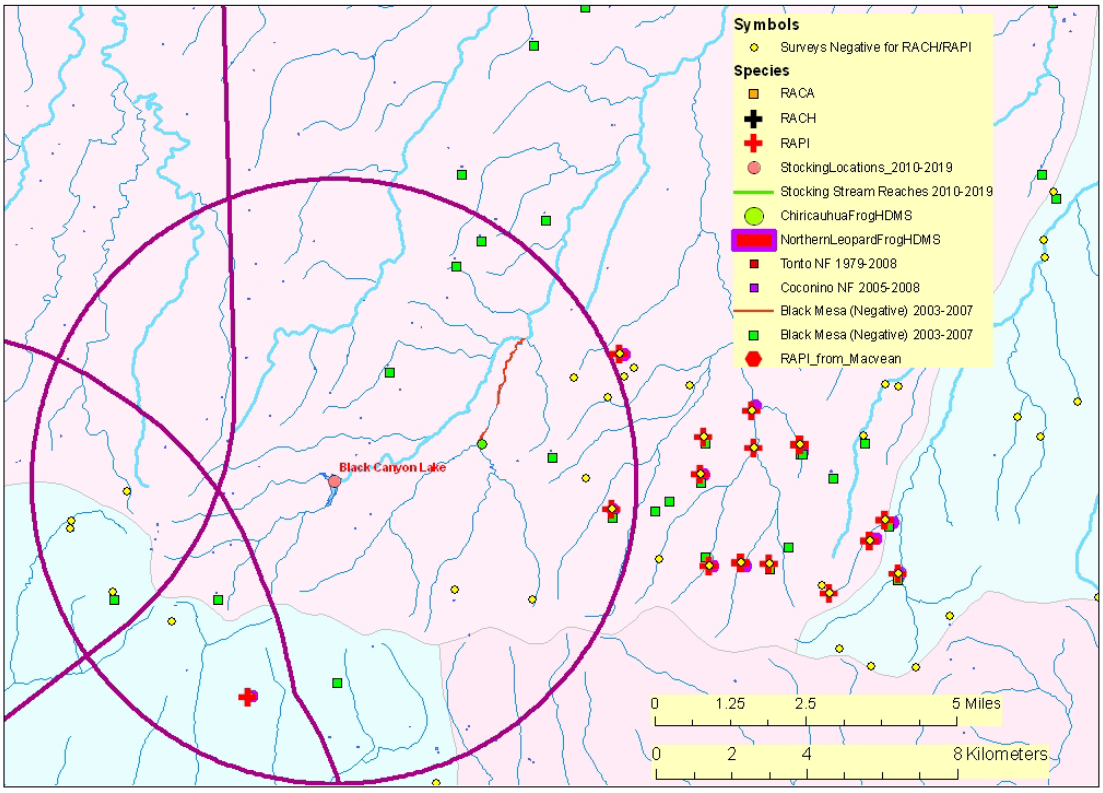

Figure 5. Map of Black Canyon Lake buffered stocking site.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Little Colorado Spinedace and Critical Habitat

Little Colorado spinedace are located in upper West Chevelon Canyon, as a result of reintroduction as a conservation action in July 2007; they are also located in lower Chevelon Creek. Both occupied locations are hydrologically downstream of Chevelon Canyon Lake, which is the lowest stocking site in the Chevelon Complex. Black Canyon joins Chevelon Canyon downstream from the Chevelon Canyon complex. Occupied habitat in upper West Chevelon Canyon is located 119.6 stream miles from Black Canyon Lake. This is via 56.1 miles of West

Fork Black Canyon, into Black Canyon, and then back upstream in Chevelon Canyon 37.4 miles to the confluence with West Chevelon, and up West Chevelon Canyon for 26.1 miles from the confluence with Chevelon Creek.

Surveys of the West Chevelon population of Little Colorado spinedace showed that in July 2008 that they had moved a short distance downstream, approximately 150 meters from where they were originally stocked. In August 2009 they were found a little further downstream, about 0.3 miles. The Little Colorado spinedace are dispersing within the series of permanent pools in upper West Chevelon Canyon, but still within a small area, with many miles of dry habitat to Chevelon Creek. It is possible for a Little Colorado spinedace to wash down into Chevelon Creek during a very high flow event, but this would likely be a rare occurrence because we believe those high flow events to be rare occurrences.

It is possible for an escaped trout to travel upstream in West Chevelon during high flow events, but the many miles of habitat that dry entirely on an annual basis means the trout would have to make the entire distance in the short spring runoff period. The survey data shows that non-native aquatic organisms, including trout, crayfish, fathead minnow, and others are not making it to permanent water in upper West Chevelon, and that the long stretch of dry habitat is functioning as a barrier to upstream movement of fish and other organisms. Two surveys of upper West Chevelon in 1999, and other surveys in 2003, 2004, 2005, 2006, 2007, 2008, and 2009 found only native fish species and no crayfish or trout.

Occupied Little Colorado spinedace habitat in lower Chevelon Creek is located 64.7 miles downstream of Black Canyon Lake. While it is possible for an escaped trout to travel that distance into occupied habitat during heavy flows, it is unlikely because of the great distance they would need to travel in a single season, since most of the habitat dries annually. Only isolated pools that are unsuitable for trout are available in Chevelon Creek during the summer months. The isolated permanent pools in Chevelon Creek get warm and become stagnant, and are generally unable to sustain trout throughout the entire summer. All of West Fork Black Canyon and Black Canyon dry every summer, killing any fish trapped in that habitat. Permanent flow within occupied Little Colorado spinedace habitat in Lower Chevelon Creek also becomes unsuitable for trout, becoming very warm with extremely high conductivity. Trout have not been collected in spinedace occupied habitat in lower Chevelon Creek after multiple surveys (see the Chevelon Canyon Complex section). The survey data show that if trout reach occupied habitat it is likely that they are in extremely low numbers and don’t persist long. It is likely given the distance and warm temperature that stocked trout from Black Lake to not reach this area.

The nearest designated Critical Habitat for Little Colorado spinedace is located 67.1 miles downstream of Black Canyon Lake. The critical habitat extends for approximately 8 miles to the confluence with the LCR. Again, it is extremely unlikely that a trout would reach critical habitat, but if one should reach the area, it would not persist in the warm waters of lower Chevelon

Creek. No trout has been collected in either occupied or critical habitat in many years of surveys as summarized in the Chevelon Creek Complex analysis.

Potential impacts

The proposed stocking activity is not expected to impact the Little Colorado spinedace because trout are not likely to reach occupied habitat, and have never been documented in occupied habitat in West Chevelon or lower Chevelon Creek. Black Canyon Lake spills occasionally and some trout likely do escape downstream, but the long distances of normally dry habitat in West Fork Black Canyon and Black Canyon, plus unsuitable habitat for trout in lower Chevelon Creek, are keeping trout from reaching occupied or critical habitat in upper West Chevelon Canyon and lower Chevelon Creek.

It is possible for a Little Colorado spinedace to wash down from upper West Chevelon into Chevelon Creek during flood flows, where it could encounter an escaped trout from Black Canyon Lake. This would be a very rare event, especially since a trout would have to navigate the extremely long distance to get there. Trout occasionally collected in the vicinity of the West Chevelon confluence are likely escapees from Chevelon Canyon Lake, which is only 10.5 miles upstream, compared to 93.5 miles from Black Canyon Lake. If the trout did navigate that great distance and a Little Colorado spinedace did disperse from upper West Chevelon, the trout could prey directly on this dispersing Little Colorado spinedace, or compete for habitat (Blinn et al. 1993; Robinson et al. 2000). There would likely be very little chance of impacting the reproduction of Little Colorado spinedace, since the occurrence of a dispersing Little Colorado spinedace is so low, they would not be expected to reproduce in that part of Chevelon Creek. Escaped trout would not affect dispersal of Little Colorado spinedace or connectivity between populations, because of the very low occurrence of trout in the area downstream of upper West Chevelon and the area upstream of lower Chevelon Creek. Additionally, the long reaches of dry and/or unsuitable habitat present between these populations are likely the greatest impediment to dispersal. Non-native predators that are not part of this proposed action, such as brown trout, crayfish, green sunfish, and largemouth bass are more likely to be encountered by a dispersing Little Colorado spinedace, than is an escaped rainbow trout or brook trout from Black Canyon Lake.

Mexican Spotted Owl

This stocking location is within Mexican Spotted Owl (MSO) critical habitat (CH), and is within 3 individual buffers. There is access around the whole perimeter of the lake with little vegetation along the shoreline.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around MSO PACs in the general vicinity

of the site. No physical effects to MSO habitat in the PAC are anticipated, since anglers are not expected to be present in the PAC. There may be some disturbance to MSOs from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Black Canyon Lake Analysis

Rainbow and brook trout stocked into Black Canyon Lake can likely escape the reservoir when it occasionally spills during high flow events from spring snowmelt runoff. Trout can persist in Black Canyon Lake, but cannot persist in the 56.1 miles of West Fork Black Canyon and Black Canyon, as those systems dry entirely during the summer months. It is possible for an escaped trout to reach Chevelon Creek, but unlikely, since it would have to travel the entire 56.1 miles to Chevelon Creek in the short period of spring runoff, before West Fork and Black Canyon dried

up. A stocked fish will not persist in the portion of Chevelon Creek at the confluence with Black Canyon, since most of that reach, up to the dam at Chevelon Lake, dries during the summer; this reach does contain isolated permanent pools, but these pools get warm and fairly stagnant during the summer. Occasional rainbow and brown trout have been found in the reach of Chevelon Creek from Chevelon Lake to the West Chevelon confluence; however, these records are few, with no evidence of them establishing or persisting. The lower reach of West Chevelon Creek dries up every year and is considered to be functioning as a barrier to upstream movement of fish towards Little Colorado spinedace occupied habitat in upper West Chevelon. The data from several surveys (see Chevelon Creek Complex for additional information) support this statement, because no trout, or any non-native aquatic organism, including crayfish, has been found in West Chevelon Creek.

It is possible for an escaped trout to travel downstream of the Black Canyon – Chevelon Creek confluence towards permanent water, Little Colorado spinedace occupied habitat, and designated critical habitat for LC spinedace in lower Chevelon Creek. However, this is very unlikely because of the distance involved. Furthermore if it did occur, trout would not persist because of the unsuitable habitat conditions in this lower portion of Chevelon Creek. The data from numerous surveys support this statement, because no trout has been collected in occupied Little Colorado spinedace habitat, critical habitat in lower Chevelon Creek, or anywhere downstream of the Black Canyon confluence (See Chevelon Creek Complex analysis).

It is possible for a dispersing Little Colorado spinedace to get washed downstream from upper West Chevelon Canyon and into Chevelon Canyon during flood flows, and to encounter an escaped trout that had made it to Chevelon Creek. However, this would likely be an unlikely occurrence because of the distance involved from occupied habitat in upper West Chevelon, plus the very low probability of trout present in Chevelon Creek being from Black Canyon Lake. The low occurrence of trout in the reach around the confluence with West Chevelon are likely from Chevelon Lake, which is a much shorter distance directly upstream and spills every year. Regardless, any impact under this situation would be because of an individual fish, with no impact on the species or population level, since a dispersing Little Colorado spinedace from upper West Chevelon would be lost to the population; that fish could not make it back to occupied habitat that it came from, would not be expected to establish in Chevelon Creek in that area, and are not likely to be washed even further downstream to the next Little Colorado spinedace population in lower Chevelon Creek because of the distances involved and numerous predators along the way. It is also unlikely that Little Colorado spinedace would disperse upstream from lower Chevelon Creek, since their current upstream distribution is very close to the upper extent of permanent and continuous flows in lower Chevelon Creek. The dry and intermittent habitat in middle Chevelon Creek, the portion from Chevelon Canyon dam downstream to Pony Canyon, is likely the greatest influence on upstream distribution of Little Colorado spinedace. Even then, the occurrence of escaped trout in Chevelon Creek is very low,

most likely from Chevelon Lake, not Black Canyon Lake, and would not likely present a major obstacle to upstream movement of Little Colorado spinedace if they were to overcome the habitat deficiencies of that reach.

CHEVELON CREEK COMPLEX

Physical Geographic Description

The Chevelon Creek complex contains 4 stocking sites: Woods Canyon Lake, Willow Springs Lake, Chevelon Canyon Lake, and Long Tom Tank (Figure 6).

Drainage area and elevations

The Chevelon Creek Complex drains the upper reaches of the mainstem Chevelon Canyon. The upper most stocking sites, Woods Canyon Lake and Willow Springs Lake, are located at the head of the upper tributaries, Woods Canyon and Willow Springs Canyon, respectively. These two canyons have perennial and ephemeral reaches and meet to form Chevelon Creek. From this point, Chevelon Creek is nearly all perennial and flows into Chevelon Canyon Lake 12.2 miles downstream of the confluence. Long Tom Tank, is located in the headwaters of an intermittent tributary, which enters Chevelon Creek approximately 4.4 miles upstream of Chevelon Canyon Lake.

Willow Springs Lake and Woods Canyon Lake are at the highest elevation within the complex, at 7513 and 7505 feet, respectively. Chevelon Creek flows north to the lowest elevation within the complex in Chevelon Canyon Lake, at 6366 feet. Long Tom is located at 7500 feet and enters into Chevelon Creek between the upper lakes and Chevelon Canyon Lake.

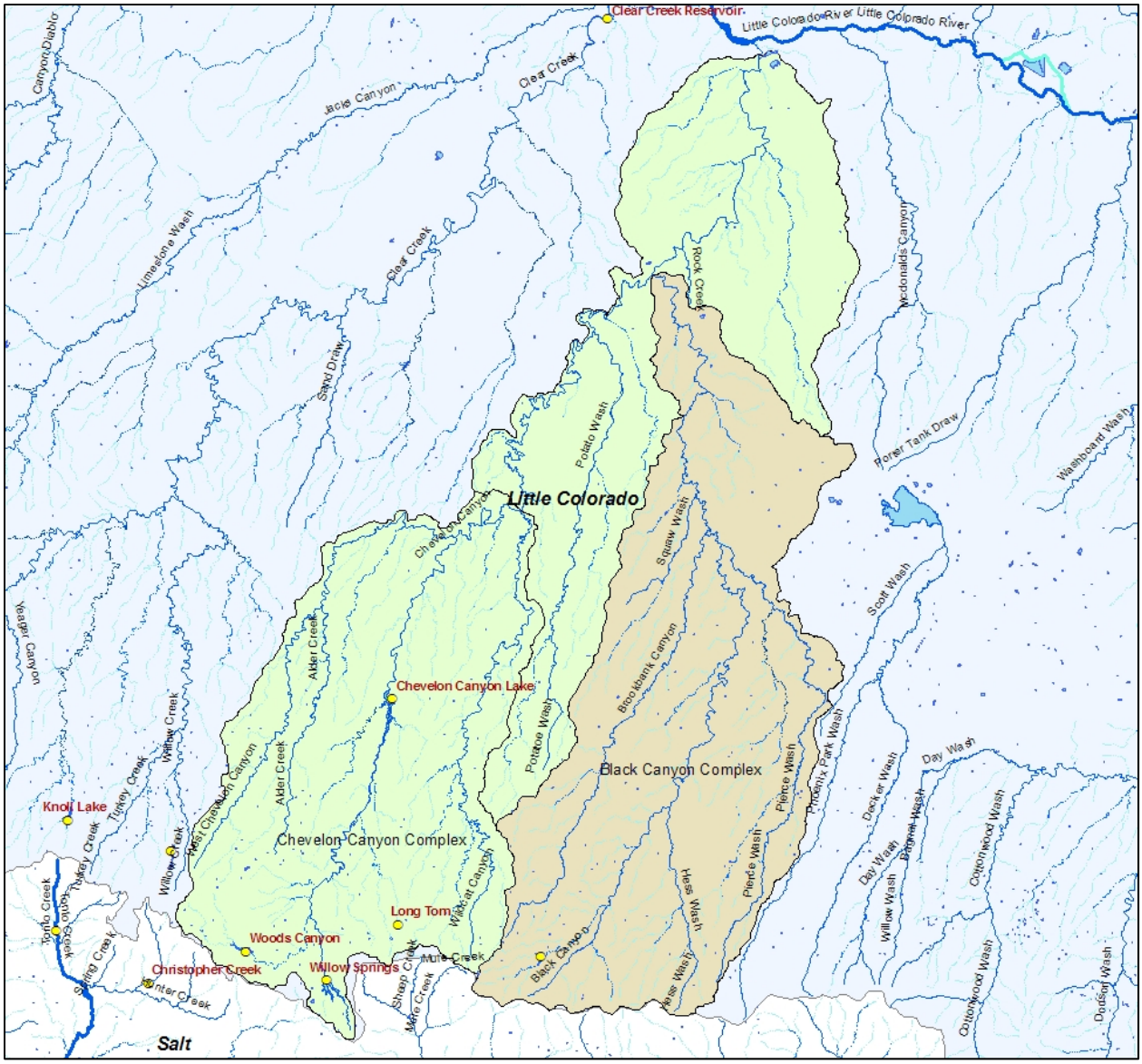

Figure 6. Chevelon Creek Complex located within the Chevelon Creek sub-watershed.

Long Tom Tank

Site Description

Long Tom Tank is a small 3-acre pond located on the edge of the Forest Lakes subdivision on the Mogollon Rim (Figure 7 and Figure 8). It is located at an elevation of 7500 feet on the Apache-Sitgreaves National Forest. Long Tom is located at the headwaters of Long Tom Canyon, which is a tributary to upper Chevelon Creek. Long Tom joins Chevelon Creek above Chevelon Canyon Lake at a point that is downstream from Woods Canyon and Willow Springs lakes. The date of construction of the dam forming the lake is unknown.

Long Tom Tank is accessed by an all-weather gravel road through the community of Forest Lakes, about 2 miles from paved Highway 260. There is a dirt parking lot, but no other amenities exist.

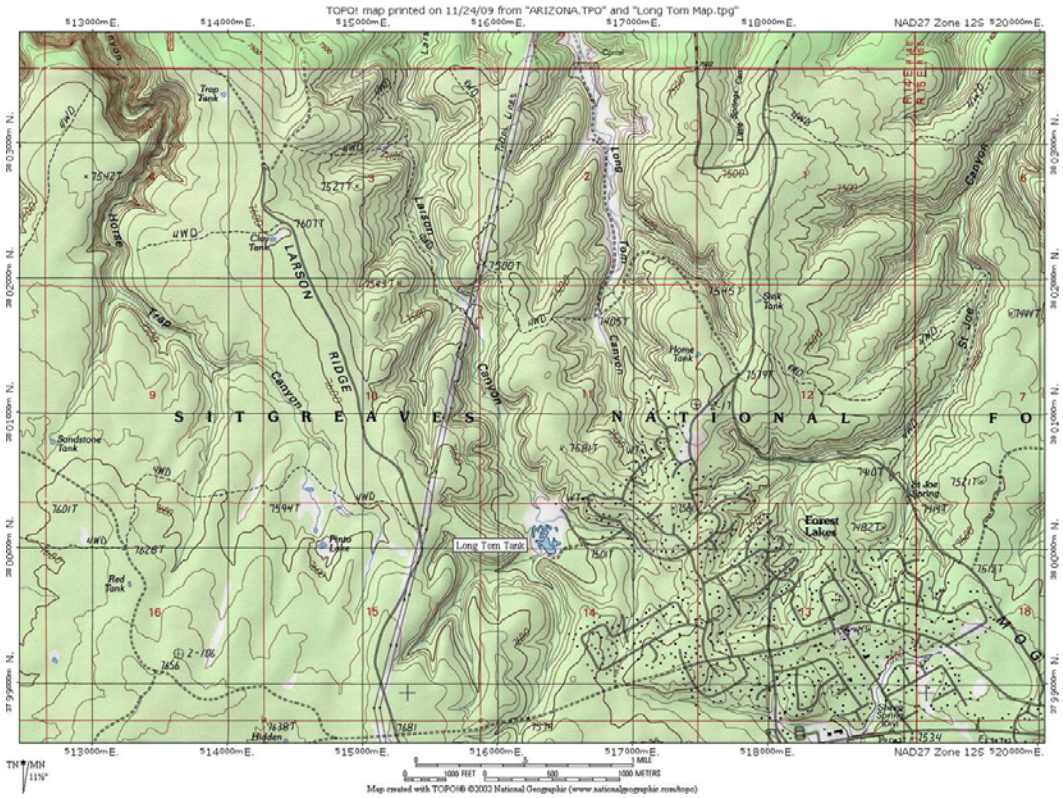

Figure 7. Map of Long Tom Tank.

Figure 8. Long Tom Tank.

Management of Water Body

Long Tom Tank has been managed as a put-grow-and-take cold water fishery with fingerling and sub-catchable rainbow trout stocked once per year; however largemouth bass and bluegill were illegally stocked in the late 1990s or early 2000s. The tank has not been stocked since 2003 (Table 3). The Department desires to continue stocking the tank again with rainbow trout, but will switch to stocking with catchable size trout instead of fingerling and sub-catchables so that the fish are immediately catchable and harvestable. Resuming regular stocking at Long Tom Tank will also help discourage additional illegal stocking at the tank.

Table 3. Stocking history at Long Tom Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1978	1995	17	24,176
Rainbow trout	1978	2003	13	29,500
Total			30	53,676

Beginning on January 1, 2009, bag limits on warm water fishes were removed, allowing unlimited harvest of bass and catfish on all rim area lakes, as a first step to send the message to

anglers that the tank is managed only for trout. There have been no angler creel surveys conducted at Long Tom Tank.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis of basic yield, put-grow-and-take cold water sport fishery with a desired species assemblage of rainbow trout, which is mostly consistent with the proposed action. The proposed action is to stock catchable size rainbow trout, which will allow better control of when trout are at catchable size, and better control of angler success and satisfaction.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from May to September each year to; numbers of trout stocked may be from 0 to 3,000 fish annually.

Water Distribution/Connectivity

Long Tom Tank receives water from an extremely small watershed during spring snowmelt runoff. There is no permanent stream or spring inflow coming into the tank. There is no outlet on the dam, thus no water is released for irrigation or other uses downstream. It is unknown if the tank spills, but if it did, it would drain into Larson Canyon. From the tank, it is 3.3 miles down Larson Canyon to Long Tom Canyon, then another 4.1 miles to Chevelon Creek above Chevelon Canyon Lake. The entire drainage from near the tank down to Chevelon Creek goes dry each summer. Long Tom Canyon enters upper Chevelon Creek, which is perennial, 4.4 miles upstream of Chevelon Canyon Lake. (See Chevelon Canyon Lake for further details on the connectivity below Chevelon Canyon Lake).

Fish Movement

There is nowhere upstream from Long Tom Tank for stocked trout to travel, as there is no stream entering the tank. If the tank spills, it likely does so only in the spring, which would allow fish to travel down Larson Canyon, to Long Tom Canyon, and down into upper Chevelon Creek. If the escaped trout did not make it all the way to Chevelon Creek during high flow events, they would die, since Larson Canyon and Long Tom Canyon dry up each year. Once in upper Chevelon Creek, escaped trout could persist and possibly reproduce, as this is good trout habitat and supports a healthy population of wild brown trout, among other fishes (Table 4).

In Chevelon Creek, an escaped trout could swim upstream for 7.8 miles to the confluence with Woods Canyon and Willow Springs Canyon. It could then swim up Woods Canyon for 5.8 miles or up Willow Springs Canyon for 3.4 miles, then get stopped at Woods Canyon Lake dam and Willow Springs Lake dam on the respective streams. An escaped trout could also swim downstream from Long Tom Canyon for 4.4 miles and into Chevelon Canyon Lake. (See Chevelon Canyon Lake for further details on the fish movement below Chevelon Canyon Lake).

Table 4. Summary of surveys of Chevelon Creek upstream of Chevelon Canyon Lake (Lopez et al. 1998a; AGFD unpublished data). All surveys were conducted with a backpack electroshocker.

Species	1995	1996	1999	2007
Brown trout		212	4	73
Rainbow trout		17	6	
Little Colorado sucker	34	5	7	
Speckled dace	27	5,573	65	300
Green sunfish				2
Fathead minnow			750	
Golden shiner	4			

Community Description

Long Tom Tank currently contains naturally reproducing and illegally stocked largemouth bass and bluegill. It likely no longer contains rainbow trout since they were last stocked in 2003 and do not reproduce in the lake. The stocked trout should persist in Long Tom Tank but will not reproduce in the tank. There is no formal survey history at Long Tom Tank. The largemouth bass and bluegill were collected during an informal survey on October 1, 2004 with a dipnet, which is not traditional gear for sampling fish in a pond or lake. Small fish were observed along the shoreline during a water quality visit to the lake and a dipnet was all that was on hand at that moment. An attempt was made to catch the fish, which definitely were not trout, but was enough to catch some of the fish and confirm the presence of bluegill and largemouth bass.

Larson Canyon and Long Tom Canyon are fishless since they dry entirely every year. A survey on October 19, 2001, found Long Tom Canyon to be almost entirely dry, with only 3 extremely small pools of water only a few inches deep in the entire stream. These pools were fishless.

Chevelon Creek at the confluence with Long Tom Canyon contains naturally reproducing brown trout, speckled dace, Little Colorado suckers, and rainbow trout, plus numerous crayfish.

Consultation Species or Critical Habitat

Chiricahua and northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Figure 9 provides a map of the complex and leopard frog analysis information.

The nearest occupied and critical habitat for Little Colorado spinedace and the known roundtail chub populations occur downstream of Chevelon Canyon Lake. For this reason they are discussed in the Chevelon Canyon complex analysis, below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua Leopard Frog

Local Analysis: Although Long Tom Tank and the Chevelon Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to stocked fish in Long Tom Tank is low. There are no historical records for Chiricahua leopard frogs at Long Tom Tank or within the Chevelon Creek buffered stocking complex. There have been 56 surveys at 37 sites within the buffered stocking complex between 1968 and 2005 (Figure 9; Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites between 2003 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Based on available data, it is likely that Chiricahua leopard frogs do not occupy the buffered stocking complex that includes Long Tom Tank (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in sites within the Chevelon Creek stocking complex due to an extreme storm event or a breached dam is moderate. Even though there are no historical records for Chiricahua leopard frogs, some available habitats have not been surveyed and it is possible that there are populations of Chiricahua leopard frogs in the area outside the buffered stocking complex where stocked fish can disperse (HDMS).

Northern Leopard Frog

Local Analysis: Although Long Tom Tank and the Chevelon Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in Long Tom Tank is low. There are no historical records for northern leopard frogs at Long Tom Tank. There have been 56 surveys at 37 sites within the Chevelon Creek buffered stocking reach between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There are 2 sites with records for northern leopard frogs; Woods Canyon Lake (1968) and Willow Springs Canyon (1996). Northern leopard frogs were not observed during subsequent surveys at Woods Canyon (1992

and 1995) or at Willow Springs Canyon (1997 and 1998) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites within the buffered stocking complex between 2003 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Data suggest that northern leopard frogs no longer occupy the buffered stocking complex and the current presence of crayfish and non-native fish in the Chevelon Creek drainage, tributaries, and surrounding tanks and lakes make the habitat within the buffered stocking complex less suitable for northern leopard frogs (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek stocking complex due to an extreme storm event or a breached dam is low. Although the area outside the buffered stocking complex has been poorly surveyed, it is likely that northern leopard frogs no longer occupy the few historical (1932, 1968) sites within the drainages where escaped fish could disperse (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

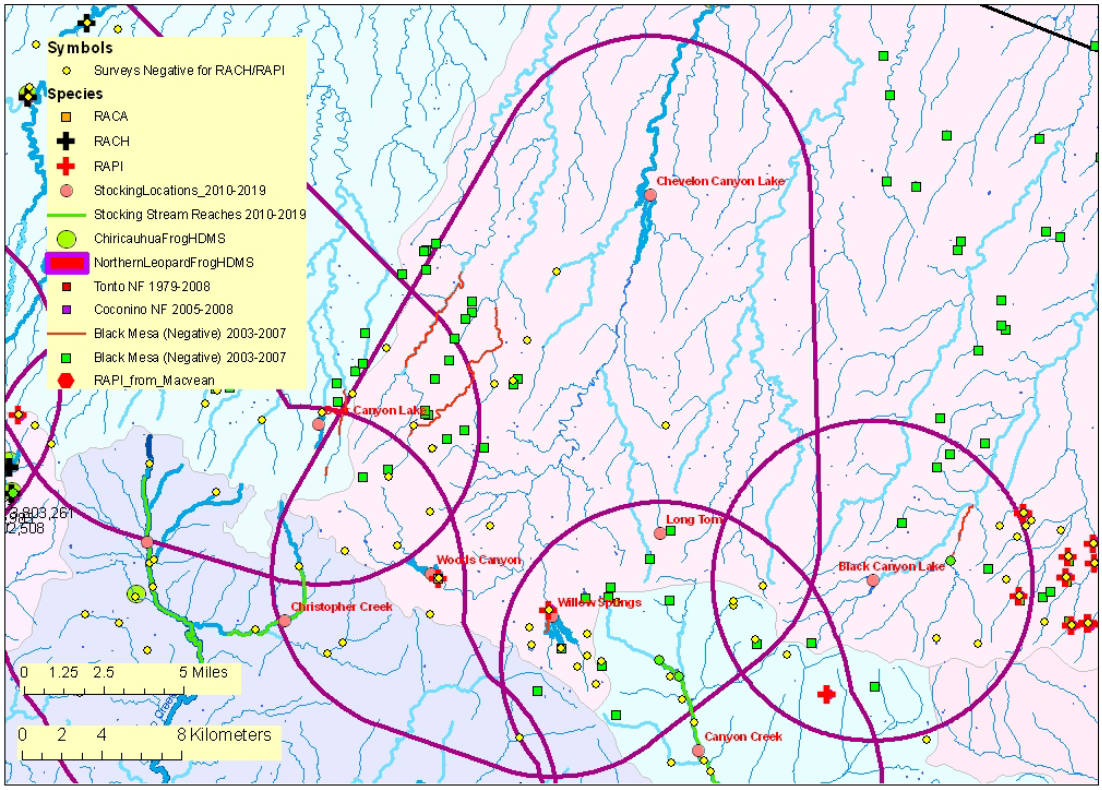

Figure 9. Map of Chevelon Creek buffered stocking complex.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Willow Springs Lake

Site Description

Willow Springs Lake is located at the head of Willow Springs Canyon (Figure 10), a headwater tributary of Chevelon Creek, one of two lakes at the top end of the complex. The lake was constructed in 1967 at an elevation of 7513 feet on the Apache-Sitgreaves National Forest, creating a 158 surface-acre lake. Willow Springs Lake is located approximately 23 miles southwest of Heber and is a popular and highly visited recreation area (Figure 11).

Willow Springs Lake can be accessed by paved Forest Road 149, usually from April through November. The lake freezes and is inaccessible by vehicle during the winter. A boat launch ramp, paved parking, restrooms, picnic facilities, and a fishing pier/boat dock are located on the west side of the lake at the main access point. Additional access points include a dirt spur road to Sardine Point between the two arms of the lake, plus hike in to the upper end of an arm from Highway 260. Sinkhole Campground is also located close by on Forest Road 149.

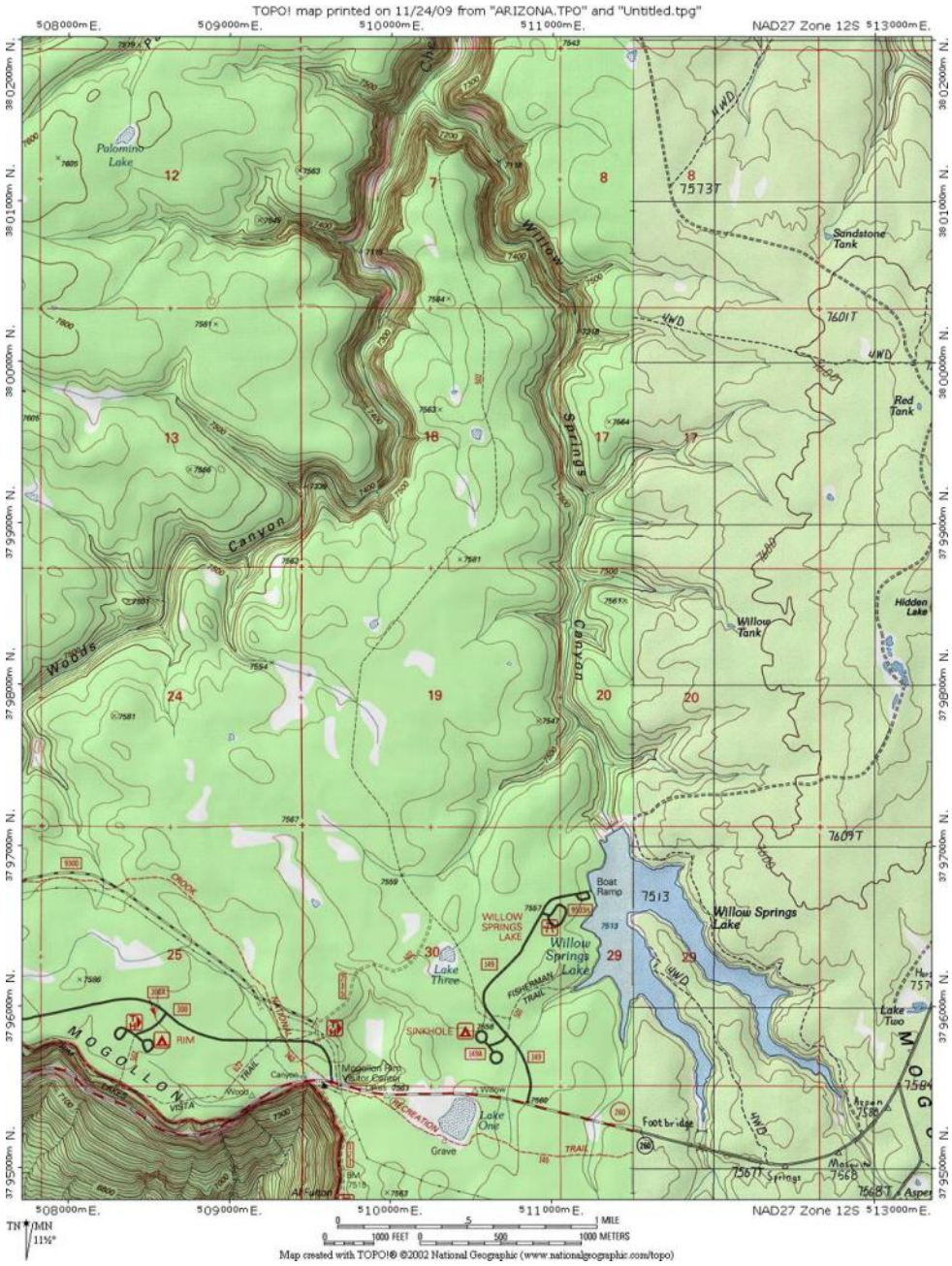

Figure 10. Map of Willow Springs Lake.

Figure 11. Willow Springs Lake.

Management of Water Body

Primary fishery is a cold water rainbow trout intensive use put-and-take fishery from spring through fall. Catchable rainbow trout are the only trout currently stocked here (Table 5) and are stocked multiple times during the stocking season.

Table 5. Stocking history at Willow Springs Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1978	1995	44	339,057
Brown trout	1976	1995	40	600,000
Cutthroat trout	1972	1995	15	495,706
Rainbow trout	1968	2009	846	3,270,485
Total			945	4,705,248

Willow Springs Lake receives very high angler use during the summer months; 65,090 AUDs as determined by mail-out survey in 2001 (Pringle 2004), which is over 10% of the total angler use for all the Department's Region I waters. The lake usually ices over in the winter from December through March and receives some ice fishing use from anglers hiking into the lake when the road is closed.

Willow Springs Lake fills and spills every year, maintaining very good water levels and water quality throughout the year. The lake is not very productive, so it is managed as a put-and-take intensive use trout fishery and is stocked on a regular basis throughout the summer. Largemouth bass were illegally stocked into the lake years ago. Recently, smallmouth bass and green sunfish were illegally introduced. These warm water fishes have reproduced and are numerous in the lake. Beginning on January 1, 2009, bag limits on warm water fishes were removed, allowing unlimited harvest of bass and catfish on all rim area lakes to send the message to anglers that the lake is managed only for trout.

The water rights for Willow Springs Lake are owned by the Department and no water is released out of the headgate on the dam. This helps to maintain a good water level in Willow Springs Lake year around, in addition to the heavy snowfall and runoff in this area of the Mogollon Rim.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis of intensive use put-and-take cold water sport fish, with a desired species assemblage of rainbow trout, which is consistent with the proposed action.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times per season from April to September each year; numbers of trout stocked may be from 0 to 100,000 fish annually.

Water Distribution/Connectivity

Willow Springs Lake has no permanent inflow; however it receives adequate winter snowpack to fill the lake every year. The water rights are owned entirely by the Department, and no water is released downstream for irrigation or other uses. The lake spills during runoff every spring. Most of the year, no water flows over the spillway (Figure 12 and Figure 13), but since there are no irrigation releases, the lake maintains a fairly constant water level. When it does spill, it drains down Willow Springs Canyon for 3.4 miles to the confluence with Woods Canyon to form Chevelon Creek. Chevelon Creek has perennial flow for 12.2 miles down to Chevelon Canyon Lake. Woods Canyon and Willow Springs Canyon have some permanent water; however, portions of these creeks dry in the summer months. Refer to the Chevelon Canyon Lake analysis for the detailed description of the connectivity below Chevelon Canyon Lake.

Figure 12. Spillway at Willow Springs Lake.

Figure 13. Downstream of the spillway at Willow Springs Lake.

Fish Movement

Stocked rainbow trout do persist in the lake, as shown by spring surveys conducted prior to stocking, but they do not reproduce in the lake. Trout have the ability to escape downstream only when the lake spills, which it does every spring, except in extreme drought years. Escaped trout can travel 3.4 miles down Willow Springs Canyon to Chevelon Creek, then down Chevelon Creek for 12.2 miles to Chevelon Canyon Lake. Trout can also move downstream of Chevelon Canyon Lake when it spills in the spring. Refer to the Chevelon Canyon Lake analysis for the detailed description of fish movement below Chevelon Canyon Lake.

Community Description

Willow Springs Lake currently contains stocked rainbow trout. The lake also contains illegally stocked largemouth bass, smallmouth bass, and green sunfish (Table 6), which are now naturally reproducing. Crayfish and fathead minnow are also very abundant in the lake. Trout do not reproduce in the lake.

Table 6. Survey history at Willow Springs Lake with experimental gillnets and electroshocking boat.

Species	Apr. 14,	Mar. 7,	Apr. 10,	Mar. 29,	Apr. 9 &

	2001	2002	2003	2005	May 5, 2008
Rainbow trout	4	22	14	22	113
Brown trout	-	-	-	-	1
Largemouth bass	13	2	2	-	49
Smallmouth bass	-	-	-	-	149
Green sunfish	-	1	-	-	113

Willow Springs Canyon contained brown trout, brook trout, and speckled dace, all in very low numbers when surveyed in 1995 (Lopez et al. 1998d). Numbers of total fish were very low for twelve 50-meter stations surveyed by electroshocking 3 depletion passes. Brook trout and brown trout may or may not be reproducing in Willow Springs Lake. Either trout collected below the lake may have escaped from the lake, or brown trout may also be swimming upstream from Chevelon Creek where they are known to maintain a reproducing population in the stream.

Habitat ratings for the potential spawning area and potential rearing area in reach 2 where all the fish were collected below Willow Springs Lake were extremely low, as determined by a General Aquatic Wildlife System survey conducted in July 1995 (Lopez et al. 1998d; Table 7). However, these ratings were much better in reach 1 where no fish were found. The gravel bottom rating for both reaches was fair. The size range on brook trout collected could indicate natural reproduction, but could also be a result of fingerling size stocked trout escaping. The brook and brown trout stocked into Willow Springs Lake in 1995 were fingerling size, while rainbow trout were catchable size, but were not collected in the 2 sampled reaches below the Lake in 1995. Brook and brown trout are no longer proposed for stocking in this lake.

Table 7. Survey results of twelve 50-meter stations in Willow Springs Canyon in July 1995 using a backpack electroshocker with 3 depletion passes (Lopez et al. 1998d).

Species	Num. Collected	Size Range (mm TL)
Brook trout	4	61-195
Brown trout	5	148-240
Speckled dace	2	35-89

Chevelon Creek upstream of Chevelon Canyon Lake contained naturally reproducing brown trout, speckled dace, Little Colorado sucker, rainbow trout, and numerous crayfish, when comprehensively surveyed in 1996 (Lopez et al. 1998a). Golden shiner, fathead minnow, and green sunfish have been collected during surveys in 1995, 1999, and 2007, respectively (Lopez

et al. 1998a and Table 4). Refer to the Chevelon Canyon Lake analysis for a detailed description for the aquatic community description downstream of Chevelon Canyon Lake.

Consultation Species or Critical Habitat
Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

The nearest occupied and critical habitat for Little Colorado spinedace and the known roundtail chub populations occur downstream of Chevelon Canyon Lake. For this reason they are discussed in the Chevelon Canyon complex analysis, below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua Leopard Frog
Local Analysis: Although Willow Springs Lake and the Chevelon Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to stocked fish from Willow Springs Lake is low. There are no historical records for Chiricahua leopard frogs at Willow Springs Lake or within the Chevelon Creek buffered stocking complex. There have been 56 surveys at 37 sites within the buffered stocking complex between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites between 2003 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Based on available data, it is likely that Chiricahua leopard frogs do not occupy the buffered complex that includes Willow Springs Lake (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek complex due to an extreme storm event or a breached dam is moderate. Even though there are no historical records for Chiricahua leopard frogs and some available habitats have not been surveyed, it is possible that Chiricahua leopard

frogs occupy the area outside the buffered complex (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Willow Springs Lake and the Chevelon Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in Willow Springs Lake is low. There are no historical records of northern leopard frogs in Willow Springs Lake itself. There have been 56 surveys at 37 sites within the Chevelon Creek buffered stocking reach between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There are 2 sites with records for northern leopard frogs from; Woods Canyon Lake (1968) and Willow Springs Canyon (1996), just below the Willow Springs Lake dam. Northern leopard frogs were not observed during subsequent surveys at Woods Canyon (1992 and 1995) or at Willow Springs Canyon (1997 and 1998) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites within the buffered stocking complex between 2003 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Data suggest that northern leopard frogs no longer occupy the buffered stocking complex and the current presence of crayfish and non-native fish in the Chevelon Creek drainage, its tributaries, and surrounding tanks and lakes make the habitat within the buffered stocking complex less suitable for northern leopard frogs (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek stocking complex due to an extreme storm event or a breached dam is low. Although the area outside the buffered stocking complex has been poorly surveyed, it is likely that northern leopard frogs no longer occupy the few historical (1932, 1968) sites within the drainages where escaped fish could disperse. (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Woods Canyon Lake

Site Description

Woods Canyon Lake is located at the head of Woods Canyon, a headwater tributary of Chevelon Creek (Figure 14). It is located approximately 27 miles southeast of Heber and is one of two lakes at the top of the Chevelon Complex. The lake was constructed in 1956 at an elevation of 7505 feet on the Apache-Sitgreaves National Forest, creating a 55 surface-acre recreational lake (Figure 15), with a maximum depth of 40 feet and average depth of 25 feet. Woods Canyon Lake has no permanent inflow; however, it receives adequate winter snowpack to fill the lake every year.

Woods Canyon Lake can be accessed by paved Forest Roads 300 and 105, usually from April through November. The lake freezes and is inaccessible by vehicle during the winter. A boat launch ramp, paved parking, restrooms, picnic facilities, several campgrounds, and a concession store with boat rentals are located on the south side of the lake at the only access point.

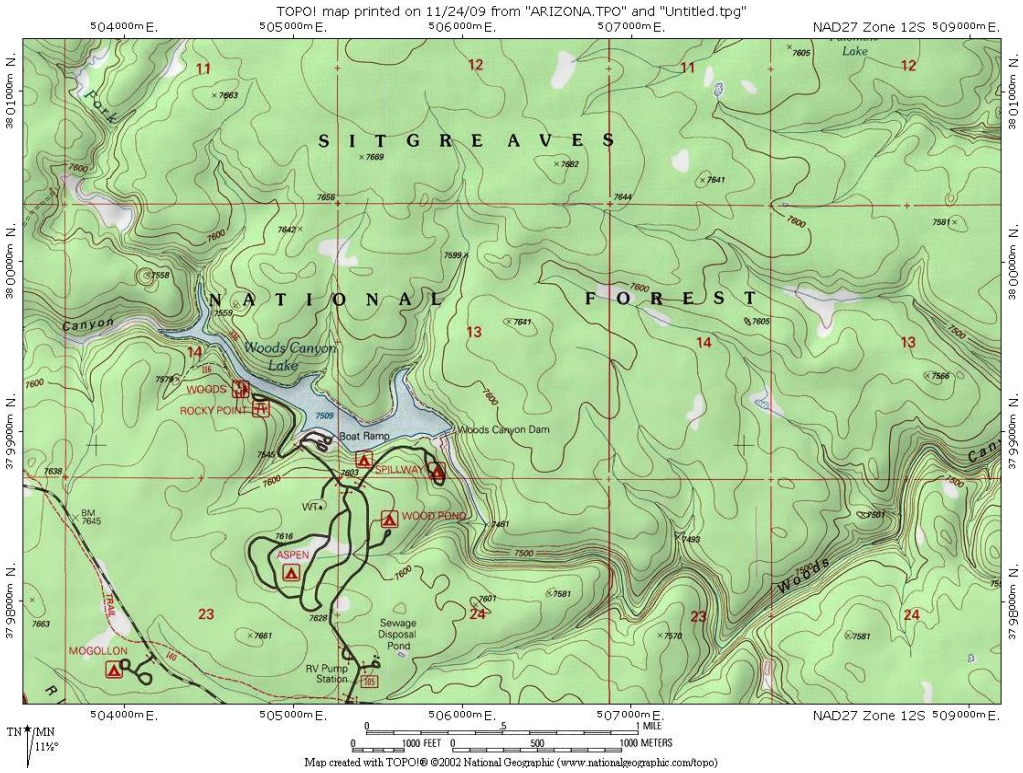

Figure 14. Map of Woods Canyon Lake.

Figure 15. Woods Canyon Lake.

Management of Water Body

Primary fishery is a cold water rainbow trout intensive use put-and-take fishery from spring through fall. Catchable rainbow trout are stocked multiple times during the stocking season. Woods Canyon Lake receives very high use during the summer months; 67,832 AUDs as determined by mail-out survey in 2001 (Pringle 2004), which is over 10% of the total angler use for all Region I waters and is stocked repeatedly to provide for that use (Table 8). The lake ices over in the winter and access is restricted by snowpack and closed Forest roads, but the lake receives some ice fishing use from anglers hiking into the lake.

Table 8. Stocking history at Woods Canyon Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1963	1995	41	195,311
Brown trout	1963	1995	32	234,730
Coho salmon	1972	1973	2	10,000
Cutthroat trout	1987	1995	8	153,000
Rainbow trout	1957	2009	1,432	3,521,258
Bullfrog tadpole	1968	1978	2	7,000

Total	1,247	3,651,024

The water rights for Woods Canyon Lake are owned by the Department and no water is released out of the headgate on the dam. This helps to maintain a good water level in Woods Canyon Lake year around, in addition to the good snowfall in this area of the Mogollon Rim.

Woods Canyon Lake fills and spills every year, maintaining very good water levels and water quality throughout the year. The lake is not very productive, so it is managed for put-and-take intensive use trout fishery, stocked on a regular basis throughout the summer. Reports of illegal stocking of warm water species and goldfish have not been verified, but would not be surprising given 4 other rim lakes have been illegally stocked with warm water fish. Beginning on January 1, 2009, bag limits on warm water fishes were removed, allowing unlimited harvest of bass and catfish on all rim area lakes, as a first step to send the message to anglers that the lake is managed only for trout.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identifies a management emphasis of intensive use put-and-take cold water sport fish at Woods Canyon Lake, with a desired species assemblage of rainbow trout, which is consistent with the proposed action.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from April to September each year; numbers of trout stocked may be from 0 to 120,000 fish annually.

Water Distribution/Connectivity

Woods Canyon Lake has no permanent inflow; however, it receives adequate winter snowpack to fill the lake every year. The water rights are owned entirely by the Department and no water is released downstream for irrigation or other uses. The lake does fill with snowmelt runoff and spills every spring. Some of the year, no water is flowing over the spillway (Figure 16), but since there are no irrigation releases, the lake maintains a fairly constant water level. When the lake does spill, it drains down Woods Canyon Creek for 5.8 miles to the confluence with Willow Springs Canyon to form Chevelon Creek. Chevelon Creek flows perennial for 12.2 miles down to Chevelon Canyon Lake. Woods Canyon and Willow Springs Canyon have some permanent water; however, portions of these creeks dry in the summer months. For more information, see the Chevelon Canyon Lake analysis for detailed description of the connectivity below Chevelon Canyon Lake.

Figure 16. Woods Canyon Lake spillway.

Fish Movement

Stocked rainbow trout do persist in the lake, as shown by spring surveys conducted prior to stocking, but they do not reproduce in the lake. Trout have the ability to escape downstream only when the lake spills, which it does every spring, except in extreme drought years. Escaped trout can travel 5.8 miles down Woods Canyon to Chevelon Creek, then down Chevelon Creek for 12.2 miles to Chevelon Canyon Lake. Refer to the Chevelon Canyon Lake analysis for the detailed description of fish movement below Chevelon Canyon Lake.

Community Description

Woods Canyon Creek contains stocked rainbow trout, and naturally reproducing fathead minnow, possibly reproducing golden shiner, and abundant crayfish. Low numbers of brown trout are maintaining a small population in the creek, despite being last stocked in 1995. This is unusual for a lake with no permanent inflow where trout can spawn. Stocked rainbow trout will persist in the lake, but have not been documented to reproduce in Woods Canyon Lake. One

largemouth bass was caught in 2002, but none since then, and goldfish have been recently reported, but not verified through Department surveys (Table 9).

Table 9. Survey history at Woods Canyon Lake with gillnets.

Species	Apr. 2001	Apr. 2002	Apr. 2003	Apr. 2004	Apr. 2005
Rainbow trout	15	15	28	28	72
Brown trout	2	4	7	5	2
Golden shiner			1		
Cutthroat trout		1			
Largemouth bass		1			

Woods Canyon Creek was found to contain rainbow trout, brook trout, brown trout, fathead minnow, and speckled dace when surveyed in 1995 (Lopez et al. 1998e; Table 10). Brook and brown trout were the majority of fish collected in the survey, but were all collected in low numbers over the twelve 50-meter stations surveyed with 3-pass backpack electroshocking depletion. The 3 species of trout collected may not be reproducing in Woods Canyon Creek and are likely escapees from Woods Canyon Lake. Evidence to support this is based on very low ratings for potential spawning area and gravel bottom, determined by a General Aquatic Wildlife System survey in 1995 (Lopez et al. 1998e); no small trout were collected, and brook, brown and rainbow trout were stocked in Woods Canyon Lake up to and including 1995.

Table 10. Survey summary at Woods Canyon Creek in Aug. 1995 (Lopez et al. 1998e).

Species	Num. Collected	Size range (mm TL)
Rainbow trout	2	195-230
Brook trout	12	142-210
Brown trout	10	159-277
Fathead minnow	1	52
Speckled dace	5	45-70

Chevelon Creek upstream of Chevelon Canyon Lake contained naturally reproducing brown trout, speckled dace, Little Colorado sucker, rainbow trout, and numerous crayfish, when comprehensively surveyed in 1996 (Lopez et al. 1998a; Table 4). Golden shiner, fathead minnow, and green sunfish have been collected during surveys in 1995, 1999, and 2007, respectively (Lopez et al. 1998a; AGFD unpublished data). Refer to the Chevelon Canyon Lake analysis for a detailed description for the aquatic community description downstream of Chevelon Canyon Lake.

Consultation Species or Critical Habitat
Chiricahua and northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. The nearest occupied and critical habitat for Little Colorado spinedace and the known roundtail chub populations occur downstream of Chevelon Canyon Lake. For this reason they are discussed in the Chevelon Canyon complex analysis, below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua Leopard Frog

Local Analysis: Although Woods Canyon Lake and the Chevelon Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to fish stocked in Woods Canyon Lake is low. There are no historical records for Chiricahua leopard frogs in Woods Canyon Lake or within the Chevelon Creek buffered stocking complex (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 56 surveys at 37 sites within the buffered stocking complex between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites between 2003 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Based on available data, it is likely that Chiricahua leopard frogs do not occupy the buffered complex that includes Woods Canyon Lake (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek complex due to an extreme storm event or a breached dam is moderate. Even though there are no historical records for Chiricahua leopard frogs and some available habitats have not been surveyed, it is possible that Chiricahua leopard frogs occupy the area outside the buffered complex (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Woods Canyon Lake and the Chevelon Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in Woods Canyon Lake is low. There is a historical record of northern leopard frogs at Woods Canyon Lake from 1968, but they have not been observed during subsequent surveys in 1997 and 1998 (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 56 surveys at 37 sites within the Chevelon Creek buffered stocking reach between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database). There is one other site within the buffered stocking complex with a record for northern leopard frogs; Willow Springs Canyon from 1996 (Arizona Game and Fish Riparian Herpetofauna Database). Northern leopard frogs were not observed during subsequent surveys at Willow Springs Canyon in 1997 and 1998 (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites within the buffered stocking complex between 2003 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Data suggest that northern leopard frogs no longer occupy the buffered stocking complex and the current presence of crayfish and non-native fish in the Chevelon Creek drainage, its tributaries, and surrounding tanks and lakes make the habitat within the buffered stocking complex less suitable for northern leopard frogs (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek stocking complex due to an extreme storm event or a breached dam is low. Although the area outside the buffered stocking complex has been poorly surveyed, it is likely that northern leopard frogs no longer occupy the few historical (1932, 1968) sites within the drainages where escaped fish could disperse. (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Chevelon Canyon Lake

Site Description

Chevelon Canyon Lake is located between the headwaters and confluence with the LCR on Chevelon Creek on the Apache-Sitgreaves National Forest (Figure 17), approximately 28 miles northwest of Heber. The dam was built in 1965, creating a 200 surface-acre lake at an elevation of 6366 feet. It has a maximum depth of 80 feet and an average depth of 35 feet. The lake is fed by upper Chevelon Creek, which is perennial. The lake spills every year, except the most severe drought years and is the lowermost stocking site in the Chevelon Complex. All other stocking sites Long Tom Tank, Willow Springs Lake, and Woods Canyon Lake, drain into upper Chevelon Creek, which flows into and through Chevelon Canyon Lake.

Chevelon Canyon Lake can be accessed by all-weather gravel Forest Road 169 and dirt Forest Road 169B to the top of the canyon. Chevelon Canyon Lake campground, which is semi-

primitive with a restroom, is located here at the top of the rim on the west side of the lake. An extremely rough road continues from the campground down into the canyon to the dam, but is only used for stocking and dam maintenance, and a locked gate prohibits public vehicle use down to the lake shore. Anglers must hike down into the canyon to fish. Some anglers haul boats to the lake by ATV which can often squeeze under the locked gate. Boat motors on the lake are restricted to a single gas motor no larger than 10 horsepower. A primitive boat launch ramp is present at the bottom of the gated road. No other facilities exist for this primitive managed lake. Access to the lake from the highest used paved roads to the south is usually cut off during the winter months; however access is usually possible much longer from the north (lower elevation).

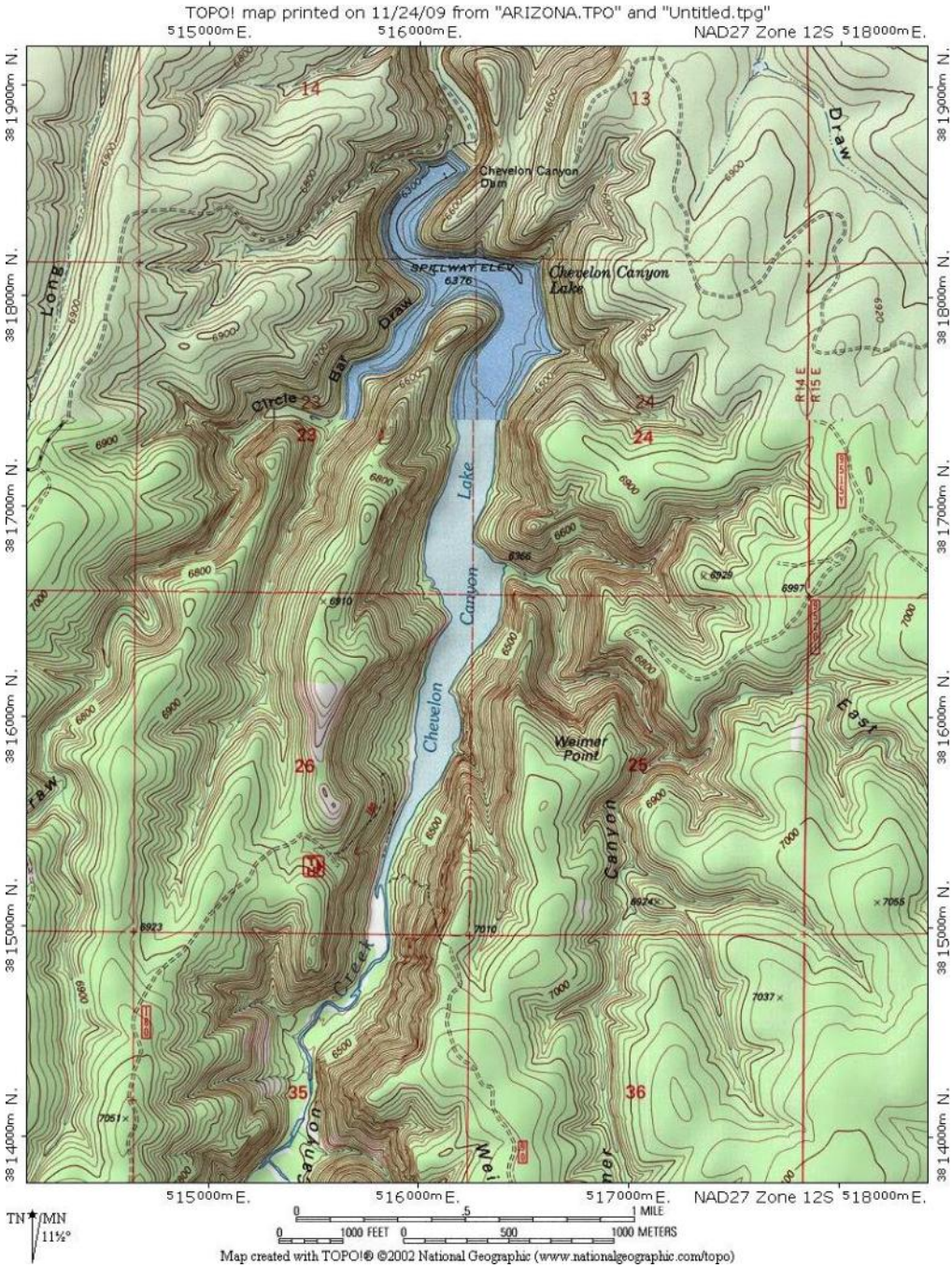

Figure 17. Map of Chevelon Canyon Lake.

Management of Water Body

Chevelon Canyon Lake is managed primarily as a cold water put-grow-and-take cold water fishery with fingerling and sub-catchable rainbow trout (Table 11) and secondarily as a cold

water featured species Arctic grayling fishery. The lake was previously stocked only with fingerling trout because it is easier to stock high numbers in few trips and allows them to grow in the lake. It would be extremely difficult to stock enough catchable trout to support the fishery, despite the lower angler use, largely because of the difficulty in getting a heavy hatchery truck to the bottom of the canyon. The Department recently switched some fingerling stockings to sub-catchables because of finding poor survival of some fingerling stockings, and it is still possible to get a good number of sub-catchables stocked into the lake in one trip per year.

Primary fishery is a cold water rainbow trout put-grow-and-take fishery, offering quality size trout. The Department proposes to add a secondary cold water featured species fishery for Arctic grayling.

Table 11. Stocking history at Chevelon Canyon Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1968	1990	3	72,737
Brown trout	1966	1995	33	921,015
Coho salmon	1971	1972	3	25,076
Cutthroat trout	1987	1990	2	92,780
Rainbow trout	1966	2009	121	3,011,621
Bullfrog tadpole	1969	1969	1	8,580
Total			163	4,131,809

Stream flow in upper Chevelon Creek is perennial, which keeps Chevelon Canyon Lake fairly full. The lake fills and spills every spring, except in only the most severe drought years. Figure 18 provides a picture of the lake and near-shore vegetation at normal water levels. Water quality at the lake remains good all year around, likely due to the depth of the lake. The lower elevation location sometimes leads to fairly warm surface waters; however, the deeper portions of the lake remain cool. The lake is productive enough to grow rainbow trout to 14-16 inches consistently, but not much beyond that.

Because of illegal stockings in other rim lakes, bag limits on warm water fishes were removed, starting on January 1, 2009, allowing unlimited harvest of bass and catfish on all rim area lakes, as a first step to send the message to anglers that the lake is managed only for trout.

The water rights for Chevelon Canyon Lake are owned by the Department and no water is released out of the headgate on the dam. This helps to maintain a good water level in the lake year around, in addition to the perennial stream flowing into the lake.

Figure 18. Chevelon Canyon Lake.

The Department recommends managing the lake for the primitive and remote conditions that currently exist. These conditions are meeting the needs of a segment of anglers that desire a primitive experience and opportunity to catch a larger trout. These conditions are also likely contributing to the lake not being illegally stocked with warm water fish like 4, possibly 5, other rim lakes.

Chevelon Canyon Lake receives fairly low angler use, likely because of the remote conditions and physical effort to get to the lake, supporting 9,062 AUDs in 2001 as determined by a mail-out survey (Pringle 2004). This is fairly consistent with the last on-site angler creel survey conducted at Chevelon Canyon Lake from April through November in 1985. This creel survey reported 8,325 AUDs. However, the lake meets the needs of a portion of anglers that wish to get away from the noise and crowds, such as Willow Springs Lake and Woods Canyon Lake.

The Integrated Fisheries Management Plan for the LCR Watershed (Young et al. 2001) identified the management emphasis at Chevelon Canyon Lake as Blue Ribbon sport fishery, which is basically a put-grow-and-take strategy that promotes growth of stocked fish to larger trophy

sizes. The desired species assemblage in Chevelon Canyon Lake is rainbow trout, brown trout, and Little Colorado sucker. Current regulations do not protect the larger blue ribbon trout from harvest. The proposed action is mostly consistent with this plan in regards to stocking rainbow trout, by allowing them to grown in the lake to larger sizes than normally caught in nearby lakes. The proposed action also adds a new species to the stocking plan; Arctic grayling. Grayling were historically stocked into Chevelon Canyon Lake, but haven't been since 1990. The Department seeks to increase the diversity for anglers and perhaps establish a much needed wild broodstock within the state. Brown trout are common in the lake, but only reproduce in the stream entering the lake (M. Lopez, pers. comm.), and are not part of the proposed stocking action. Little Colorado sucker are abundant in the lake and are naturally reproducing in the lake and in the stream. It is unknown if natural recruitment of Little Colorado sucker is occurring within the lake spawning, or is maintained by juvenile fish spawned in the stream washing down into the lake, as is expected that happens with the brown trout.

Proposed Action

The Department proposes to stock rainbow trout and Arctic grayling for the period covered by this consultation.

Sub-catchable and fingerling rainbow trout and Arctic grayling would be stocked up to multiple times in May to September each year; numbers of trout stocked may be from 0 to 140,000 rainbow trout and 0 to 10,000 Arctic grayling annually.

Water Distribution/Connectivity

Chevelon Canyon Lake receives water from the perennial flow of upper Chevelon Creek. Upper Chevelon Creek is about 12.2 miles long, most of which runs perennial into the lake with high quality water supporting good fish populations. Chevelon Creek is formed at the confluence of its two major headwater streams, Woods Canyon and Willow Springs Canyon, each with a major trout lake at the upper end, Woods Canyon Lake and Willow Springs Lake, 5.8 miles and 3.4 miles upstream of the confluence, respectively. These two headwater lakes do not have perennial water feeding them, but are perennial themselves, maintaining good water quality throughout the year, with a good temperature, pH and oxygen levels, and do not experience winterkills. They are the two uppermost stocking sites within the Chevelon Complex and spill into their respective canyons every spring during snowmelt runoff. Woods Canyon and Willow Springs Canyon have some permanent water; however, portions of these creeks dry in the summer months, which can also lead to a very short dry section in the extreme portion of upper Chevelon Creek.

There are no other tributaries to upper Chevelon Creek that have perennial water, except Long Tom Canyon. Long Tom itself does not have perennial water; however, Long Tom Tank is located on Larson Canyon, a tributary to Long Tom Canyon. This tank is perennial and is the third stocking site, with Chevelon Canyon Lake being the fourth and lowermost stocking site in the Chevelon Complex. Long Tom Tank is located on Larson Canyon approximately 3.3 miles

upstream of Long Tom Canyon. Long Tom Canyon then runs down for 4.1 miles to Chevelon Creek, at a point approximately 4.4 miles upstream of Chevelon Canyon Lake. Larson, Long Tom, and other smaller tributaries do not have perennial water and only flow during spring snowmelt runoff or during an extreme monsoon event. Since the historical management of Long Tom Lake consisted of stocking fingerling trout, it is assumed at this point that it does not winterkill, although there is no survey history to confirm winterkills or winter survival.

Chevelon Canyon Lake fills and spills over the spillway (Figure 19 and Figure 20) every year in the spring with spring snowmelt runoff, except in the most extreme drought years when it may not spill. The Department owns all the water rights and no water is released downstream through the headgate in the dam; therefore, the water levels remain fairly constant, dropping 5-6 feet through the summer during base flows, which is not significant to this deep lake. Water quality (temperatures, pH and oxygen) remains very good throughout the year and the lake does not experience winterkills.

Figure 19. Chevelon Canyon Lake spillway.

Figure 20. Chevelon Canyon Lake spillway.

From the lake, Chevelon Creek continues downstream through a mostly intermittent canyon (Figure 21) for 53.0 miles to the first permanent flow in lower Chevelon Creek, at the confluence with Pony Canyon. Through this mostly intermittent canyon, there are occasional perennial pools, some of which are several hundred yards long and support fish year around, like Durfee Crossing, Chevelon Crossing, and Points of Wildcat, to name a few. The reaches immediately downstream from Chevelon Canyon Lake support brown trout year around but appear to support rainbow trout for only part of the year, with the reaches midway and lower towards perennial flow do not support trout. Even the upper pools become warm and somewhat stagnant in the summer as the flow between pools dries up, leaving the pools with no inflow and poor water quality.

Figure 21. Dry stream channel in Chevelon Creek.

From the start of perennial flow, it is another 3.5 miles down to occupied spinedace habitat, near Rock Tank Canyon confluence, and another 2.4 miles to designated spinedace critical habitat at Bell Cow Canyon confluence. Perennial flows continue down for another 3.1 miles through The Steps, a well known spinedace collection site (Figure 22), and into a very long, deep pool. This reach from the start of perennial flow down to the large pool consists of mostly shallow flows over bedrock, with small pools vegetated with bulrushes, sedges, and overhanging willows. The large pool is entirely different habitat, and is approximately 1.7 miles long in a very narrow slot canyon with no vegetation. Vertical canyon walls drop straight down into the pool, allowing access though this reach only by canoe, kayak or other type of floatation. Depths measured in 1997 indicate that portions of the pool are at least 19.8 feet deep, bottom substrates are unknown, and water velocities are un-noticeable. This pool transitions into another perennial pool that is approximately 2.4 miles long. This pool starts approximately where the canyon and cliffs end and opens into the Little Colorado valley floor, thus, this pool consists of much shallower habitat, and consists of all sand/silt substrates and banks covered with thick stands of salt cedar. At the bottom end of this pool is a large diversion dam operated by the City of Winslow,

diverting some water through a ditch for unknown uses in Winslow. Water flows permanently over, or through cracks in the diversion, and down the lowest reach of Chevelon Creek for 1.7 miles to the confluence with the LCR. This lower reach is almost entirely shallow lotic flows over sand/silt substrates. Figure 22, Figure 23, Figure 24, Figure 25, Figure 26, Figure 27, and Figure 28 provide representative photos of the habitat transitions and types through this reach of stream. Perennial flows continue down the LCR for 9.1 miles to the confluence with Clear Creek, then another 2.5 miles to the City of Winslow, then another several miles before permanent flows disappear into the sand. Upstream of the confluence with Chevelon Creek, the LCR is often dry for many miles. It is 43.3 miles from the confluence with Chevelon Creek upstream to the confluence with Silver Creek. Silver Creek is perennial and contributes perennial flow into the LCR for several miles downstream, then it becomes intermittent. From the confluence with Silver Creek, it is 54.2 miles to Zion Reservoir, then another 30.9 miles to Lyman Lake.

Several large tributaries enter into lower Chevelon Creek downstream of Chevelon Canyon Lake. The first is West Chevelon Canyon, entering approximately 10.5 miles downstream of Chevelon Canyon Lake. The lower 16.2 miles of West Chevelon Canyon is normally dry, running only during spring snowmelt runoff. The next 7.5 miles is mostly dry, but has an occasional shallow isolated pool that supports native fish. From here it is another mile or so to more abundant, more perennial, and deeper pools, plus occupied spinedace habitat. West Chevelon runs continuous during spring snowmelt runoff. Wildcat Canyon enters Chevelon Creek approximately 18.5 miles downstream of Chevelon Canyon Lake. Wildcat Canyon is considered to be dry most of the year, as observed at several Forest Road crossings and by aerial big-game surveys; however, some reaches of Wildcat Canyon have not been surveyed by foot that might detect isolated pools.

Black Canyon enters Chevelon Creek approximately 47.9 miles downstream of Chevelon Canyon Lake. Black Canyon is considered to be dry throughout its length for 56.1 miles, based on observations at Forest Road crossings and aerial big-game surveys, except for Black Canyon Lake near its origin (M. Lopez, pers. comm.). Black Canyon Lake does not have perennial flow entering above, and only spills in years with heavy snowpack or heavy winter precipitation. However, when it does spill, it runs continuous to the confluence with Chevelon Creek. Black Canyon Lake is not included in the Chevelon Complex. Refer to the Black Canyon Lake analysis in the Black Canyon Complex for a detailed description of that lake and fish community in Black Canyon.

Figure 22. Spinedace occupied habitat at The Steps in lower Chevelon Creek.

Figure 23. Deep pool habitat in lower Chevelon Creek downstream of The Steps.

Figure 24. Shallow pool habitat in lower Chevelon Creek just upstream of diversion dam.

Figure 25. Diversion dam on lower Chevelon Creek.

Figure 26. Chevelon diversion ditch.

Figure 27. Spinedace habitat below diversion dam in 1998.

Figure 28. Same photo point as Figure 27 of habitat below diversion dam in 2008.

During heavy spring snowmelt runoff, the entire watershed of Chevelon Creek is connected, and flows downstream into the LCR. From the confluence of Chevelon Creek and the LCR, the LCR runs for 82.2 miles to Grand Falls, another 49.7 miles to the LCR gorge, another 31.3 miles to Blue Spring, and another 13.1 miles to the Colorado River.

Fish Movement

Trout and grayling stocked into Chevelon Canyon Lake will persist in the lake, as the lake maintains good water quality year around and does not winterkill. They also have the opportunity to move upstream into the perennial flows of upper Chevelon Creek. This habitat is suitable for trout, and escaped trout from the lake can persist and possibly reproduce in upper Chevelon Creek. persistence and reproduction of grayling in this area would not be expected to occur. Stocked fish may also swim upstream into Long Tom Canyon, Woods Canyon, or Willow Springs Canyon, where they likely will not persist long because of regularly dry conditions in Long Tom or sub-optimal conditions in Woods Canyon and Willow Springs Canyon. Movement of stocked fish downstream of the lake is discussed below in the complex analysis.

Community Description

Chevelon Canyon Lake contains stocked rainbow trout, and naturally reproducing brown trout, Little Colorado sucker, golden shiner, fathead minnow, speckled dace, and numerous crayfish (Table 10). The brown trout, and possibly stocked rainbow trout, reproduce in the perennial stream entering the lake, but not in the lake itself. Large schools of speckled dace were observed along the shoreline of Chevelon Canyon Lake just above the spillway in 2009.

Table 12. Survey history at Chevelon Canyon Lake with experimental gillnets.

Species	Apr. 2004	Apr. 2005	Apr. 2006	Apr. 2007	Apr. 2008
Rainbow trout	48	92	62	28	3
Brown trout	5	13	2	9	2
LC sucker	47	111	55	78	32

Chevelon Creek above the lake is dominated by wild brown trout (Lopez et al 1998a), which helps to keep the lake populated with that species since they haven't been stocked there since 1995. Rainbow trout have been documented upstream of the lake in extremely low numbers (total number collected was 17) based on surveys conducted 1995-1998 (Lopez et al 1998a). Little Colorado sucker are also found in the stream above the lake, as were golden shiner and speckled dace. Unsubstantiated reports of bluehead sucker above the lake need to be investigated.

Isolated permanent pools immediately below the lake have been found to contain brown trout, rainbow trout, fathead minnow, golden shiner, roundtail chub, bluehead sucker, Little Colorado sucker, speckled dace, and numerous crayfish. Rainbow trout have been collected downstream of the lake on several occasions, with most collections between the lake and West Chevelon Canyon, 10.5 miles downstream of the lake; however, 1 isolated collection near Potato Wash, 42.0 miles downstream of the lake, was the lowest record of rainbow trout in Chevelon Creek over many years of surveys. No trout have been recorded below the confluence with Black Canyon. One black bullhead was found near the confluence with Potato Wash. California floater shells and canyon treefrogs have also been reported from this reach.

Table 13 provides a summary of fish surveys in Chevelon Creek from Chevelon Canyon Lake downstream to Pony Canyon, which is the end of intermittent reach with isolated permanent pools. The table begins with a survey site immediately below Chevelon Canyon Lake dam and lists other survey sites in sequence downstream towards the lower reaches of Chevelon Creek. The surveys in 1965 were from an unknown source in the Kansas Gap database (cited from SONFISHES data) and are about the time of dam construction. The 1983 surveys were conducted with 1/8" mesh seines, with an effort of 10 seine hauls per site (Minckley 1984). The 1991-1995 surveys were conducted with a combination of 1/8" mesh seines and backpack electroshocker (Dorum and Young 1995). The 1995-1998 surveys were conducted with 1/8"

mesh seines, green meanie gillnets, backpack electroshocker, and canoe electroshocker (Lopez et al 1998a). The 2005 surveys were conducted with hoop nets, green meanie gillnets, and backpack electroshocker (McKell 2005b). The 2007 surveys were conducted with hoop nets, minnow traps, 1/8” mesh seines, and backpack electroshocker (Weiss 2007a; AGFD unpublished data). The 2008 survey was conducted with 1/8” mesh seines (AGFD unpublished data). The 2009 surveys were conducted with 1/8” mesh seines, backpack electroshocker, green meanie gillnets, and hoopnets (AGFD unpublished data).

Table 13. Summary of fish surveys below Chevelon Canyon Lake.

Date	Species								
	Brown Trout	Rainbow Trout	LC Sucker	Bluehead Sucker	Speckled Dace	Fathead Minnow	Golden Shiner	Black Bullhead	Roundtail Chub
Immediately below Chevelon Canyon Lake									
1965	present	Present	present		present				present
1983					present	present			present
8/3/2005			3		49	47			
Durfee Crossing									
1991			7		5	33			
10/3/1995	2		44	3	3				1
8/2/2005			6			36			25
8/3/2005			1		166	16			3
9/6/2007			11		21	785			36
9/23/2008						present			30
Upstream of Chevelon Crossing									
1966		Present	present		present		present		present
8/15/1995					27		22		1
8/16/1995					4		11		
Chevelon Crossing									
1965					present				
1983					present	present	present		
6/19/1991		5	1		18	110			
8/15/1995			4		86	3	92		1
6/5/2001									present
8/1/2005						49			18
8/2/2005					3	60			2
9/6/2007					3	68			1

Date	Species								
	Brown Trout	Rainbow Trout	LC Sucker	Bluehead Sucker	Speckled Dace	Fathead Minnow	Golden Shiner	Black Bullhead	Roundtail Chub
USFS downstream of Chevelon Crossing									
6/21/1991		1							
8/9/1995						3	151		
8/9/1995					25	18	75		
8/10/1995					7	1	50		
Wildcat Gage station									
6/1991			11			466	4		5
7/25/1991			53	1					14
8/1993				1	2	183			
7/1995				1	10	45			3
10/7/1996						194			
8/1/2005			1			8			
6/2/2009			278			311			
Intermittent below Forest Boundary									
10/2/1997						49			
10/2/1997						280			
10/2/1997									
10/2/1997			43			102			
10/3/1997			1			93			
10/3/1997			38						
10/4/1997						38			2
10/4/1997									
10/4/1997									
10/4/1997									
10/4/1997									
10/4/1997									
10/4/1997									
10/4/1997									
10/4/1997									
10/27/1997									
10/27/1997									
10/27/1997									
10/27/1997			5						7

Date	Species								
	Brown Trout	Rainbow Trout	LC Sucker	Bluehead Sucker	Speckled Dace	Fathead Minnow	Golden Shiner	Black Bullhead	Roundtail Chub
10/28/1997									
10/28/1997						15			
10/29/1997		1				120		1	
10/30/1997						89			
10/5/1997						567			
10/5/1997						831			
6/15/1998			3			36			
6/16/1998			1			25			1
6/16/1998			4			5			
6/2/2009						1087			

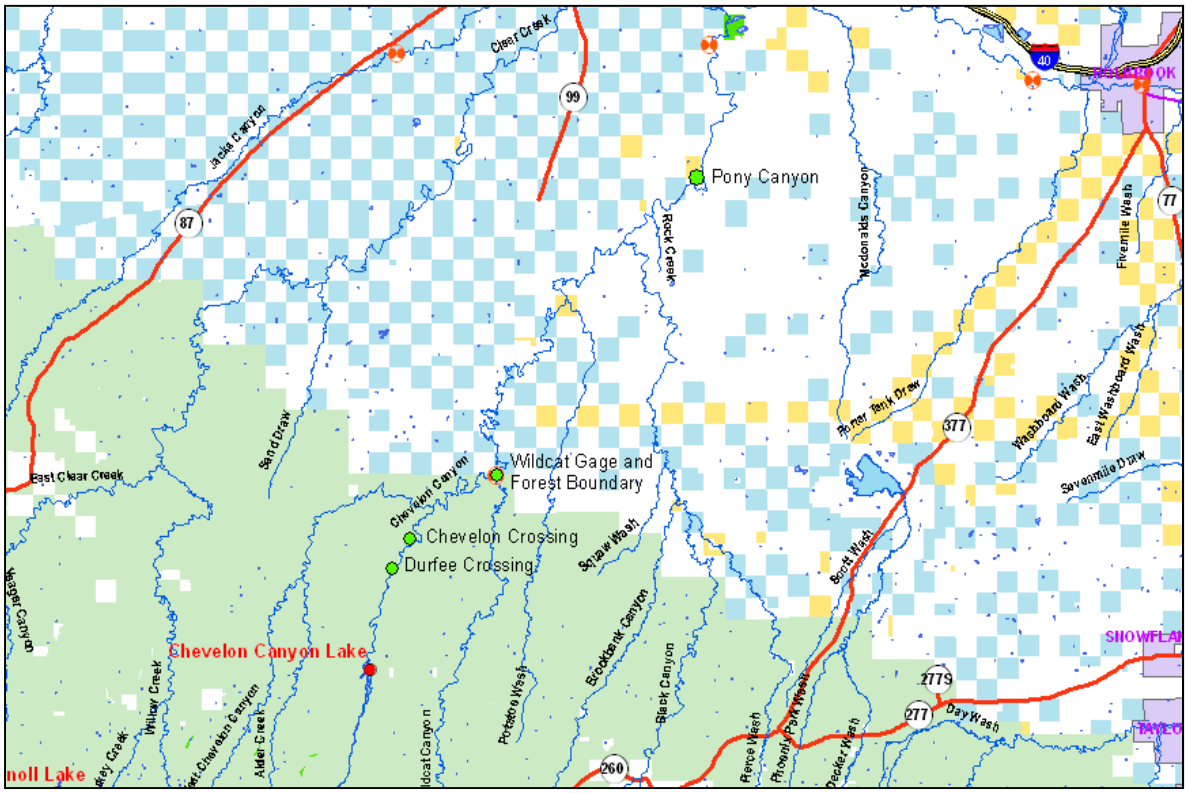

Figure 29. Map of points mentioned in Table 13.

Permanent flow from the confluence of Pony Canyon downstream to just above the very large pool (including The Steps) contains LC spinedace, LC sucker, bluehead sucker, speckled dace, green sunfish, fathead minnow, plains killifish, red shiner, golden shiner, black bullhead, yellow bullhead, and crayfish. The population of spinedace in and around The Steps area is large and robust, containing the highest densities of spinedace anywhere recorded. They have been observed in schools up to several hundred individuals. Little Colorado sucker, bluehead sucker, speckled dace, green sunfish, fathead minnow, and crayfish are also well established in this area. Plains killifish and black bullhead are locally common, and records of red shiner, golden shiner, and yellow bullhead are rare.

Table 14 provides a summary of fisheries surveys in reaches believed to provide permanent flow, and where occupied spinedace habitat is known to occur in Chevelon Creek from Pony Canyon to 1.7 miles above McLaws Road. Surveys were conducted with a backpack electroshocker and seines (Dorum and Young 1995; Lopez et al. 1998a; Weiss 2007a; AGFD unpublished data).

Table 14. Summary of fisheries surveys in permanent flow in Chevelon Creek from Pony Canyon to 1.7 miles above McLaws Road.

Date	Species										
	LC Spinedace	LC Sucker	Bluehead Sucker	Speckled Dace	Green Sunfish	Fathead Minnow	Plains Killifish	Red Shiner	Golden Shiner	Black Bullhead	Yellow Bullhead
Where permanent flow begins											
6/1998						499					
6/1998		1		2	41	10				1	
6/1998	17	3		37	27	144				1	
6/1998	1	6	2	11	146	119				9	
6/1998	5			1	1	8					
1 mile above The Steps											
10/8/1996	1			18	29	110					
7/1995	2		44	106							
6/1994	3	6	5	84	5	8					
8/1993		36		185	1						
7/1990	4										
Bell Cow Canyon confluence											
6/4/2009	221		1	18	322	191					
Just above The Steps											
6/4/2009	11		13	72	9	6					

Date	Species										
	LC Spinedace	LC Sucker	Bluehead Sucker	Speckled Dace	Green Sunfish	Fathead Minnow	Plains Killifish	Red Shiner	Golden Shiner	Black Bullhead	Yellow Bullhead
The Steps											
8/1977	111	21			75				1		
7/1983	76			3	7	443					
6/1990	33			5	55	89					2
7/1990	244		1	5	120	75					
8/1993	4		45	162	11	8					
6/1994	6			62	11	21					
7/1995	1		1	33	10	9					
10/8/1996				1	47	206	13	1			
7/23/2002	417					present	present				
10/11/2006	165					present	present				
7/23/2007	95	present	present	present	present	present					
9/4/2009	105		7	44	10	25					
Downstream of The Steps											
6/1998	1	present			present	3				present	
6/1998	6										
6/1998	2										
6/1998	7										
6/1998	1				present						
6/1998	4										
6/1998	1										
6/1998	1										
6/1998	2										
6/4/2009	267		5	94	4	1					

Downstream of The Steps area is a very large, deep pool in a deep slot canyon. This point down to the LCR is dominated by non-native fishes. This deep pool is difficult to navigate and even more difficult to survey because of the depth, difficult access, and nearly no structure on which

to attach gillnets. Limited surveys in this large pool in June 1998 with some gillnets resulted in the capture of Little Colorado sucker, green sunfish, and black bullhead (Lopez et al. 1998a; Table 15). An angling survey also found largemouth bass, green sunfish, and common carp in this large pool (M. Lopez, pers. comm.).

Table 15. Survey summary of the large deep pool between the McClaws Road bridge and The Steps area, conducted in Jun 1998 with gill nets.

Date	Largemouth Bass	Green Sunfish	Black Bullhead
6/1998 (3-2)	5	13	2
6/1998 (3-1)	2		

Downstream of the large, deep pool in the slot canyon, and downstream of McClaws Road Bridge, is another pool backed up by a large diversion dam. This area is not within a canyon, but entering the LCR valley, with much of the pool located on the Chevelon Wildlife Area. It consists of sand/silt substrates and has thick salt cedar stands along both banks. This reach contains native Little Colorado sucker, but dominated by non-native fishes, including green sunfish, fathead minnow, plains killifish, common carp, red shiner, channel catfish, and black bullhead (Lopez et al. 1998a; Table 16).

Table 16. Survey summary of the shallow pool downstream of McClaws Road bridge, conducted in 1997 and 1998, with gillnets, canoe electroshocker, and seine.

Date	Species							
	LC Sucker	Green Sunfish	Fathead Minnow	Plains Killifish	Common Carp	Red Shiner	Channel Catfish	Black Bullhead
7/1998	1	2			4			2
7/1998		40	75	20		21		
11/21/1997	3							
11/21/1997	16	11			2		3	28
11/21/1997	4	1			2		1	1
11/21/1997	9	11			1		1	6

Downstream of the diversion dam, extreme lower Chevelon Creek flows as a stream again down to the confluence with the LCR, but in wide, shallow, sand/silt habitat. A very short section of

this area immediately downstream of the diversion dam once consisted of run/riffle habitat over gravel and cobble substrates, and supported native fishes including Little Colorado spinedace, Little Colorado sucker, bluehead sucker, and speckled dace, in addition to massive numbers of non-native minnows (mostly cyprinids) and crayfish (Dorum and Young 1995; Lopez et al. 1998a). However, this run/riffle section has been replaced by a larger and deeper pool immediately downstream of the diversion dam, which leads directly into the sand/silt substrates, and is currently dominated by largemouth bass, crayfish, and other non-natives (Weiss 2007a; Table 17). A portion of this reach is also located on the Chevelon Wildlife Area and is also known as the Hugo Meadow survey site.

Table 17. Survey summary of the Hugo Meadow survey site, using backpack electroshockers and seines.

Date	Species						
	LC Spinedace	LC Sucker	Bluehead Sucker	Speckled Dace	Green Sunfish	Fathead Minnow	Plains Killifish
Aug-77	6	10			68	72	10
Jul-83	154				5	832	134
Jun-90	55				27	482	9
Aug-93	2	34		52	1000+	10000+	3
Jun-94	3	21	2	10	6	1243	20
Jul-95	46			14		1222	44
Oct-96	9			4	4	402	91
Nov-97				3	40	202	83
Jul-02					26	240	48
Jul-07					12		10
Jun-09						310	

Date	Species							
	Common Carp	Red Shiner	Golden Shiner	Channel Catfish	Largemouth Bass	Black Bullhead	Yellow Bullhead	Bluegill
Aug-77	92		22	12	12	9	1	
Jul-83	4			3				83
Jun-90	5	8	1				1	

Aug-93	4	10000+		4				
Jun-94	Present	378						
Jul-95	13	211						
Oct-96		1787						
Nov-97		539						
Jul-02		201						
Jul-07		1			108			
Jun-09	20	168		1	88			

The LCR is also dominated by non-native fishes in the vicinity of the Chevelon Creek confluence, with Little Colorado suckers occasionally collected. The next closest population of Little Colorado spinedace occurs near St. Johns, approximately 110 miles upstream of the Chevelon Creek confluence. Table 18 provides a summary of fishes surveyed from the LCR between Winslow upstream to near St. John's (Dorum and Young 1995; Weiss 2007a; AGFD unpublished data).

Table 18. Survey summary of the LCR using backpack electroshockers and seines. The table begins with the Winslow site and lists other sites in sequence upstream towards Lyman Lake.

Date	Species												
	LC Spinedace	LC Sucker	Bluehead Sucker	Speckled Dace	Fathead Minnow	Green Sunfish	Plains Killifish	Bluegill	Channel Catfish	Red Shiner	Common Carp	Yellow Bullhead	Goldfish
LCR – Winslow													
7/2007					703	1	1587	1	5	10			
6/2009		4			39		104			22			
LCR – Indian Cove													
8/1991					608								10
LCR – Holbrook													
4/2007					10		1						
5/2007					1								
6/2009													
LCR – Woodruff													
8/1991			1		143					3			
8/1991			11		30	5				1			
6/1994		5			11				2		1	1	

6/2009					38								
LCR – Silver Creek confluence													
7/1997		2			536						6		
6/2009		7			14						4	21	
LCR – Sewage Ponds North of St. Johns													
9/1991	2			3	3		50						
8/1993	16		1		2		16						
7/2009													
LCR – North of St Johns													
9/1991	33			2	86		95				2		
LCR – St Johns													
7/2009					5	1					2		
LCR – South of St Johns, near Little Reservoir													
7/1983	30	17			3		2						
9/1991	69	1	1	3			2						
8/1993	11		30	6									
6/1994	10	1		2									
7/1995	12			10			4						
LCR – Carl Pew's property													
7/1990	4	6		4									
7/1990	23	1			14	1	12						
7/2009	21	5		1	9	1	1						
7/2009					5		9						
7/2009		1			19		10						
7/2009	1				9		4						
7/2009	2				6								
LCR – Downstream of Salado													
7/1990		2			3								
8/1993					16						1		
4/2007					6	1	2				1		
LCR – Salado													
8/2009					3	1					1		
8/2009											1		
8/2009											2		

West Chevelon Creek was originally surveyed in 1999, finding only native fish, bluehead sucker and speckled dace (AGFD unpublished data). An extreme drought in 2002 nearly dried up all

habitats within West Chevelon, likely eliminating bluehead sucker, as they have not been collected there since. However, speckled dace persisted through the drought and currently exist in the stream (AGFD unpublished data; Carter 2006; Weiss 2008). Little Colorado spinedace were reintroduced into permanent pools in upper West Chevelon in July 2007 (Weiss 2007e). Recent surveys in upper West Chevelon have documented the persistence of speckled dace and LC spinedace (Table 19), with evidence of reproduction by spinedace (AGFD unpublished data). No trout or other non-native fish, including non-native crayfish, have ever been collected in West Chevelon Creek, providing evidence that the lower 16.2 miles of dry habitat has effectively kept non-native organisms out of permanent habitat in upper West Chevelon, including rainbow trout.

Table 19. Survey summary in West Chevelon Creek, conducted with backpack electroshocker, dipnets, and seines.

Date	Species		
	Speckled Dace	Bluehead Sucker	Little Colorado Spinedace
6/1999	Present	Present	
11/1999	75	25	
9/2003	Present		
4/2004	Present		
5/2005	250		
6/2006	Present		
6/2007	Present		
11/2007	Present		Present
5/2008	Present		Present
7/2008	79		12
8/2009	207		76

Consultation species or Critical Habitat

Potential impacts to Mexican spotted owl, Chiricahua and northern leopard frogs are analyzed below. Both frog species are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. The nearest occupied and critical habitat for Little Colorado spinedace and the known roundtail chub populations occur downstream of Chevelon Canyon Lake. For this reason they are discussed in the Chevelon Canyon complex analysis below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Mexican Spotted Owl

The stocking location is within Mexican spotted owl (MSO) critical habitat (CH) and is within a buffer. The stocking location is located in a very steep canyon based on review of topographic maps which limit angler access. World imagery maps show that there is minimal shoreline around the lake. Most access to the reservoir will be by boat.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around Mexican spotted owl PACs in the general vicinity of the site. No physical effects to Mexican spotted owl habitat in the PAC are anticipated, since anglers are not expected to be present in the PAC. There may be some disturbance to Mexican spotted owls from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of Mexican spotted owl critical habitat and/or restricted and protected habitats.

The critical habitat designation included most other protected and restricted habitats for the Mexican spotted owl. Indirect effects to critical habitat may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the

vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of Mexican spotted owl critical habitat and/or restricted and protected habitats.

Chiricahua Leopard Frog

Local Analysis: Although Chevelon Canyon Lake and the Chevelon Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that fish stocked in Chevelon Canyon Lake will have an impact on Chiricahua leopard frogs is low. There are no historical records for Chiricahua leopard frogs at Chevelon Canyon Lake or within the Chevelon Creek buffered stocking complex. There have been 56 surveys at 37 sites within the buffered stocking complex between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites between 2003 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Based on available data, it is likely that Chiricahua leopard frogs do not occupy the buffered complex that includes Chevelon Canyon Lake (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek complex due to an extreme storm event or a breached dam is moderate. Even though there are no historical records for Chiricahua leopard frogs and some available habitats have not been surveyed, it is possible that there are populations of Chiricahua leopard frogs in the area outside the buffered stocking complex (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frogs

Local Analysis: Although Chevelon Canyon Lake and the Chevelon Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in Chevelon Canyon Lake is low. There are no historical records of northern leopard frogs at Chevelon Canyon Lake. There have been 56 surveys at 37 sites within the Chevelon Creek buffered stocking reach between 1968 and 2005 (Figure 9, Arizona Game and Fish Riparian Herpetofauna Database). There are 2 sites with records for northern leopard frogs; Woods Canyon Lake (1968) and Willow Springs Canyon (1996) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern

leopard frogs were not observed during subsequent surveys at Woods Canyon (1992 and 1995) or at Willow Springs Canyon (1997 and 1998) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District, Tonto National Forest, surveyed 29 sites within the buffered stocking complex between 2003 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). Data suggests that northern leopard frogs no longer occupy the buffered stocking complex and the current presence of crayfish and non-native fish in the Chevelon Creek drainage, its tributaries, and surrounding tanks and lakes make the habitat within the buffered stocking complex less suitable for northern leopard frogs (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in the Chevelon Creek stocking complex due to an extreme storm event or a breached dam is low. Although the area outside the buffered stocking complex has been poorly surveyed, it is likely that northern leopard frogs no longer occupy historical (1932, 1968) sites within the drainages where escaped fish could disperse. (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

CHEVELON CREEK COMPLEX ANALYSIS

Water Distribution

Woods Canyon Lake and Willow Springs Lake spill into Woods Canyon and Willow Springs Canyon during the spring runoff. These two canyons meet to form Chevelon Creek, which runs perennial into Chevelon Canyon Lake. Woods Canyon and Willow Springs are the main headwater tributaries to Chevelon Creek, contributing most of the spring runoff flow, but are only partially perennial at base flows. Long Tom Tank is located in the headwaters of tributary Long Tom Canyon, which is dry during the summer and a minor contributor to spring runoff in the system. Chevelon Creek, between the confluence of Woods Canyon and Willow Springs Canyon down to Chevelon Canyon Lake, is good quality perennial trout habitat for approximately 12 miles.

Water draining over the spillway at Chevelon Canyon Lake, the lowest stocking site in the complex, drains down to the LCR. However, only isolated pools persist through the summer in the middle 53.0 miles of Chevelon Creek below the reservoir. Perennial continuous flow does return in the lower 14.5 miles of Chevelon Creek down to the confluence with the LCR.

Fish Movement

Rainbow trout stocked into Long Tom Tank, Willow Springs Lake, Woods Canyon Lake, and Chevelon Canyon Lake, plus Arctic grayling in Chevelon Canyon Lake, can likely escape those reservoirs during high flow events that occur during spring snowmelt runoff, and end up in Chevelon Canyon Lake, the lowest stocking site in the complex. Rainbow trout can persist in all these lakes and in upper Chevelon Creek between the lakes. All trout that are in Chevelon

Canyon Lake, including those coming down from the other 3 reservoirs, have the potential to disperse downstream over the spillway at Chevelon Canyon Lake during spring runoff. At this point it is not possible to know which lake a dispersing trout comes from, but is most logically those stocked directly into Chevelon Canyon Lake. Rainbow trout do escape Chevelon Canyon Lake and have been documented in the creek below the lake. They were collected downstream of the lake on several occasions, with most collections occurring between the lake and West Chevelon Canyon, 10.5 miles downstream of the lake; however, 1 rainbow trout was collected near Potato Wash in 1997, 42 miles downstream of the lake. This isolated collection was the furthest downstream record of rainbow trout in Chevelon Creek over many years of surveys presented in previous tables. Although it is possible for escaped trout to travel throughout lower Chevelon Creek and even into the LCR during heavy spring flows, no trout of any kind has been collected in occupied spinedace habitat in lower Chevelon Creek, or in the LCR upstream from Grand Falls to Lyman Lake based on the data presented in the previous tables. Trout are not expected to persist due to the drying of the stream and unsuitable habitat between the lake and spinedace populations. The data from numerous surveys support this statement, because no trout has been collected in occupied spinedace habitat in upper West Chevelon Canyon and lower Chevelon Creek, or anywhere in West Chevelon Canyon, or in designated Critical Habitat in lower Chevelon Creek. Arctic grayling have not been stocked since 1990, but they would be expected to have dispersal and survival chances lower than rainbow trout due to their natural history, habitat limitations and biology.

Escaping fish could potentially swim upstream in the LCR from the confluence with Chevelon Creek, for 43.3 miles to the confluence with Silver Creek during high flows. However, they could not get upstream of the Woodruff Dam on the very lower portion of Silver Creek. They could continue up the LCR for an additional 85.1 miles to Lyman Lake dam, also only during high flows, but it is extremely unlikely escaped stocked fish would ever make it into these habitats. No trout has ever been documented in the LCR in these reaches, or in lower Silver Creek below White Mountain Lake.

Escaped fish could also potentially move downstream in the LCR from the confluence with Chevelon Creek during high flows. At Clear Creek, a trout could not go upstream past the Clear Creek Reservoir dam into very lower Clear Creek, but could possibly get up into Jacks Canyon, or into Diablo Canyon, or even further downstream. However, it is extremely unlikely because of the harsh conditions that exist in all but the most wetted periods and given that trout have never been found in lower Chevelon Creek or any of the other lower stream reaches mentioned.

Community Description

Isolated permanent pools immediately below the lake have been found to contain brown trout, rainbow trout, fathead minnow, golden shiner, roundtail chub, bluehead sucker, Little Colorado sucker, speckled dace, and numerous crayfish (Table 13). Rainbow trout have been collected

downstream of the lake on several occasions, with most collections between the lake and West Chevelon Canyon, 10.5 miles downstream of the lake; however, one isolated collection near Potato Wash, 42.0 miles downstream of the lake, was the record of rainbow trout at the lowest elevation in Chevelon Creek over many years of surveys. No trout have been recorded below the confluence with Black Canyon. One black bullhead was found near the confluence with Potato Wash. California floater shells and canyon treefrogs have also been reported from this reach.

Permanent flow from the confluence of Pony Canyon (which is 12 miles upstream from the LCR confluence) downstream to just above the very large pool, including The Steps (about 5 miles upstream of the confluence), contains Little Colorado spinedace, Little Colorado sucker, bluehead sucker, speckled dace, green sunfish, fathead minnow, plains killifish, red shiner, golden shiner, black bullhead, yellow bullhead, and crayfish (Table 14). The population of spinedace in and around The Steps area is large and robust, containing the highest densities of spinedace anywhere recorded, and were observed in schools up to several hundred individuals. Little Colorado sucker, bluehead sucker, speckled dace, green sunfish, fathead minnow, and crayfish are also well established in this area. Plains killifish and black bullhead are locally common, and records of red shiner, golden shiner, and yellow bullhead are rare.

Downstream of The Steps area is a very large, deep pool in a deep slot canyon. From this point down to the LCR is dominated by non-native fishes. This deep pool is difficult to navigate and even more difficult to survey because of the depth, difficult access, and nearly no structure on which to attach gillnets. Limited surveys in this large pool in June 1998 with some gillnets resulted in the capture of Little Colorado sucker, green sunfish, and black bullhead (Lopez et al. 1998a; Table 15). An angling survey also found largemouth bass, green sunfish, and common carp in this large pool (M. Lopez, pers. comm.).

Downstream of the large, deep pool in the slot canyon, and downstream of McClaws Road Bridge, is another pool backed up by a large diversion dam. This area is not within a canyon, but entering the LCR valley, with much of the pool located on the Chevelon Wildlife Area. It consists of sand/silt substrates and has thick salt cedar stands along both banks. This reach contains native Little Colorado sucker, but is dominated by non-native fishes, including green sunfish, fathead minnow, plains killifish, common carp, red shiner, channel catfish, and black bullhead (Lopez et al. 1998a; Table 16).

Downstream of the diversion dam, extreme lower Chevelon Creek flows as a stream again down to the confluence with the LCR, but in wide, shallow, sand/silt habitat. A very short section of this area immediately downstream of the diversion dam once consisted of run/riffle habitat over gravel and cobble substrates, and supported native fishes including Little Colorado spinedace, Little Colorado sucker, bluehead sucker, and speckled dace, in addition to massive numbers of non-native minnows (mostly cyprinids) and crayfish (Dorum and Young 1995; Lopez et al. 1998a). However, this run/riffle section has been replaced by a larger and deeper pool

immediately downstream of the diversion dam, which leads directly into the sand/silt substrates, and is currently dominated by largemouth bass, crayfish, and other non-natives (Weiss 2007a; Table 17). A portion of this reach is also located on the Chevelon Wildlife Area and is also known as the Hugo Meadow survey site.

The LCR is also dominated by non-native fishes in the vicinity of the Chevelon Creek confluence, with Little Colorado suckers occasionally collected. Little Colorado spinedace also occur near St. Johns, approximately 110 miles upstream of the Chevelon Creek confluence. Table 18 provides a summary of fishes surveyed from the LCR between Winslow and near St. John's (Dorum and Young 1995; Weiss 2007b; AGFD unpublished data).

West Chevelon Creek was originally surveyed in 1999, finding only native fish, bluehead sucker and speckled dace (AGFD unpublished data). An extreme drought in 2002 nearly dried up all habitats within West Chevelon, likely eliminating bluehead sucker, as they have not been collected there since. However, speckled dace persisted through the drought and currently persist in the stream (AGFD unpublished data; Carter 2006; Weiss 2008). Little Colorado spinedace were reintroduced into permanent pools in upper West Chevelon in July 2007 (Weiss 2007e). Recent surveys in upper West Chevelon have documented the persistence of speckled dace and Little Colorado spinedace (Table 19), with evidence of reproduction by spinedace (AGFD unpublished data). No trout or other non-native fish, including non-native crayfish, have ever been collected in West Chevelon Creek, providing evidence that the lower 16.2 miles of dry habitat has effectively kept non-native organisms, including rainbow trout, out of permanent habitat in upper West Chevelon.

Consultation Species or Critical Habitat
Potential impacts to Little Colorado spinedace and roundtail chub downstream from Chevlon Canyon Lake are addressed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Little Colorado Spinedace

Spinedace were reintroduced as a conservation action in July 2007 in upper West Chevelon Canyon. They also persist as a naturally occurring population in lower Chevelon Creek, downstream of Chevelon Canyon Lake, which is the lowest downstream stocking site in the Chevelon Complex. Occupied spinedace habitat in upper West Chevelon Canyon is located 36.6 miles from Chevelon Canyon Lake, via 10.5 miles of Chevelon Creek downstream of the lake and up West Chevelon Canyon for 26.1 miles from the confluence with Chevelon Creek. Surveys of the West Chevelon spinedace indicate they have moved approximately 150 meters downstream in July 2008 from where they were originally stocked and 0.3 miles further downstream in August 2009. The spinedace are dispersing within the series of permanent pools within upper West Chevelon Canyon, but still within that small area, with many miles of dry habitat existing downstream to Chevelon Creek.

Potential Impacts

The potential for trout or grayling to disperse downstream of Chevelon Canyon Lake into occupied and critical habitat for spinedace in lower Chevelon Creek exists, but is extremely low. Trout do disperse downstream of the lake, and individual rainbow trout have been documented. However, the numbers are low and the fish do not persist. Trout and grayling have the potential to go over the dam only during spring runoff, at which time Chevelon Creek is flowing continuously down to occupied habitat. But as the flows drop to base flow, approximately 53 miles of Chevelon Creek dries to isolated pools that do not appear to support rainbow trout through the summer. Grayling have a lower tolerance for warm temperatures and drying stream conditions and would be expected to have an even lower opportunity for dispersal and persistence. Brown trout seem to persist in some of the pools at the upper end of this reach, but this species is more tolerant of warm conditions. Rainbow trout have also never been found downstream past the confluence of Black Canyon, and have never been documented in occupied spinedace habitat or critical habitat in many years of surveys.

It is possible for a dispersing spinedace to get washed downstream from upper West Chevelon Canyon and into Chevelon Canyon during flood flows and encounter an escaped rainbow trout or grayling from the upper stocking sites. However, this would not be a likely occurrence because of the distance involved from occupied habitat, plus the low occurrence of rainbow trout near the confluence of West Chevelon Creek. Because the population of spinedace in West Chevelon has been reintroduced, any impact under this situation would be on an individual fish and have no impact on the species or population level, since a dispersing spinedace from upper West Chevelon would be lost to the population. Since that fish could not make it back to occupied habitat that it came from, it would not be expected to establish in Chevelon Creek in that area due to the presence of non-native fish and crayfish, and is not likely to be washed even further downstream to the next spinedace population in lower Chevelon Creek, because of the distances involved and numerous predators along the way. It is also unlikely that spinedace would disperse

upstream from lower Chevelon Creek, since their current upstream distribution is nearly identical to the upper extent of permanent and continuous flows in lower Chevelon Creek. The dry and intermittent habitat in middle Chevelon Creek, from Chevelon Canyon dam downstream to Pony Canyon, is likely the greatest influence on upstream distribution of spinedace. Even then, the occurrence of escaped trout in Chevelon Creek downstream of the lake is very low and would not likely present a major obstacle to upstream movement of spinedace if they were to overcome the habitat deficiencies of that reach.

Roundtail chub

Roundtail chub are known to occupy habitats at Durfee Crossing (just upstream from the West Chevelon Canyon confluence and Chevelon Crossing, approximately 10 miles downstream from Chevelon Canyon Lake) and downstream to the confluence with the Little Colorado River.

Potential Impacts

Exposure to stocked fish that could escape from Chevelon Canyon or lakes upstream would be to adult and juvenile chub. While there is a possibility that escaped trout or grayling may reach occupied chub habitat, the low likelihood of persistence reduces the potential for impacts to roundtail chub. If stocked trout dispersed into occupied roundtail chub habitat in lower parts of Chevelon Canyon, they could compete with roundtail chub for food and space or prey on juvenile roundtail chub as described in the species interactions if the timing of the escapement of trout and spawning of chub overlap. However, this impact, if it did occur, would be of short duration due to the poor conditions for trout and grayling.

The Conservation Team implementing the Arizona conservation agreement for the roundtail chub was comfortable with stocking rainbow trout and Apache trout in drainages containing roundtail chub as long as the stocking was not on top of the roundtail population (SCAS meeting notes, 3/6/08). The attendees at that meeting were:

- *Arizona Game and Fish Department*: Chuck Benedict, Chris Cantrell, Greg Cummins, Tim Grosch, Mike Lopez, Scott Reger, Matt Rinker, Jeff Sorensen, Dannette Weiss
- *Arizona State University:* Tom Dowling, Mike Schwemm
- *U.S. Fish & Wildlife Service (USFWS or Service)*: Glen Knowles
- *U.S. Forest Service (USFS)*: Bob Calamusso
- *The Nature Conservancy (TNC)*: Mark Haberstich
- *U.S. Bureau of Reclamation (BR)*: Rob Clarkson, Jeff Lantow
- *National Park Service:* Melissa Trammell, and
  Salt River Project (SRP): Chuck Paradzick

According to Chris Cantrell, Arizona's lead on the conservation agreement team (pers. comm.) the reason they felt it was ok was due to the limited potential for the stocked fish to actually disperse to occupied sites with the roundtail (i.e. flood events and fish over the top of dams). If they did, they would be in small numbers and due to their known feeding preferences they didn't

think it would be detrimental to the roundtail population that exists there. In almost all chub sites where rainbow trout are the only fish stocked the two species have continued to coexist together for extended periods. Small numbers of stocked fish wouldn't create a detrimental impact. It was where we stock (or have in the past) thousands of trout on top of chub populations we have seen impacts that result in extirpations and lower population numbers. Cantrell also provided that "Grayling would be ok as well as they also wouldn't be envisioned to create an impact" (pers. comm.).

The main threats to roundtail chub in Chevelon Canyon are from highly piscivorous brown trout near the dam, largemouth bass in the lower canyon, bullhead catfish and green sunfish throughout, the abundant crayfish and dewatering of the stream channel.

Chiricahua leopard frog
See Local and Broad Scale analyses under each stocking location.

Northern leopard frog
See Local and Broad Scale analyses under each stocking location.

Northern Mexican Gartersnake
Stocking complex analysis: There are no verified records of northern Mexican gartersnakes from the Chevelon Creek Complex, thus, the likelihood that the species will be exposed to stocked sportfish is low. Outside of the stocking complex there is one questionable record from Hart Canyon, a tributary of Willow Creek (approx. 14 air km N of Woods Canyon Lake and W of Chevelon Canyon Lake), for which Holycross et al (2006) provide this analysis: "Wright and Wright (1957) discuss a *T. eques* from Hart Canyon....and provide both a physical description and photographs (p. 802). Unfortunately, it is difficult to tell from the photographs or description whether or not this specimen is a *T. eques*, so the specimen is not mapped."

Downstream analysis: There are no northern Mexican gartersnake records downstream of the stocking sites, therefore, gartersnakes are not likely to be exposed to dispersing stocked sport fish.

Narrow-headed Gartersnake
Stocking complex analysis: There are no verified records of narrow-headed gartersnakes from the Chevelon Creek Complex and they likely do not occupy the stocking complex. Therefore, the likelihood that the gartersnakes will be exposed to stocked sport fish is low. There is an unvouchered narrow-headed gartersnake record from Hart Canyon (HDMS, V. Boyarski pers. comm.), however, Holycross et al. (2006) consider this a misidentification.

Downstream analysis: There are no narrow-headed gartersnake records downstream of the stocking sites, therefore, gartersnakes are not likely to be exposed to dispersing stocked sport fish.

CLEAR CREEK COMPLEX

Physical Geographic Description

The Clear Creek drainage drains an area of approximately 608.3 square miles (389,292 acres) above Clear Creek Reservoir before entering the Little Colorado River (Figure 30; Figure 31). The Clear Creek Complex consists of 3 reservoirs found near the Mogollon Rim in north central Arizona; all drain into Clear Creek, which is a tributary to the Little Colorado River (LCR). C.C. Cragin Reservoir, formerly known as Blue Ridge Reservoir, is the furthest upstream, and is located on East Clear Creek approximately 50 miles southeast of Flagstaff. Knoll Lake is about 70 Miles South East of Flagstaff and is located on Leonard Canyon, which is a tributary of East Clear Creek. The confluence of East Clear Creek and Leonard Canyon is about 14 miles downstream of C.C. Cragin Reservoir. Bear Canyon Lake is located on Willow Creek. Willow Creek and East Clear Creek join to form Clear Creek about 3 miles downstream of the Leonard Canyon and East Clear Creek confluence. Clear Creek drains into Clear Creek Reservoir near Winslow. Water that spills from Clear Creek Reservoir drains into the LCR.

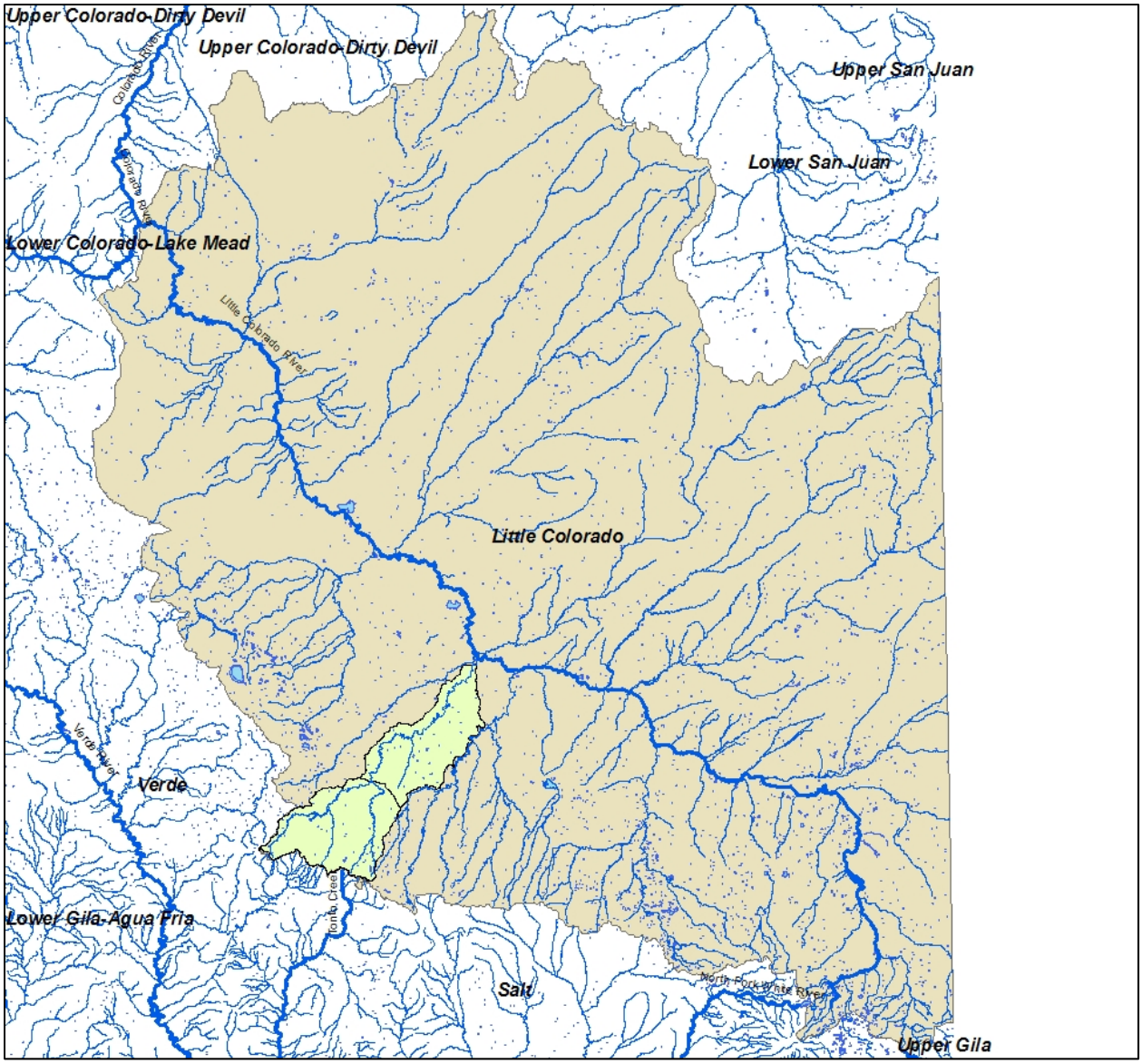

Figure 30. Map of the Clear Creek Complex(shaded in light green) and drainage within the Little Colorado River watershed.

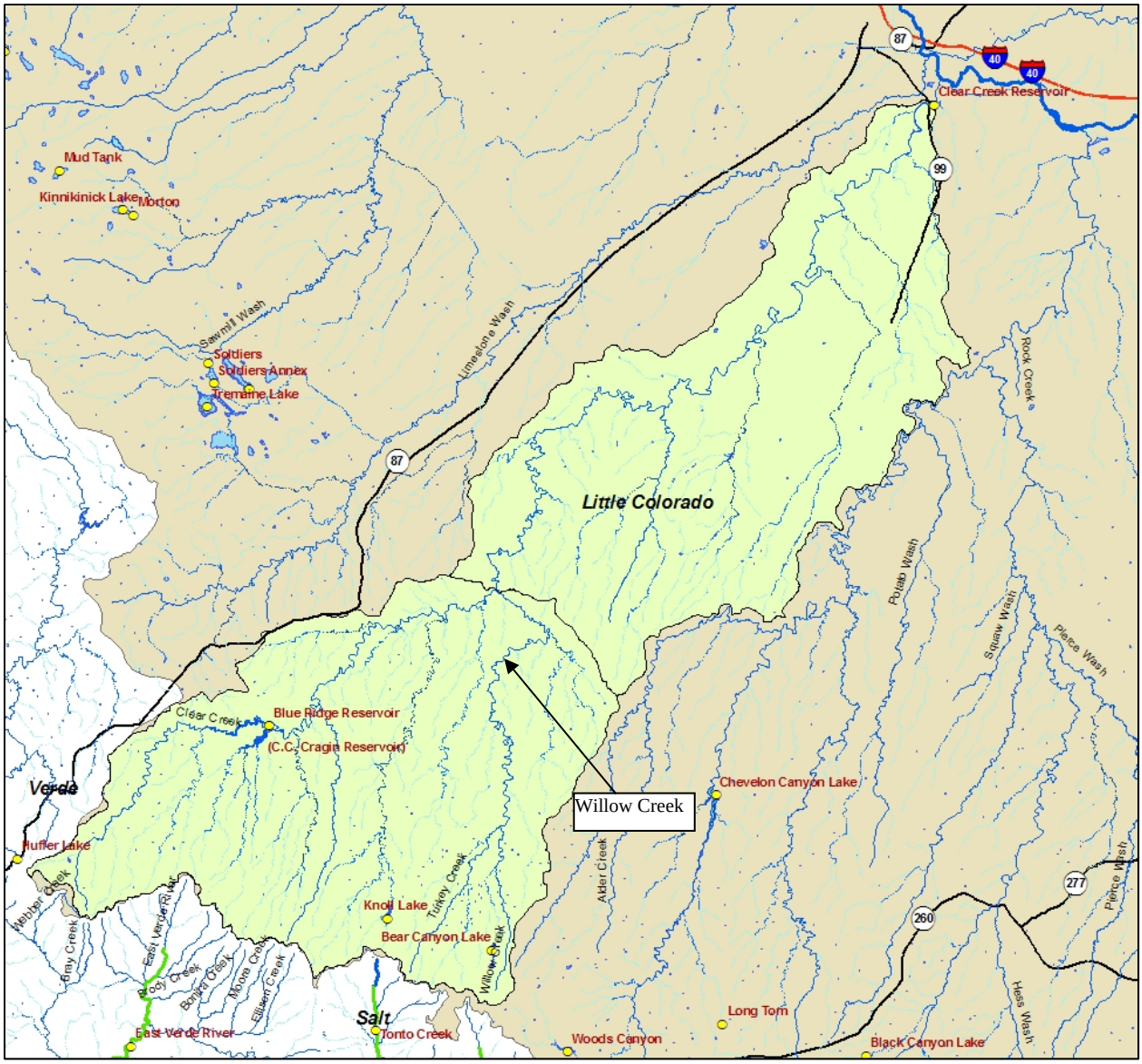

Figure 31. Map of the Clear Creek Complex within the Clear Creek drainage that flows into Clear Creek Reservoir before entering the Little Colorado River.

C.C. Cragin Reservoir

Site Description

C.C. Cragin Reservoir, formerly known as Blue Ridge Reservoir, is a 275 acre reservoir located on the Coconino National Forest (Figure 32). The reservoir is about 10 miles north of the Mogollon Rim and about 50 miles southeast of Flagstaff. Constructed in 1964, the reservoir impounds East Clear Creek at its confluence with Bear Canyon, forming a V-shaped lake, with one arm in Bear Canyon and one in East Clear Creek Proper. The dam was originally constructed by Phelps Dodge Corporation, to provide water via a pump system to the East Verde River, as a

repayment to Salt River Project (SRP) for water used by Phelps Dodge's mining operation in the Salt River drainage. During the years Phelps Dodge operated the reservoir it was pumped down most summers. The reservoir is currently owned by the Bureau of Reclamation (BR) and the management of the reservoir is conducted by SRP. Currently the pump system is being repaired and tested. SRP plans to begin pumping the water over the Mogollon rim into the East Verde River to supply water for its customers by 2012.

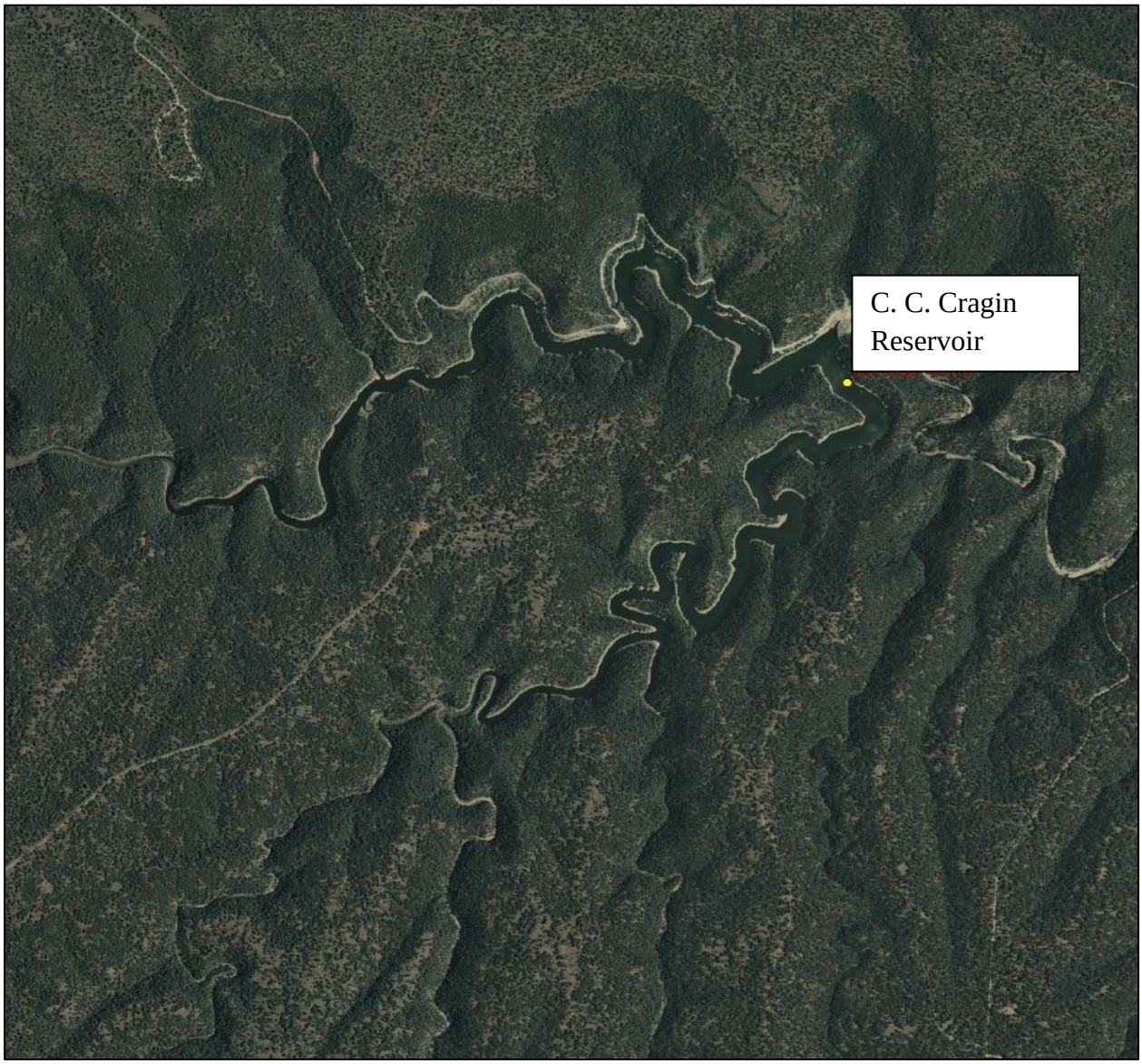

Figure 32. Image of C.C. Cragin Reservoir located in the Clear Creek complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Since its completion, the reservoir has been managed primarily as a put-and-take rainbow trout fishery. Stockings of rainbow trout first occurred in C.C. Cragin Reservoir in 1965. Brown trout, brook trout, and cutthroat trout have been historically stocked into the reservoir in addition to the rainbow trout.

In 1993 the Department's stocking of C.C. Cragin Reservoir and Knoll Lake was part of an interagency Section 7 consultation on the Department's statewide stocking program. A determination of "May Effect" on the threatened Little Colorado spinedace was given on the stocking of C.C. Cragin Reservoir and Knoll Lake. Stocking at these lakes was halted in 1994 while formal consultation occurred.

A Biological Opinion (BO) was issued with the determination that stocking, as proposed under specific stocking conditions was not likely to jeopardize the continued existence of the threatened Little Colorado spinedace, and that designated critical habitat for the spinedace was not likely to be adversely affected. This consultation covered the stocking of catchable rainbow trout for a 5-year period, January 1, 1996, to December 31, 2000 (USFWS 1995).

The Department conducted a five-year evaluation in 2000, and formal intra-service consultation was reinitiated in 2001. The 2001 biological evaluation found that the proposed action of rainbow trout stocking would have no effect on the southwestern willow flycatcher or Chiricahua leopard frog. The U.S. Fish and Wildlife Service (USFWS) concurred. The 2001 biological opinion found that the proposed stocking was not likely to jeopardize the continued existence of the Little Colorado Spinedace (USFWS 2001). The Department then approved stocking rainbow trout into C. C . Cragin Reservoir.

In 1997, AGFD proposed a change in fishing regulations to increase the harvest of trout in the East Clear Creek watershed. In the proposed regulations, from May 1 to September 1, the statewide harvest and bag limits of 6 trout apply; from September 2 to April 31, after stocking is completed for the year, there is no bag limit on trout in the system, including C.C. Cragin Reservoir and Knoll Lake. The proposed regulations were approved and went into effect in 1998. These regulations were further refined with the statewide harvest and bag limits of 6 trout, applying from April 1 through August 31, and unlimited harvest for rainbow and brown trout from September 1 through March 31.

In 2001, consultation was reinitiated for the two reservoirs. Stocking provisions were re-assessed and modified:

> Stock to maintain put-and-take rainbow trout fishery.
> All stocked fish to be tagged with coded wire tags or tetracycline.

Stocking to begin each year as soon as practical following spring runoff and outflow from the reservoir ceases.
Cease stocking if/when habitat conditions (temperature, pH) deteriorate but prior to Labor Day.
Initial stocking rate to be 15,000 catchable rainbow trout per year, but adjusted to accommodate angler use, fish survival, and water conditions.

Monitoring was also implemented:

Creel census to be stratified random, 2 weekdays, 2 weekend/holiday per month during the period of April to September at least once every 5 years.
Following significant stocking season runoff events resulting in spills sufficient to move fish, population surveys upstream and downstream from the reservoir, conducted during the low flow periods of May to June and September to October, are needed to detect movement of tagged fish should they migrate from the reservoir

The emphasis listed in the Integrated Fisheries Management Plan for the LCR Watershed for C.C. Cragin Reservoir is for sport fish management with a desired concept of Intensive Use Fishery (Young et al. 2001).

The primary fishery is a high intensity put-and-take rainbow trout fishery. Catchable rainbow trout are stocked multiple times during the stocking season (Table 20). The limit on trout is 6 fish from April 1 to August 31, with unlimited harvest from September 1 to March 31.

Table 20. Stocking History for C.C. Cragin Reservoir

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1968	1969	2	35,000
Brook trout	1965	1987	14	175,680
Brown trout	1969	1993	22	137,401
Cutthroat trout	1990	1992	4	114,792
Rainbow trout	1965	2008	134	799,761
Total			176	1,262,634

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout will be stocked multiple times from May to June annually but only after the reservoir stops spilling following spring snow melt; numbers of trout stock may be from 0-15,000 fish annually.

Water Distribution / Connectivity

C.C. Cragin is located on East Clear Creek at its confluence with Bear Canyon. The lake runs generally west to east in a V shape, with the northern arm of the lake located in East Clear Creek Canyon, and the southern arm located in Bear Canyon. Spring runoff from East Clear Creek and Bear Canyon (this a different Bear Canyon than where Bear Canyon Lake is located) provides most of the water for the reservoir, but some inflow can occur during other seasons as a result of storms in the watershed.

Most years the portion of East Clear Creek located upstream of the reservoir is intermittent with a few pockets of water present. Two stream systems, Miller Canyon and Kehl Canyon, have their confluences with East Clear Creek upstream of the reservoir. Both Miller and Kehl Canyons have sections of permanent water upstream of their confluence with East Clear Creek.

The Bear Canyon arm of the lake receives water from Bear Canyon and from General Springs Canyon. Bear Canyon has permanent water in its upper reaches, but generally goes dry near the reservoir, except in very wet years. General Springs Canyon is typically dry except for a short section located near the Mogollon Rim in the area around General Springs.

Seepage from the dam and water released from a 2 inch pipe provide the majority of the flow for East Clear Creek downstream of the reservoir, although spilling water also flows into East Clear Creek. Flow is generally permanent downstream to the confluence with Leonard Canyon, where flows become intermittent during dry years. East Clear Creek becomes known as Clear Creek downstream from the confluence with Leonard Canyon, according to USGS topographic maps. Major tributaries of East Clear Creek located downstream of the reservoir include Barbershop Canyon, Yeager Canyon, and Leonard Canyon. During the time period when Phelps Dodge was pumping water from the reservoir, C.C. Cragin rarely spilled and then only spilled during the highest water years. Phelps Dodge ceased pumping water from the reservoir around 2000, and since that time spills have become more frequent. The reservoir spilled in 2005, 2008, and 2009. SRP plans to begin pumping the reservoir in about 2012.

Fish Movement

C.C. Cragin is an open system; fish can move freely upstream of the reservoir when East Clear Creek is flowing. The creek upstream of the reservoir, most years, ranges from dry to isolated pools most of the year. Survival of fish swimming upstream of the reservoir is limited. During wet years, there is a potential for fish to move from C.C. Cragin upstream into the tributaries of East Clear Creek above C.C. Cragin. Fish that go over the spillway may survive in the permanent waters of East Clear Creek downstream of the reservoir. There is a potential for fish from C.C.

Cragin to move upstream into the tributaries of East Clear Creek below the reservoir when connections are made.

Community Description

Electrofishing sampling has been conducted on the reservoir periodically since 1994 (Table 21). Prior to 1999, the species caught during the reservoir sampling were rainbow trout, brown trout, Little Colorado sucker, golden shiner, and fathead minnows. Golden shiners and fathead minnows were found in great numbers and were not counted during the surveys (Table 21; Table 22). Brown trout have not been collected from the reservoir since 1998. In 2007, three new species were captured during electrofishing surveys of the reservoir; green sunfish, largemouth bass, and yellow bullhead (Table 23). In addition, an angler reported a yellow perch from the reservoir in 2008, which was confirmed by the local wildlife manager.

Table 21. Number of Fish Sampled on C.C. Cragin using electrofishing 1994-1999.

Species	1994	1995	1996	1997	1998	1999
rainbow trout	0	4	14	19	37	6
Brown trout	1	27	2	5	3	0
LC sucker	8	5	3	1	17	40
fathead minnow	Present	Present	Present	Present	Present	Present
Golden shiner	Present	Present	Present	Present	Present	Present

Table 22. C.C. Cragin Reservoir 2004 Electrofishing Data.

Species	Num	Catch/ min	% of Total	Mean TL (mm)	Min-Max TL (mm)	Max Wt. (g)
rainbow trout	8	.07	18.60	314.63	280-387	425
LC sucker	3	.03	6.98	385.00	338-425	855
Golden shiner	32	.29	74.41	149.84	109-207	-
fathead minnow	Present	-	-	-	-	-
Total	43	.39	-	-	-	-

Total EFFORT 6,633 SECONDS. (110.55 MINUTES)

Table 23. 2007 C.C. Cragin Reservoir Electrofishing Data.

Species	Num.	Catch/min	% of Total	Mean TL (mm)	Min-Max TL (mm)	Max Wt. (g)
rainbow trout	7	0.066	0.36	281.57	136-353	530
LC sucker	31	0.29	1.58	316.74	145-440	1,050

Golden shiner	8	0.075	0.41	164.88	131-213	125
fathead minnow	1,899	17.81	96.99	-	-	-
Largemouth bass	1	0.009	0.0005	144	144	45
Bullhead (unid)	1	0.009	0.0005	240	264	230
Green sunfish	11	0.10	0.56	100.64	25-154	75
Total	1,958	18.36	-	-	-	-

Total EFFORT 6,398 SECONDS. (106.63 MINUTES)

Annual stream sampling has been conducted on East Clear Creek at 5 standard stations downstream of the reservoir since 1995 (Table 24 through Table 30) in accordance with the East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species (USDA Forest Service 1999). Only 2 stations were sampled in 2002 prior to the forest closure because of extreme fire danger. To date no marked hatchery rainbow trout have been caught during the standard station sampling in East Clear Creek (Benedict 2000; Benedict et al. 2005, 2007). Fish captured during standard station sampling in 2000, 2004, 2005 and 2007 include rainbow trout, brown trout, Little Colorado sucker, bluehead sucker, speckled dace, Little Colorado spinedace, and fathead minnows (Benedict 2000; Benedict et al. 2005 and 2007). In 2005, one marked hatchery trout was collected in East Clear Creek below the dam during non-standard pre-stocking stream fish surveys. Roundtail chub are found near Macks Crossing and downstream of Macks Crossing.

Table 24. Locations for East Clear Creek Surveys.

Station	Location
1) 1 mile above 95 road crossing	T14N, R11E, Section 34
2) 95 crossing	T13N, R11E, Section 35
3) Kinder Crossing	T14N, R11E, Section 25
4) Horse Crossing	T14N, R11E, Section 24
5) Macks Crossing	T14N, R12E, Section 8

Table 25. Fish Survey Results 1 mile above 95 road crossing Station 1995-2008

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	LC Sucker	Fathead Minnow	Rainbow Trout	Brown Trout
1995	9	261	1	10	70	2	1
1996	10	176	0	0	27	2	0
1997	11	328	6	7	0	0	0
1998	0	244	0	16	81	0	0
1999	0	138	0	30	36	0	0

2001	0	183	4	0	17	0	0
2004	0	66	10	1	13	0	0
2005	0	66	4	1	4	0	0
2006	0	53	5	0	1	0	0
2007	0	64	13	4	14	0	0
2008	0	52	5	2	30	0	0

Table 26. Fish Survey Results 95 Road Crossing Station 1995-2008

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	LC Sucker	Fathead Minnow	Rainbow Trout	Brown Trout
1995	0	55	1	0	50	3	0
1996	10	131	0	0	29	1	0
1997	0	128	0	1	153	0	0
1998	0	33	0	0	242	0	0
1999	0	175	0	19	207	0	0
2001	0	100	0	2	239	0	0
2005	0	41	2	3	13	1	0
2006	0	94	1	0	0	0	0
2007	0	104	14	3	81	0	0
2008	0	78	7	0	41	0	1

Table 27. Fish Survey Results Kinder Crossing Station 1995-2008

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	LC Sucker	Fathead Minnow	Rainbow Trout	Brown Trout
1995	4	47	0	7	38	0	0
1996	5	73	0	11	0	0	0
1997	0	178	0	0	105	1	0
1998	0	142	2	0	38	1	0
1999	0	207	3	5	0	0	0
2001	0	150	0	2	31	0	0
2004	0	196	14	1	4	2	0
2005	0	33	5	2	8	0	0
2006	0	78	3	0	6	3	0
2007	0	97	17	1	4	2	0
2008	0	20	3	2	6	0	0

Table 28. Fish Survey Results Horse Crossing Station 1995-2008

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	LC Sucker	Fathead Minnow	Rainbow Trout	Brown Trout
1995	0	63	0	0	26	2	0
1996	3	81	0	11	0	4	1
1997	0	141	10	1	76	12	1
1998	0	386	4	20	78	6	2
1999	0	121	0	5	22	14	14
2001	0	71	0	0	2	2	0
2004	0	37	0	0	26	0	0
2005	0	15	0	3	13	0	0
2006	0	42	4	1	49	1	0
2007	0	36	0	1	39	0	0
2008	0	26	2	0	17	4	0

Table 29. Electrofishing Fish Survey Results Macks Crossing Station 1995-2008

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	LC Sucker	Roundtail Chub	Fathead Minnow	Rainbow Trout
1995 Dry	0	0	0	0	0	0	0
1996	0	152	0	0	0	56	1
1997	0	138	2	1	0	47	0
1998	0	28	0	0	0	6	0
1999	0	215	0	7	0	3	0
2001 Dry	0	0	0	0	0	0	0
2008	0	54	0	2	1	8	4

Table 30. Trammel Net Fish Survey Results Macks Crossing area 2007-2008

Year	Bluehead Sucker	LC Sucker	Roundtail Chub	Rainbow Trout	Brown Trout
2007	0	9	5	5	1
2008	0	41	1	6	1

During sampling of East Clear Creek in June-July 2003, a total of 7 stations were sampled using electrofishing. As in the past two years, large numbers of crayfish made sampling difficult. A total of 10 small rainbow trout were caught out of 403 total fish sampled (Table 31). No Little Colorado spinedace were sampled. The YOY rainbows may be part of a reproducing population below the lake.

Table 31. Results of East Clear Creek sampling below C.C. Cragin Reservoir in 2003.

Species	Number	Mean Length
Little Colorado Sucker	1	181
Bluehead Sucker	22	69.6
Rainbow Trout	10	94.8
Brown Trout	2	61
Speckled Dace	211	44.4
Fathead Minnows	157	43

Sampling of the ½ mile of the creek directly below the dam is conducted prior to stocking of the reservoir whenever the lake spills. In 2005, the only marked hatchery rainbow trout collected in East Clear Creek during any of the stream surveys was collected during the post spilling survey, approximately ¼ of a mile below the dam. A Little Colorado spinedace was also collected below the dam during this survey (Benedict et al. 2005).

Fish sampling has also been conducted in waters of the drainage that contain Little Colorado spinedace, or in waters where spinedace could potentially be stocked (Table 32 through Table 34). Miller Canyon is located upstream of the reservoir, Bear Canyon flows into the reservoir, and Dane Canyon is a tributary to Barbershop Creek and is downstream of the reservoir. None of the rainbow trout captured in these areas over this time period were marked (i.e. stocked) fish.

Table 32. Bear Canyon Electrofishing sampling results all stations 2003-2008

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	LC Sucker	Fathead Minnow
2003	0	457	0	6	
2005	0	61	0	0	
2006	24	167	4	1	
2007	20	557	11	0	
2008	3	285	22	0	
2009	63	2831	168	1	8

Table 33. Dane Canyon Electrofishing sampling results all stations 2003-2009

Year	LC Spinedace	Speckled Dace	Bluehead Sucker	Rainbow trout
2005	0	25	0	0
2006	0	325	6	0
2007	0	218	4	0
2008	1	306	10	0
2009	55	1826	105	4

Table 34. Miller Canyon 2008 fish sampling all stations

Species	Number
Speckled dace	55
Bluehead sucker	6
Fathead minnow	13

In 2009, sampling was conducted on Kehl Canyon, which is upstream of C.C. Cragin; Miller Canyon, which is upstream of C.C. Cragin;, Bear Canyon, which drains into C.C. Cragin; Barbershop Canyon, which is downstream of C.C. Cragin; Dane Canyon, which is a tributary of Barbershop Canyon; Yeager Canyon, which is downstream of C.C. Cragin; West Leonard Canyon, which is downstream of C.C. Cragin; and Dines Tank, which is in Leonard Canyon and drains in downstream of C.C. Cragin (Table 35). None of the rainbow trout captured in these areas over this time period were marked (i.e. stocked) fish. See Figure 33 for areas sampled in the summer of 2009.

Table 35. 2009 Summer Sampling

Location	Species captured
Kehl Canyon	Rainbow Trout, Fathead minnows
Miller Canyon	Little Colorado sucker, bluehead sucker, speckled dace, fathead minnow
Bear Canyon	bluehead sucker, speckled dace, Little Colorado spinedace, fathead minnow (near C.C. Cragin), green sunfish (near C.C. Cragin)
Barbershop Canyon	bluehead sucker, speckled dace, rainbow trout
Dane Canyon	bluehead sucker, speckled dace, Little Colorado spinedace, rainbow

	trout
Yeager Canyon	Little Colorado spinedace
West Leonard Canyon	Little Colorado sucker, bluehead sucker, speckled dace, Little Colorado spinedace
Dines Tank	Little Colorado sucker, bluehead sucker, speckled dace, Little Colorado spinedace, fathead minnow

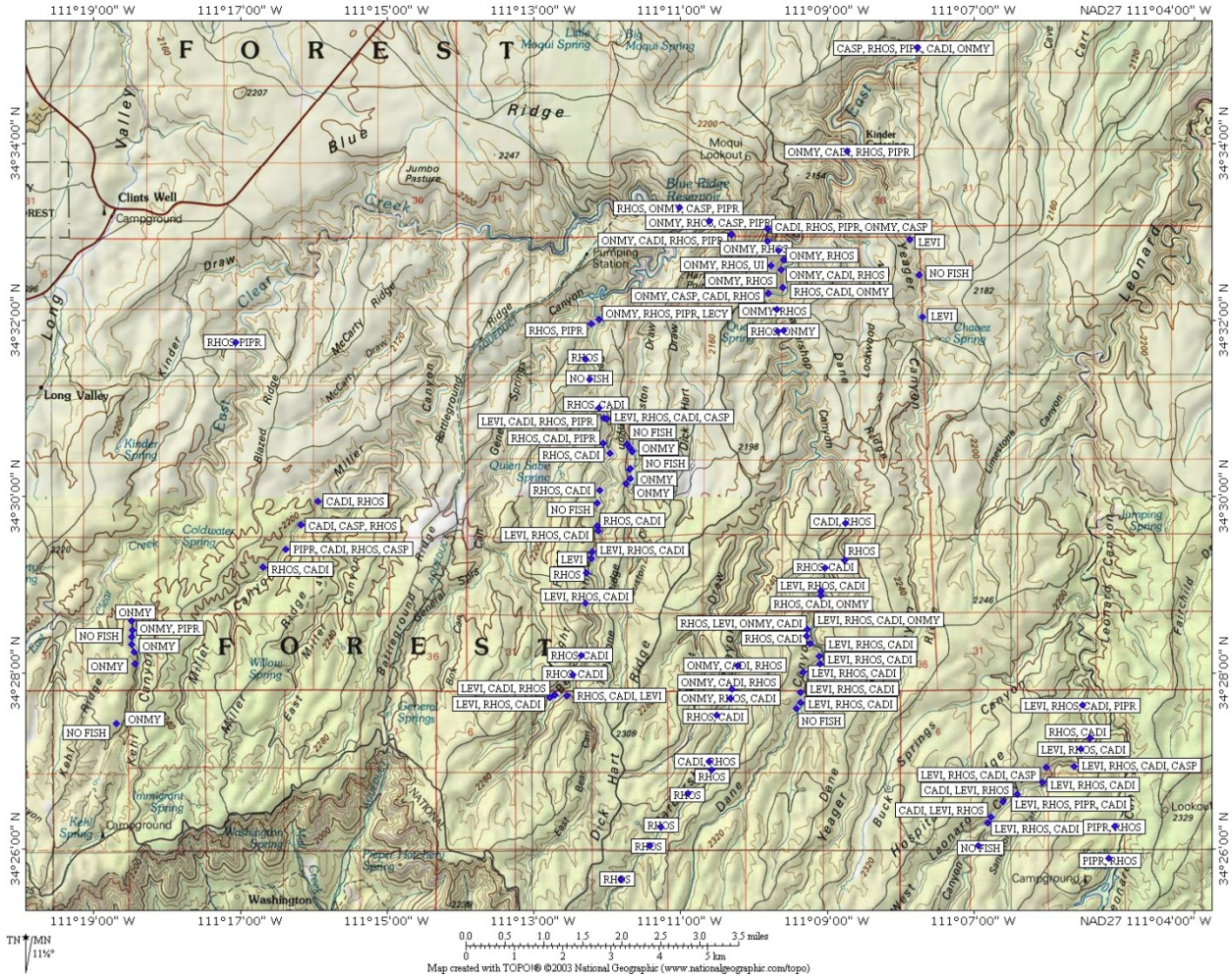

Figure 33. 2009 Stream Fish Sampling.

(LEVI =Little Colorado spinedace, CADI= bluehead sucker, CASP=Little Colorado sucker, ONMY= rainbow trout, SATR=brown trout, PIPR=fathead minnow, LECY=green sunfish)

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Little Colorado Spinedace and critical habitat, Mexican spotted owl, Little Colorado spinedace are covered below and Chiricahua and Northern leopard frogs are also analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake and narrow-headed garter are addressed in the Clear Creek Complex analysis.

Northern Leopard Frog
Local Analysis: Although C.C. Cragin Reservoir and the Clear Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs will be exposed to fish stocked in C.C. Cragin Reservoir or within the buffered stocking complex is low. There are no historical records for northern leopard frogs at C.C. Cragin Reservoir; however, there are historical records for northern leopard frogs from 3 sites in the complex: Dines Tank (1981), Unmarked Pond (=Cindy's Pond) (1984), and Unnamed Tank (=Borrow Pit South Tank) (1981) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 80 surveys at 44 sites within the buffered stocking complex between 1961 and 2000 (Figure 34; HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Dines Tank (1990, 1992, 1993, and 1997) or Unmarked Pond (=Cindy's Pond) (1997 and 1998) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 19 sites within the buffered stocking complex in 2004 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). It is likely that that northern leopard frogs no longer occupy Dines Tank, Unmarked Pond (=Cindy's Pond), or Unnamed Tank (=Borrow Pit South Tank) and current presence of crayfish and non-native fish in C.C. Cragin Reservoir, East Clear Creek, and its tributaries make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing fish stocked in C.C. Cragin Reservoir or elsewhere in the Clear Creek buffered stocking complex is low. It is likely that northern leopard frogs no longer occupy the upper stretch of Clear Creek or any of its tributaries. In addition, the habitat in these drainages are less suitable for northern leopard frogs due to the presence of crayfish and non-native fish.

Chiricahua leopard frog

Local Analysis: Although C.C. Cragin Reservoir and the Clear Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs will be exposed to fish stocked in C.C. Cragin Reservoir or within the buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs at C.C. Cragin Reservoir; however, there are historical records for Chiricahua leopard frogs from 3 sites in the complex: East Clear Creek (=Horse Crossing) (1961), Unnamed Tank (=Buck Springs Canyon Tank) (1984), and East Clear Creek (=FS 96/95 JCT) (1972) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 80 surveys at 44 sites within the buffered stocking complex between 1961 and 2000 (Figure 34; HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at East Clear Creek (=Horse Crossing) (1992, 1995, and 1997), Unnamed Tank (=Buck Springs Canyon Tank) (later in 1984, 1997, and 1998), and East Clear Creek (=FS 96/95 JCT) (1987, 1990, 1992, 1993, and 1999) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 19 sites within the buffered stocking complex in 2004 and 2007 and did not observe any Chiricahua leopard frogs (Black Mesa Ranger District, Tonto National Forest). It is likely that Chiricahua leopard frogs no longer occupy East Clear Creek (=Horse Crossing), Unnamed Tank (=Buck Springs Canyon Tank), or East Clear Creek (=FS 96/95 JCT) and current presence of crayfish and non-native fish in C.C. Cragin Reservoir, East Clear Creek, and its tributaries make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing sport fish from C.C. Cragin Reservoir or elsewhere in the Clear Creek Complex is low. It is likely that Chiricahua leopard frogs no longer occupy Clear Creek or any of its tributaries due to the presence of crayfish and non-native fish which make the habitat less suitable for Chiricahua leopard frogs.

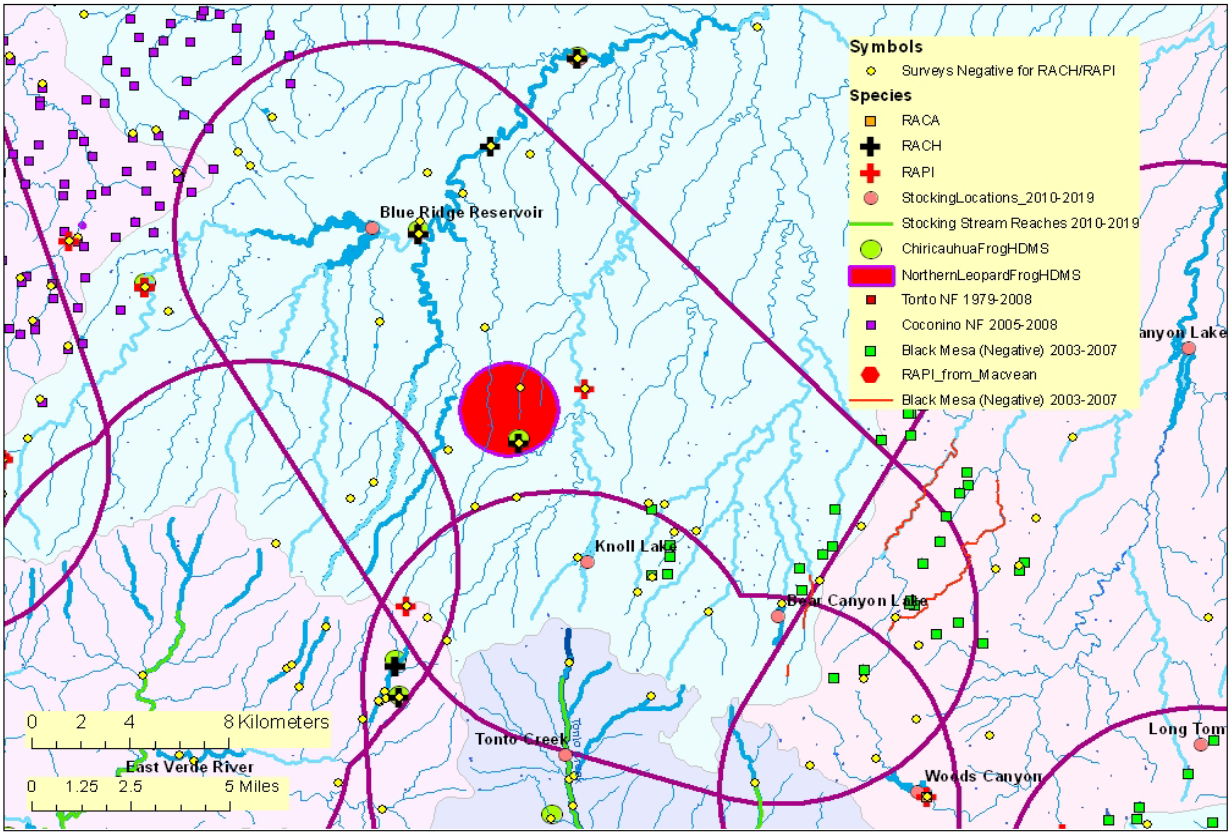

Figure 34. Map of Clear Creek buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Colorado Spinedace and Critical Habitat

Little Colorado spinedace currently occupy small, perennial pool habitats in West Leonard Canyon, Leonard Canyon including Dines Tank, Dane Canyon, and Yeager Canyon downstream of C.C. Cragin Reservoir. They are also found in Bear Canyon, which feeds directly into C.C. Cragin. Bear Canyon, Dane Canyon, and Yeager Canyon populations were established by moving spinedace from West Leonard Canyon and Dines Tank to these areas (USFWS 2008e). Further information including critical habitat is discussed in the Clear Creek Complex Analysis.

Potential Impacts

The summary of potential impacts is discussed in the Clear Creek Complex Analysis. Below is specific information pertinent to the site analysis.

Currently, East Clear Creek contains self-sustaining rainbow and brown trout populations. Any rainbow trout stocked and escape from C.C. Cragin Reservoir would be assimilated into the sustaining trout population outside of C.C. Cragin Reservoir. Fish sampling has occurred annually since 1994, except for 2002 when the forest was closed, downstream of the reservoir at 5 stations, along with sampling of the ½ mile directly below the reservoir in years when the reservoir spills. Over all of the years of sampling outside of C.C. Cragin Reservoir, only one stocked rainbow trout has been captured (2005, Below C.C. Cragin Reservoir, refer back to Table 26). All of the other trout collected during sampling have been part of the self sustaining population outside the reservoir. Any rainbow trout stocked that leaves would likely be assimilated into the self-sustaining trout population. Any stocked trout that escapes may prey on eggs, fry, juvenile, and adult fish, if they encounter spinedace.

Trout escaping from C.C. Cragin Reservoir do not appear to enter most of the waters currently containing Little Colorado spinedace, except for the East Clear Creek proper.

Critical habitat

Critical habitat includes eighteen miles of East Clear Creek in Coconino County; eight miles of Chevelon Creek in Navajo County and five miles of Nutrioso Creek in Apache County (USFWS 1987). Constituent elements for critical habitat, include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate..

Potential Impacts

Currently no barriers exist to prevent upstream movement of trout into designated critical habitat upstream of C.C. Cragin reservoir. Likewise there are no barriers to prevent downstream movement of trout from C.C. Cragin or Nelson Reservoirs other than the dams that impound the stream. When critical habitat areas for spinedace were designated, these areas were reported as "…presently support(ing) healthy self-perpetuating populations of the Little Colorado spinedace" (USFWS 1987). Since that time, habitat degradation, introduction of non-native fishes, and scarcity of water have resulted in low numbers of spinedace in East Clear Creek and Leonard Canyon. In years of high precipitation or during periods of high runoff, trout have the opportunity to move out of stocked area into spinedace habitat. Similarly, spinedace may move into trout areas. In either case, some spinedace could be consumed by rainbow trout or other non-native species. Movement of predaceous fish into designated critical habitat may contribute to the disjunct distribution patterns and retreat of spinedace to suboptimal habitats. Results may include competition, predation, harassment or further loss of spinedace.

Mexican Spotted Owl and Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH), and is within 4 buffers. Four PACS borders the reservoir. Angler access along the shoreline is difficult based of the topography and vegetation in the area. Most access to the reservoir will be by boat.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around MSO PACs in the general vicinity of the site. No physical effects to MSO habitat in the PAC are anticipated because anglers are not expected to be present in the PAC. There may be some disturbance to MSOs from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Knoll Lake

Site Description

Knoll lake is a 75 acre lake located on the Coconino National Forest (Figure 35). The lake is about 2 miles north of the Mogollon Rim and about 80 miles southeast of Flagstaff. Knoll Lake impounds East Leonard Canyon, a tributary to Leonard Canyon, and ultimately East Clear Creek. The concrete dam on Knoll Lake was completed in 1963 with a spillway elevation of 7,340 feet and a capacity of 1,575 acre-feet of water at 77 surface acres.

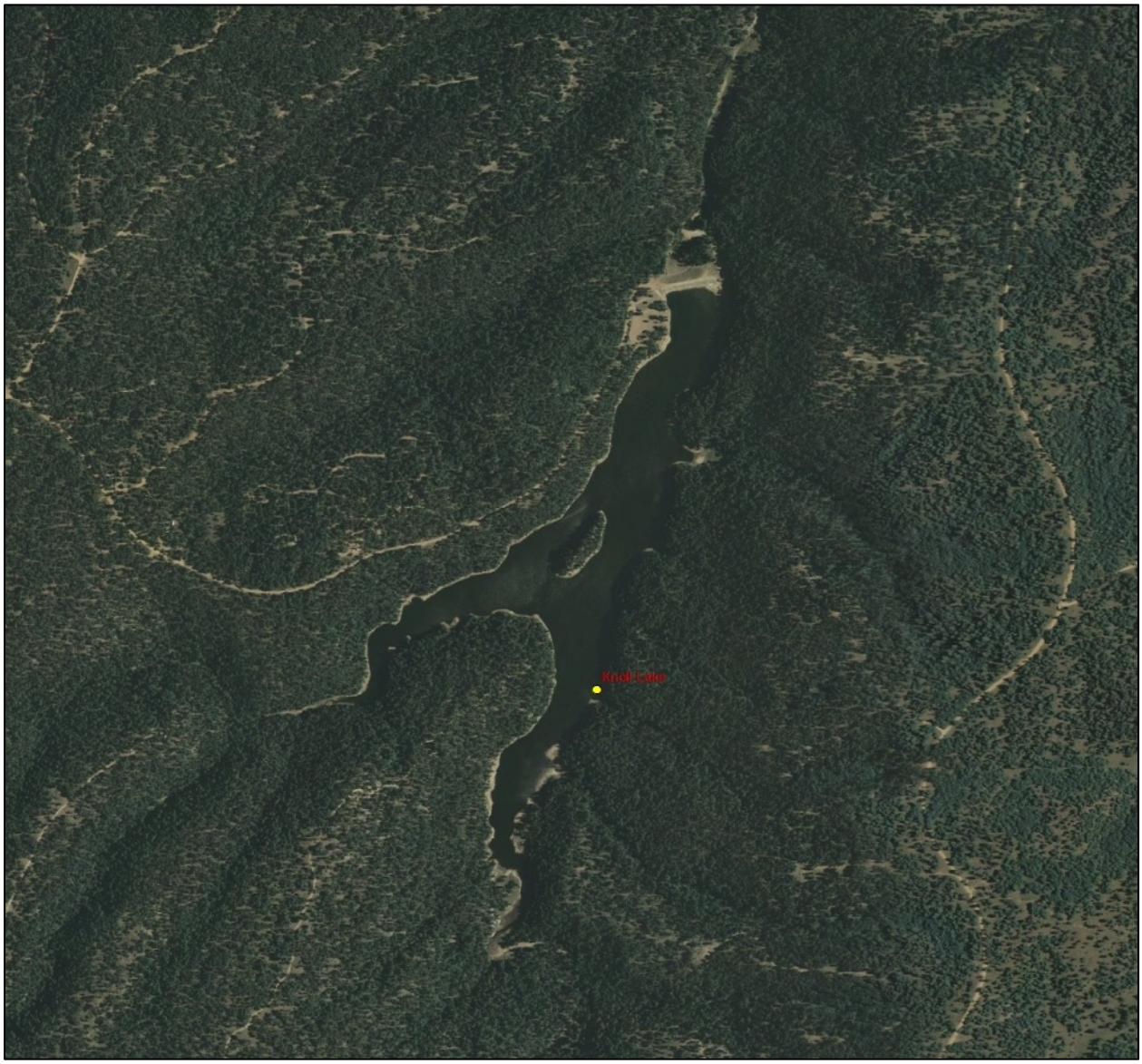

Figure 35. Image of Knoll Lake located in the Clear Creek complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body
Since its completion, the reservoir has been managed primarily as a put-and-take rainbow trout fishery. Stockings of rainbow trout first occurred in Knoll Lake in 1965. Brown trout, brook trout, and cutthroat trout have been historically stocked into the reservoir in addition to the rainbow trout (Table 36).

In 1993, the Department's stocking of C.C. Cragin Reservoir and Knoll Lake was part of an interagency Section 7 consultation on the Department's statewide stocking program. Refer to the discussion in C.C. Cragin for information on the previous consultation and provisions there in.

Creel censuses from May to September and fish sampling were conducted on Knoll Lake in 2007. Expansion of the creel census data estimated that 15,559 rainbow trout were caught by anglers with 8,652 being reported as harvested, out of the 20,067 stocked (Benedict et al. 2007).

The emphasis listed in the Integrated Fisheries Management Plan for the LCR Watershed for Knoll Lake is for sport fish management with a desired concept of Intensive Use Fishery (Young et al. 2001).

The primary fishery is a high intensity put-and-take rainbow trout fishery. Catchable rainbow trout are stocked multiple times during the stocking season. The limit on trout is 6 fish from April 1 to August 31, with unlimited harvest from September 1 to March 31.

Table 36. Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1968	1969	2	15,000
Brook trout	1964	1983	13	98,500
Brown trout	1969	1993	12	85,999
Cutthroat trout	1992	1992	1	38,000
Rainbow trout	1963	2009	238	729,184
Total			260	947,281

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout will be stocked multiple times from May to July annually but only after the reservoir stops spilling following spring snow melt; numbers of trout stock may be from 0-20,000 fish annually.

Water Distribution/Connectivity
Knoll Lake is located near the Mogollon Rim in the head waters of East Leonard Canyon. Runoff from the surrounding area fills the lake, with the primary runoff occurring during the spring. Surveys of the area located upstream of the reservoir have not shown any permanent water. When Knoll Lake spills it flows down East Leonard Canyon; East Leonard Canyon joins West Leonard Canyon to form Leonard Canyon, which eventually flows into East Clear Creek.

Fish Movement
Knoll Lake is an open system. Fish can move freely upstream of the reservoir, but the inflow sources dry, so survival of fish swimming upstream of the reservoir is unlikely. Fish that go over the spillway may survive in Leonard Canyon and possibly East Clear Creek.

Community Description
Brown trout were present historically, but have not been captured during sampling since pre 1999 (Table 37 through Table 40)(Benedict 2000; Benedict et al. 2005, 2007). Knoll Lake contains bluehead sucker, speckled dace, fathead minnow, and rainbow trout (Table 40) (Benedict et al. 2007).

Table 37. Number of Fish Sampled on Knoll Lake.

Species	1994	1995	1996	1997	1998	1999
rainbow trout	0	0	154	29	3	1
Brown trout	29	16	10	5	3	0

Table 38. Knoll Reservoir Electrofishing Data from 11/15/04; surveys were canceled by snow after 2 stations)

Species	Num.	Catch/min.	% of Total	Mean length (mm)	Min-Max length (mm)	Max Weight (grams)
rainbow trout	5	0.20	50	243.6	220-261	Not measured
fathead minnow	5	0.20	50	Not measured	-	-
Total	10	0.40	-	-	-	-

Total EFFORT=1,510 SECONDS. (25.17 MINUTES)

Table 39. Knoll Reservoir Electrofishing Data on 5/24/05.

Species	Num.	Catch/min.	% of Total	Mean	Min-Max	Max

				length (mm)	length (mm)	Weight (grams)
bluehead sucker	3	0.04	1%	83	76-91	-
fathead minnow	304	4.01	98.4%	-	-	-
speckled dace	2	0.03	.6%	75	70-80	-
Total	309	4.08	-	-	-	-

Total EFFORT SECONDS=4549 (75.82MINUTES)

Table 40. 2007 Knoll Reservoir Electrofishing Data.

Species	Num.	Catch/min	% of Total	Mean length (mm)	Min-Max length (mm)	Max Weight (g)
rainbow trout	47	0.77	3.49	231.40	174-368	455
speckled dace	97	1.60	7.21	72.58	42-114	2
fathead minnow	1,198	19.73	89.07	43.30	26-67	-
bluehead sucker	3	0.05	0.22	47	42-52	-
Total	1,345	21.15	-	-	-	-

Total EFFORT=3,644 SECONDS. (60.73 MINUTES)

Dines Tank is located downstream of Knoll Lake in Leonard Canyon and contains Little Colorado spinedace, speckled dace, bluehead sucker, and Little Colorado sucker (Table 41). The same species are found in West Leonard Canyon upstream of the confluence with East Leonard Canyon.

To date no stocked rainbow trout have been collected downstream of Knoll Lake during post-spilling surveys or during sampling in Dines Tank or West Leonard Canyon.

Table 41. Dines Tank 2006 Fish Sampling.

Species	Num.	% of Total
Speckled dace	50	27.32
Bluehead sucker	14	7.65
Little Colorado Spinedace	119	65.03
Total	183	-

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Mexican spotted owl are covered below and Chiricahua and Northern leopard frogs are also analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake and narrow-headed garter snakes as well as downstream impacts to Little Colorado Spinedace and critical habitat are addressed in the Clear Creek Complex analysis.

Northern Leopard Frog
Local Analysis: Although Knoll Lake and the Clear Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs will be exposed to fish stocked in Knoll Lake or within the buffered stocking complex is low. There are no historical records for northern leopard frogs at Knoll Lake; however, there are historical records for northern leopard frogs from 3 sites in the complex; Dines Tank (1981), Unmarked Pond (=Cindy's Pond) (1984), and Unnamed Tank (=Borrow Pit South Tank) (1981) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 80 surveys at 44 sites within the buffered stocking complex between 1961 and 2000 (Figure 34**Error! Reference source not found.**; HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during surveys at Dines Tank (1990, 1992, 1993, and 1997) or Unmarked Pond (=Cindy's Pond) (1997 and 1998) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 19 sites within the buffered stocking complex in 2004 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). It is likely that northern leopard frogs no longer occupy Dines Tank, Unmarked Pond (=Cindy's Pond), or Unnamed Tank (=Borrow Pit South Tank) and current presence of crayfish and non-native fish in the surrounding waters make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing fish stocked in Knoll Lake or elsewhere in the Clear Creek buffered stocking complex is low. It is likely that northern leopard frogs no longer occupy the upper stretch of Clear Creek or any of its tributaries. In addition, the habitat in these drainages is less suitable for northern leopard frogs due to the presence of crayfish and non-native fish.

Chiricahua leopard frog

Local Analysis: Although Knoll Lake and the Clear Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs will be exposed to fish stocked in Knoll Lake or within the buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs at Knoll Lake; however, there are historical records for Chiricahua leopard frogs from 3 sites in the complex: East Clear Creek (=Horse Crossing) (1961), Unnamed Tank (=Buck Springs Canyon Tank) (1984), and East Clear Creek (=FS 96/95 JCT) (1972) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 80 surveys at 44 sites within the buffered stocking complex between 1961 and 2000 (Figure 34; HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at East Clear Creek (=Horse Crossing) (1992, 1995, and 1997), Unnamed Tank (=Buck Springs Canyon Tank) (later in 1984, 1997, and 1998), and East Clear Creek (=FS 96/95 JCT) (1987, 1990, 1992, 1993, and 1999) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 19 sites within the buffered stocking complex in 2004 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). It is likely that Chiricahua leopard frogs no longer occupy East Clear Creek (=Horse Crossing), Unnamed Tank (=Buck Springs Canyon Tank), and East Clear Creek (=FS 96/95 JCT) and current presence of crayfish and non-native fish in the surrounding waters make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing fish stocked from Knoll Lake or elsewhere in the Clear Creek buffered stocking complex is low. It is likely that Chiricahua leopard frogs no longer occupy the upper stretch of Clear Creek or any of its tributaries. In addition, the habitat in these drainages is less suitable for leopard frogs due to the presence of crayfish and non-native fish.

Mexican Spotted Owl and Critical Habitat

The stocking location is within Mexican spotted owl (MSO) critical habitat (CH), occurs in two individual buffers, and 2 individual PACS border the whole lake. There appears to be opportunity for angler access around the majority of the lake based on topographic maps.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within boundary of at least one MSO PACs in the general vicinity of the site. There may be some disturbance of MSOs at the nest site, roosting or foraging areas within the PAC during the breeding season.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Bear Canyon Lake

Site Description

Bear Canyon Lake is located at the head of Bear Canyon, a tributary of Willow Creek in the Clear Creek drainage; it is not to be confused with a different Bear Canyon upstream of C.C. Cragin Reservoir. Bear Canyon Lake is located towards the bottom of the Clear Creek Complex, as Willow Creek drains into Clear Creek downstream of Knoll Lake and C.C. Cragin Reservoir. However, all the stocked lakes in the Clear Creek Complex, including Bear Canyon Lake, are considered to be in the headwaters of the Clear Creek watershed.

The dam at Bear Canyon Lake was built in 1964 at an elevation of 7560 feet, creating a 60 surface acre lake, with a maximum depth of 50 feet (Figure 36). Bear Canyon Lake is located on the Apache-Sitgreaves National Forest, approximately 36 miles west of Heber-Overgaard. The lake fills and spills every year, maintaining very good water levels and water quality throughout the year. The Department holds the water rights in the lake; thus no water is released for downstream irrigation or domestic use.

Bear Canyon Lake is accessed only by a short hike into Bear Canyon from nearby roads and parking areas on top of the canyon rim. Vehicle access to these trailheads is by all-weather gravel Forest Roads 300 and 89, typically from April through November. The lake freezes and is inaccessible during the winter. Vehicle access on Forest Road 89 ends at 2 dirt parking areas with restrooms on the rim of the canyon on the west side of the lake, with hiking trails down to the lake shore. Bear Canyon Lake campground is also located at the rim of the canyon on Forest Road 89. Other hike-in access points off smaller dirt roads occur at the head of the lake and also on the east side down to the dam. The east side access also includes a gated road to the dam that is used only for stocking and dam maintenance. A primitive boat launch ramp is located at the corner of the dam at the end of this road. Small boats can be carried in by foot on this short road because vehicle access is not allowed, and launched at the dam. Boat motors on Bear Canyon are restricted to electric motors only.

Figure 36. Image of Bear Canyon Lake located in the Clear Creek complex (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Bear Canyon Lake is managed as an intensive use, put-and-take cold water fishery, stocked regularly through the summer with catchable size rainbow trout, and occasionally stocked with arctic grayling. The lake is deep with not much primary productivity, thus trout do not grow well in this lake. Catchable size trout are stocked so that anglers can catch and harvest them immediately, without having to rely on growth of fingerling or sub-catchable fish. Sub-catchable and/or fingerling grayling may be stocked because of the limited availability of sizes and numbers of this species. The Integrated Fisheries Management Plan for the LCR Watershed

(Young et al. 2001) identifies the management emphasis for Bear Canyon Lake as intensive use sport fish, with a desired fish species assemblage of rainbow trout and Arctic grayling. This plan also identifies the current stocking regime of catchable rainbow trout and occasional stocking of Arctic grayling.

Bear Canyon Lake was historically managed for featured species Apache trout and Arctic grayling, with special regulations of artificial lure and fly only, and an occasional restricted bag limit for Arctic grayling (Table 42). Apache trout were stocked from 1967 through 1973 when State hatcheries had Apache trout broodstock. Arctic grayling were initially stocked in 1965 and 1966, then sporadically in the 1980s and 1990s. Because of the difficulty in obtaining Arctic grayling and Apache trout for stocking, brook trout were added, beginning in 1977, to help meet angler demand. Rainbow trout and cutthroat trout were similarly added in the late 1980s. Brook trout, cutthroat trout, and Arctic grayling were last stocked in 1995, with only rainbow trout stocked annually since then. Regulations were also changed in 1995 from artificial lure and fly only to statewide regulations with no special size or restricted bag limits. This change was made because the low productivity of the lake did not grow trout well, and the low angler use at the lake. Rainbow trout are available in catchable size and are easily caught by anglers.

Angler use at Bear Canyon Lake increased from 4,659 AUDs in 1985, as determined by the only on-site angler creel survey, to 19,266 AUDs in 2001, as determined by mail-out survey; data also showed that bear Canyon Lake receives moderate use during the summer months, likely limited by access to the lake shore (Pringle 2004).

Bear Canyon Lake is managed as a put-and-take cold water fishery with rainbow trout. To discourage illegal stocking of warm water fish, bag limits on warm water fishes were removed at five other rim lakes, allowing unlimited harvest of bass and catfish on all rim area lakes starting January 1, 2009, as a first step to send the message to anglers that the lake is managed only for trout.

Table 42. Stocking history at Bear Canyon Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Apache trout	1967	1973	11	38,956
Arctic grayling	1965	1995	10	85,608
Brook trout	1977	1995	23	274,562
Brown trout	1977	1977	1	500
Cutthroat trout	1965	1995	7	98,248
Rainbow trout	1984	2009	65	168,191

Total	111	657,237

Proposed Action

The Department proposes to stock rainbow trout and Arctic grayling for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from April through September each year; numbers of trout stocked may be from 0 to 30,000 trout annually.

Arctic grayling may be stocked multiple times as fingerlings or sub-catchables from April through September each year; numbers of grayling may be from 0 to 15,000 fish annually.

Water Distribution / Connectivity

There is no permanent inflow to the lake. There are two very small intermittent drainages that flow into the upper end of the lake in the spring during snowmelt runoff. These drainages are dry for the remainder of the year. The lake gets nearly all its water from winter snowpack and snowmelt runoff in the spring. The lake fills and spills every spring, then the water level in the lake drops slowly but steadily after the snowmelt runoff subsides, and the lake does not fill again until the following spring.

When the lake spills in the spring, water flows continuously down Bear Canyon for 4.2 miles to Willow Creek. Bear Canyon is mostly dry outside of the spring runoff season, with occasional isolated pools, which are typically small and shallow, capable of holding only fathead minnow, as found during a survey through the canyon in 1999.

In Willow Creek, water flows continuously during the spring runoff season for 25.2 miles to Clear Creek. For much of the year outside of spring runoff, Willow Creek is mostly dry throughout its length to Clear Creek. Exceptions include a fair amount of continuously flowing water in the 2.7 miles from the confluence of Bear Canyon downstream to the confluence of Gentry Canyon; however, most of this water appeared not to be permanent and was very shallow and exposed. Gentry Canyon is a major tributary that contributes water to Willow Creek, and deep permanent pools are present from this point downstream to Clear Creek. There are short stretches of flowing water connecting some of the deep permanent pools in the 17.6 mile reach from Gentry Canyon downstream to Cabin Draw, but still having a fair amount of dry streambed in places. The very lower 4.3 miles of Willow Creek are mostly dry, with occasional isolated deep pools that did not appear as permanent as those pools in the middle reach.

After the confluence of Willow Creek and Clear Creek, the stream flows on to Clear Creek Reservoir, 40 miles away. Clear Creek Reservoir then drains into the LCR less than a mile downstream of the reservoir.

There are no irrigation or other releases from Bear Canyon Lake dam. Water flows downstream over the spillway only during spring runoff, during the months of March and April, occasionally in May, then does not spill the rest of the year.

Fish Movement

The only barriers to downstream movement are long stretches of ephemeral stream channel in Willow Creek and Clear Creek, which are effective at keeping trout from moving around after the spring runoff ceases; however, these long stretches would not be an effective barrier during the spring runoff when the water is all continuous.

Stocked trout may move upstream into the two very small drainages during spring runoff only, but will die when the drainages dry up during the summer.

Stocked trout have the ability to move downstream over the spillway into Bear Canyon, and throughout Willow Creek and into Clear Creek during spring runoff when everything is connected. After spring runoff ceases, trout do not have the ability to leave the reservoir, or move around within or from Bear Canyon and Willow Creek. There are few opportunities for trout to hold over within Bear Canyon, or within Willow Creek from the Bear Canyon confluence down to the Gentry Canyon confluence, because of the shallow and exposed habitat present in those reaches (Lopez et al. 1999b). However, brook trout were collected in 1991 at Mule Crossing, upstream of the confluence with Bear Canyon (Dorum and Young 1995), indicating that some suitable habitat for trout exists in that area. Trout could holdover in the deep perennial pools within the middle and lower reaches of Willow Creek downstream of Gentry Canyon confluence; some of the perennial pools are connected by low flow in the middle reach, although most are isolated, especially in the lower reach.

Trout moving downstream into Willow Creek and towards Clear Creek would have deep perennial pools to occupy; however, they do not appear to persist well in those perennial pools, assuming they do exit the reservoir; a thorough survey of 70 sites in Willow Creek in 1997 found no rainbow trout. However, five brook trout ranging in size from 92 to 105 mm were found in one pool. Other surveys at Wiggins Crossing within the middle reach in 1991, 1993, and 2009 found only native fishes (and fathead minnow in 1991) (Table 43).

Table 43. Summary of fish collected at Wiggins Crossing.

Species	June 1991	August 1993	June 2009
Speckled dace	108	164	346
Bluehead sucker	0	129	127
Fathead minnow	7	0	0
Unid. Sucker	0	1	0
Total fish	115	294	473

Community Description

Bear Canyon Lake contains stocked rainbow trout and naturally reproducing fathead minnow and crayfish. The lake no longer contains Arctic grayling, Apache trout or brook trout because they have not been stocked since 1995. Trout do not reproduce in the lake. One adult brook trout remaining form the last stocking was collected in 2000 (Table 44).

Table 44. Survey history at Bear Canyon Lake.

Species	1999	2000	2001	2002	2003
Rainbow trout	23	3	28	13	9
Brook trout	0	1	0	0	0

Bear Canyon downstream of the lake contained fathead minnow, rainbow trout, and crayfish when surveyed in June 1999 (Table 45). The one rainbow trout was caught in a small pool at the bottom of the spillway, obviously coming from the reservoir, but the remainder of Bear Canyon was not very suitable for holding trout during this survey.

Table 45. Summary of fish survey in Bear Canyon in 1999.

Species	Num. Collected	Size
Fathead minnow	6	Not recorded
Rainbow trout	1	10 inches

Willow Creek, downstream of Bear Canyon, contains speckled dace, bluehead sucker, fathead minnow, and few brook trout (Lopez et al. 1999b; Table 46). These surveys were conducted by AGFD using gear suitable for the habitat, including backpack electrofisher, seines, and gill nets. A small number of speckled dace were collected upstream of the Gentry Canyon confluence, within the reach where Bear Canyon drains into Willow Creek. Dorum and Young (1995) found 11 brook trout in this general area in 1991, specifically at Mule Crossing upstream of the Bear Canyon confluence, but found no fish during surveys in the same location in 1993 and 1994.

The middle reach from Gentry Canyon confluence downstream to Cabin Draw contained primarily native fishes; speckled dace and bluehead sucker. In a thorough survey in 1997, however, 5 small brook trout were found in one isolated pool. Other surveys at Wiggins Crossing within this reach in 1991, 1993, and 2009 found mostly native fishes and a small number of fathead minnow, but no trout (Table 43).

The lower reach was dominated by many fathead minnow, with very few native fish, in 1997. This reach also contained numerous crayfish and tiger salamander larvae.

Table 46. Summary of fish collected throughout Willow Creek in 1997.

Reach	Species	Num. Collected	Average length (mm)	Average weight (g)	Size range (mm)
Clear Creek to Cabin Draw confluence (Reach 1)	Fathead minnow	2195	47	1	15-75
	Speckled dace	2	51	2	37-65
	Bluehead sucker	1	100	10	100
	Total fish	2198	-	-	-
Cabin Draw confluence to Gentry Canyon confluence (Reach 2)	Speckled dace	1343	43	2	11-97
	Bluehead sucker	515	51	4	15-170
	Brook trout	5	97	11	92-105
	Total fish	1863	-	-	-
Gentry Canyon confluence upstream for 10,617 meters (Reach 3)	Speckled dace	16	75	9	51-108
	Total fish	16	-	-	-
Reach 4	No fish				
Reach 5	No fish				
Stream Total	Fathead minnow	2195	47	1	15-75
	Speckled dace	1358	44	2	11-108
	Bluehead sucker	516	51	4	15-170
	Brook trout	5	97	11	92-105
	Total fish	4074	-	-	-

Fathead minnows are well established and reproducing in the lower reach of Willow Creek and within Bear Canyon Lake. Native fishes speckled dace and bluehead sucker are well established and reproducing in the middle reach of Willow Creek, from the confluence of Gentry Canyon downstream to Cabin Draw. One rainbow trout has been found downstream of Bear Canyon Lake, in the pool immediately below the dam. More rainbow trout have likely come over the dam, but none have been caught within Willow Creek, or downstream in Clear Creek during surveys in 1999 and 2000 (AGFD unpublished surveys), and 2004-2005 (Clarkson and Marsh 2005).

Spinedace historically inhabited Willow Creek but have not been found since 1966. Spinedace currently occupy small, perennial pool habitats in West Leonard Canyon, Leonard Canyon including Dines Tank, Bear Canyon, Dane Canyon, and Yeager Canyon.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to Chiricahua and Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to northern Mexican garter snake and narrow-headed garter snakes as well as downstream impacts to Little Colorado Spinedace and critical habitat are addressed in the Clear Creek Complex analysis.

Northern Leopard Frog

Local Analysis: Although Bear Canyon Lake and the Clear Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that frogs will be exposed to fish stocked in Bear Canyon Lake or within the buffered stocking complex is low. There are no historical records for northern leopard frogs at Bear Canyon Lake; however, there are historical records for northern leopard frogs from 3 sites in the complex: Dines Tank (1981), Unmarked Pond (=Cindy's Pond) (1984), and Unnamed Tank (=Borrow Pit South Tank) (1981) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 80 surveys at 44 sites within the buffered stocking complex between 1961 and 2000 (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during surveys at Dines Tank (1990, 1992, 1993, and 1997) or Unmarked Pond (=Cindy's Pond) (1997 and 1998) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 19 sites within the buffered stocking complex in 2004 and 2007 and did not observe any northern leopard frogs (based on data provided by the Black Mesa Ranger District, Tonto National Forest). It is likely that northern leopard frogs no longer occupy Dines Tank, Unmarked Pond (=Cindy's Pond), or Unnamed Tank (=Borrow Pit South

Tank) and current presence of crayfish and non-native fish in Bear Canyon Lake, Willow Creek, and its tributaries make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs will be exposed to dispersing fish stocked in Bear Canyon Lake or elsewhere in the Clear Creek buffered stocking complex is low. It is likely that northern leopard frogs no longer occupy the upper stretch of Clear Creek or any of its tributaries. In addition, the habitat in these drainages is less suitable for northern leopard frogs due to the presence of crayfish and non-native fish.

Chiricahua Leopard Frog

Local Analysis: Although Bear Canyon Lake and the Clear Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs will be exposed to fish stocked in Bear Canyon Lake or within the buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs at Bear Canyon Lake; however, there are historical records for Chiricahua leopard frogs from 3 sites in the complex: East Clear Creek (=Horse Crossing) (1961), Unnamed Tank (=Buck Springs Canyon Tank) (1984), and East Clear Creek (=FS 96/95 JCT) (1972) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 80 surveys at 44 sites within the buffered stocking complex between 1961 and 2000 (Figure 34; HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at East Clear Creek (=Horse Crossing) (1992, 1995, and 1997), Unnamed Tank (=Buck Springs Canyon Tank) (later in 1984, 1997, and 1998), and East Clear Creek (=FS 96/95 JCT) (1987, 1990, 1992, 1993, and 1999) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 19 sites within the buffered stocking complex in 2004 and 2007 and did not observe any Chiricahua leopard frogs (Black Mesa Ranger District, Tonto National Forest). It is likely that Chiricahua leopard frogs no longer occupy East Clear Creek (=Horse Crossing), Unnamed Tank (=Buck Springs Canyon Tank), and East Clear Creek (=FS 96/95 JCT) and current presence of crayfish and non-native fish in Bear Canyon Lake, Willow Creek, and its tributaries make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs will be exposed to dispersing fish stocked from Bear Canyon Lake or elsewhere in the Clear Creek buffered stocking complex is low. It is likely that Chiricahua leopard frogs no longer occupy the upper stretch of Clear Creek or any of its tributaries. In addition, the habitat in these drainages is less suitable for leopard frogs due to the presence of crayfish and non-native fish.

CLEAR CREEK COMPLEX ANALYSIS

The Clear Creek Complex consists of 3 reservoirs found near the Mogollon Rim in north central Arizona; C.C. Cragin Reservoir, Knoll Lake, and Bear Canyon Lake. All drain into Clear Creek, which is a tributary to the Little Colorado River (LCR). Downstream of these three stocked reservoirs, Clear Creek leaves National Forest ownership and enters checker-boarded state and private lands. Throughout the next 40+ miles the stream is ephemeral or interrupted perennial with isolated pools. Clear Creek drains into Clear Creek Reservoir near Winslow. Additional information on this area is provided in the section on Clear Creek Reservoir. Water that spills from Clear Creek Reservoir drains into the LCR and is discussed later under the LCR Watershed analysis.

Water Distribution / Connectivity

Most of the headwaters of the Clear Creek watershed are found near the Mogollon Rim, beginning with the headwaters of East Clear Creek upstream of C.C. Cragin Reservoir, including Kehl Canyon and Miller Canyon. Bear Canyon also drains into C.C. Cragin Reservoir. In the summer the drainages upstream of C.C. Cragin Reservoir vary from often dry during drought years to only isolated pools with no surface flow during wetter summers. Water from seepage around the dam at C.C. Cragin Reservoir and from a 2 inch pipe provide permanent flow for East Clear Creek, which extends from the dam downstream to Macks Crossing. Tributaries to East Clear Creek in this section of the creek include Barbershop Canyon (Dane Canyon is a tributary of Barbershop Canyon) and Yeager Canyon, both of which flow during spring runoff but are often reduced to dry stretches with isolated pools in the summer. Downstream of Macks Crossing, East Clear Creek dries to isolated pools during dry years. Knoll Lake is located on East Leonard Canyon, and when it spills it flows down East Leonard Canyon, which joins with West Leonard Canyon to form Leonard Canyon. Leonard Canyon is a tributary of East Clear Creek with the confluence being located about 2 to 3 miles downstream of Macks Crossing. These canyons flow during spring runoff but are usually reduced to dry stretches and or isolated pools in the summer. Dines Tank is an example of an isolated pool in the bottom of Leonard Canyon. Bear Canyon Lake is located on Willow Creek; when it spills, it flows down Willow Creek to its confluence with East Clear Creek downstream of Leonard Canyon. The Willow Creek Drainage Flows during spring runoff, but is often reduced to dry stretches and or isolated pools during the summer. East Clear Creek and Willow Creek join to form Clear Creek. All of these waters are connected except for fish moving upstream from below the dams to above the dams.

Fish Movement

Fish can move upstream of all of the stocking sites, though most of the waters go dry or at the most are restricted to isolated pools during the summer. Fish can move downstream of the reservoirs during runoff events that cause the reservoirs to spill, and move throughout the watershed unless natural barriers are present to prevent fish from moving. To date only one stocked rainbow trout has been captured downstream of the reservoirs since sampling began downstream of Knoll and C.C. Cragin Reservoir in 1995.

Community Description
Fish found in the reservoirs include rainbow trout, green sunfish, largemouth bass, yellow perch, yellow bullhead, fathead minnow, golden shiner, crayfish, speckled dace, bluehead sucker in Knoll Lake, and Little Colorado Sucker in C.C. Cragin Reservoir. Fish found in the East Clear Creek and Clear Creek proper include rainbow trout, brown trout, green sunfish, fathead minnow, crayfish, speckled dace, and roundtail chub from about Macks Crossing downstream; in addition, bluehead sucker, Little Colorado sucker, and Little Colorado spinedace are present. Little Colorado spinedace, Little Colorado sucker, bluehead sucker, and speckled dace are also present in Dane Canyon, Bear Canyon, Yeager Canyon, West Leonard Canyon, and Dines Tank. Naturally spawned rainbow trout are also found in Dane Canyon, Barbershop Canyon, Kehl Canyon, West Leonard Canyon, and Leonard Canyon. Green sunfish and fathead minnows were also found in 2009 in Lower Bear Canyon near where it enters C.C. Cragin Reservoir. Narrow-headed garter snakes are not known from the LCR (see analysis below). Although northern Mexican garter snakes have been observed in the LCR watershed near Lakeside, they are not known from Clear Creek (see analysis below).

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Potential impacts from the proposed action to northern Mexican garter snake and narrow-headed garter snakes, Little Colorado Spinedace and critical habitat and roundtail chub are addressed below in the Clear Creek Complex analysis.

Potential impacts to Chiricahua and northern leopard frogs was discussed at the site specific analysis and includes the broader scale analysis.

Little Colorado Spinedace and Critical Habitat
Little Colorado spinedace currently occupy small, perennial pool habitats in West Leonard Canyon, Leonard Canyon including Dines Tank, Dane Canyon, and Yeager Canyon downstream of C.C. Cragin Reservoir. They are also found in Bear Canyon, which feeds directly into C.C. Cragin. The populations and available habitat are all relatively small throughout the watershed, but West Leonard Canyon and Leonard Canyon continue to be one of the most dependable

locations to find spinedace in the entire watershed. Bear Canyon, Dane Canyon, and Yeager Canyon populations were established by moving spinedace from West Leonard Canyon and Dines Tank to these areas (USFWS 2008e).

Additionally, it has been reported spinedace populations appear and disappear over short time frames, which makes specific determination on status and exact location of populations difficult to determine. This makes management of the species difficult, because responses of the population to changes within the watershed cannot be measured with certainty (USFWS 2008e).

Currently, East Clear Creek and Leonard Canyon contain self-sustaining rainbow trout and brown trout populations.

Potential Impacts

To date, no stocked fish have been observed outside of Knoll Lake. Should any stocked trout exit Knoll Lake, competition is potentially possible (refer to the interactions discussed in Chapter 4). Any rainbow trout stocked that leave Knoll lake would likely be assimilated into self-sustaining trout populations in East Clear Creek. Any stocked trout that escape may prey on eggs, fry, juvenile, and adult fish, if they encounter spinedace.

Any rainbow trout or arctic grayling stocked that were to escape from Bear Canyon Lake during natural events would not likely persist for long periods of time, and would not become established due to high water temperatures and drying conditions. Surveys completed by AGFD in over 70 locations in Willow Creek in 1997 did not find any rainbow trout. Additional surveys of the confluence of Willow and Gentry creek in 2006 also did not detect rainbow trout. In addition, AGFD surveys in 2000, 2004, and 2005 in Clear Creek near the confluence with Willow Creek did not find any rainbow trout.

Trout and/or arctic grayling escaping Bear Canyon Lake may temporarily compete for food and space and potentially prey on eggs, fry, and juvenile fish. Due to the intermittent nature of the stream and the lack of evidence supporting long-term survival of trout once they have escaped Bear Canyon Lake, it is unlikely these fish would persist long enough to have opportunity to ascend into Leonard Canyon, to occupied spinedace habitat, or into East Clear Creek to critical habitat.

Potential impacts to Little Colorado spinedace from stocking fish in C.C. Cragin reservoir are discussed in the C.C. Cragin reservoir section above.

Robinson et al. (2000) reported that diet overlap between rainbow trout and Little Colorado spinedace was low in both experimental and natural settings, indicating a low potential for diet overlap in general. Competition is most likely to occur between small trout and small bodied fish and less likely to occur between larger bodied trout (Robinson et al. 2000). Because stocked trout

are larger bodied, competition is unlikely. Any rainbow trout stocked that leaving stocking locations would likely be assimilated into self-sustaining trout populations. Any stocked trout that escape may prey on eggs, fry, juvenile, and adult fish, if they encounter spinedace.

Arctic grayling escaping may temporarily compete for food and space and potentially prey on eggs, fry, and juvenile fish. Due to the intermittent nature of the stream and the lack of evidence supporting long-term survival of grayling once they have escaped, it is unlikely these fish would persist long enough to have opportunity to ascend into the Leonard Canyon complex, to occupied spinedace habitat, or into East Clear Creek to critical habitat.

Critical habitat

Critical habitat includes eighteen miles of East Clear Creek in Coconino County; eight miles of Chevelon Creek in Navajo County and five miles of Nutrioso Creek in Apache County (USFWS 1987). Constituent elements for critical habitat, include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate.

Potential Impacts

There are no barriers to prevent downstream movement of trout from Bear Canyon or Knoll Lake other than the dams that impound the stream. When critical habitat areas for spinedace were designated, these areas were reported as "…presently support(ing) healthy self-perpetuating populations of the Little Colorado spinedace" (USFWS 1987). Since that time, habitat degradation, introduction of non-native fishes, and scarcity of water have resulted in low numbers of spinedace in East Clear Creek and Leonard Canyon. In years of high precipitation or during periods of high runoff, trout have the opportunity to move out of stocked area into spinedace habitat. Similarly, spinedace may move into trout areas. In either case, some spinedace could be consumed by rainbow trout or other non-native species. Movement of predaceous fish into designated critical habitat may contribute to the disjunct distribution patterns and retreat of spinedace to suboptimal habitats. Results may include competition, predation, harassment or further loss of spinedace.

Potential impacts to Little Colorado Spinedace from stocked fish at C.C. Cragin reservoir are addressed in the C.C. Cragin reservoir section above.

Roundtail Chub

Known populations of roundtail chub in the Clear Creek watershed are in Clear Creek downstream of the National Forest boundary, to near Clear Creek Reservoir.

Potential Impacts

Currently, East Clear Creek contains self-sustaining rainbow trout and brown trout populations. Any rainbow trout stocked that were to escape from stocking sites during natural events would

most likely be incorporated into the self sustaining trout population. Rainbow trout are not thought to persist in the majority of the occupied chub habitat in the lower elevations of Clear Creek due to warm water temperatures, which makes for unsuitable habitat. However, trout escaping from the 3 reservoirs may temporarily compete for food and space and potentially prey on eggs, fry, and juvenile fish if they are able to survive the transport into occupied roundtail chub habitat.

Northern Mexican Garter Snake

Stocking Complex Analysis: There are no verified records of northern Mexican garter snakes from this part of the watershed or the mainstem LCR. Although no systematic surveys for garter snakes have been conducted in this area, within the 20 km buffer established for this stocking complex, there is one questionable historical (1933) record from Hart Canyon, a tributary of Willow Creek (approx. 2.2 air mi NW of Woods Canyon Lake and approx. 6.2 air mi E of Knoll Lake), for which Holycross et al. (2006) provide this analysis: "Wright and Wright (1957) discuss a *T. eques* from Hart Canyon....and provide both a physical description and photographs (p. 802). Unfortunately, it is difficult to tell from the photographs or description whether or not this specimen is a *T. eques*, so the specimen is not mapped…Whether [this record is valid] is a question that needs to be resolved, if possible." The presence of non-native fishes and crayfish in Cragin Reservoir, Knoll Lake, Bear Canyon Lake, and the Clear Creek complex makes this habitat less suitable for the species. Therefore, it is unlikely that northern Mexican garter snakes will be exposed to fish stocked into the Clear Creek complex.

Downstream Analysis: There are no records of northern Mexican garter snakes downstream of the Clear Creek complex (HDMS, Arizona Game and Fish Riparian Herpetofauna Database). Within the LCR watershed, the only northern Mexican garter snake records are from and near Lake of the Woods (1942, 1949), which is more than 150 river km upstream of the confluence of Clear Creek and the LCR, and none have been detected there since (Holycross et al. 2006). Therefore, it is unlikely that northern Mexican garter snakes will be exposed to dispersing stocked sport fish.

Narrow-headed Garter Snake

Stocking Complex Analysis: There are no verified narrow-headed garter snake records from the Clear Creek complex, though the area has not been systematically surveyed for garter snakes. Unidentified garter snakes were observed during surveys in 1999 and 2000 and were likely *T. cyrtopsis* (known from Wildcat Canyon) or *T. elegans* (common in the area); they were unlikely to be narrow-headed garter snakes. There is an unvouchered report of a narrow-headed garter snake in Hart Canyon, a tributary of Willow Creek (approx. 2.2 air mi NW of Woods Canyon Lake and approx. 6.2 air mi E of Knoll Lake) (HDMS); Holycross et al. (2006) consider this

report a misidentification. Therefore, it is unlikely that narrow-headed garter snakes will be exposed to sport fish stocked in the complex.

Downstream Analysis: There are no known records of narrow-headed garter snakes downstream of the Clear Creek complex. Although stocked fish may disperse up or downstream, it is unlikely that narrow-headed garter snakes will be exposed.

Clear Creek Reservoir

Site Description

The reservoir is located about 6 miles southwest of Winslow at an elevation of 4870 feet (Figure 37). Clear Creek Reservoir is a 45 acre reservoir impounding lower Clear Creek approximately one mile above its confluence with the Little Colorado River (Figure 38, Figure 39, and Figure 40). The dam and water rights are managed by the City of Winslow for irrigation and domestic water use. The reservoir is permanent and fills and spills annually during the spring snowmelt runoff in the Clear Creek watershed. The lake level can drop several feet through the year as water is released to the City of Winslow. Clear Creek Reservoir is accessed year around by paved Highway 99. A county park, McHood Park, is located at the reservoir with paved parking, picnic facilities, restrooms on the east side, and a boat launch ramp and picnic/camping sites on the west side, with the facilities managed as a City of Winslow town park.

Management of Waterbody

Clear Creek Reservoir is managed primarily for a naturally reproducing warmwater fishery because the lake gets very warm in the summer. Largemouth bass, sunfish, channel catfish, black bullheads, and common carp reproduce naturally in the reservoir. Catchable size rainbow trout are stocked in the spring/early summer after the lake stops spilling when the water quality is still cool enough to support trout survival. Channel catfish and brown trout were stocked annually during the 1980s and early 1990s. However, catchable rainbow trout have been the only species stocked in Clear Creek Reservoir since 1993 (Table 47).

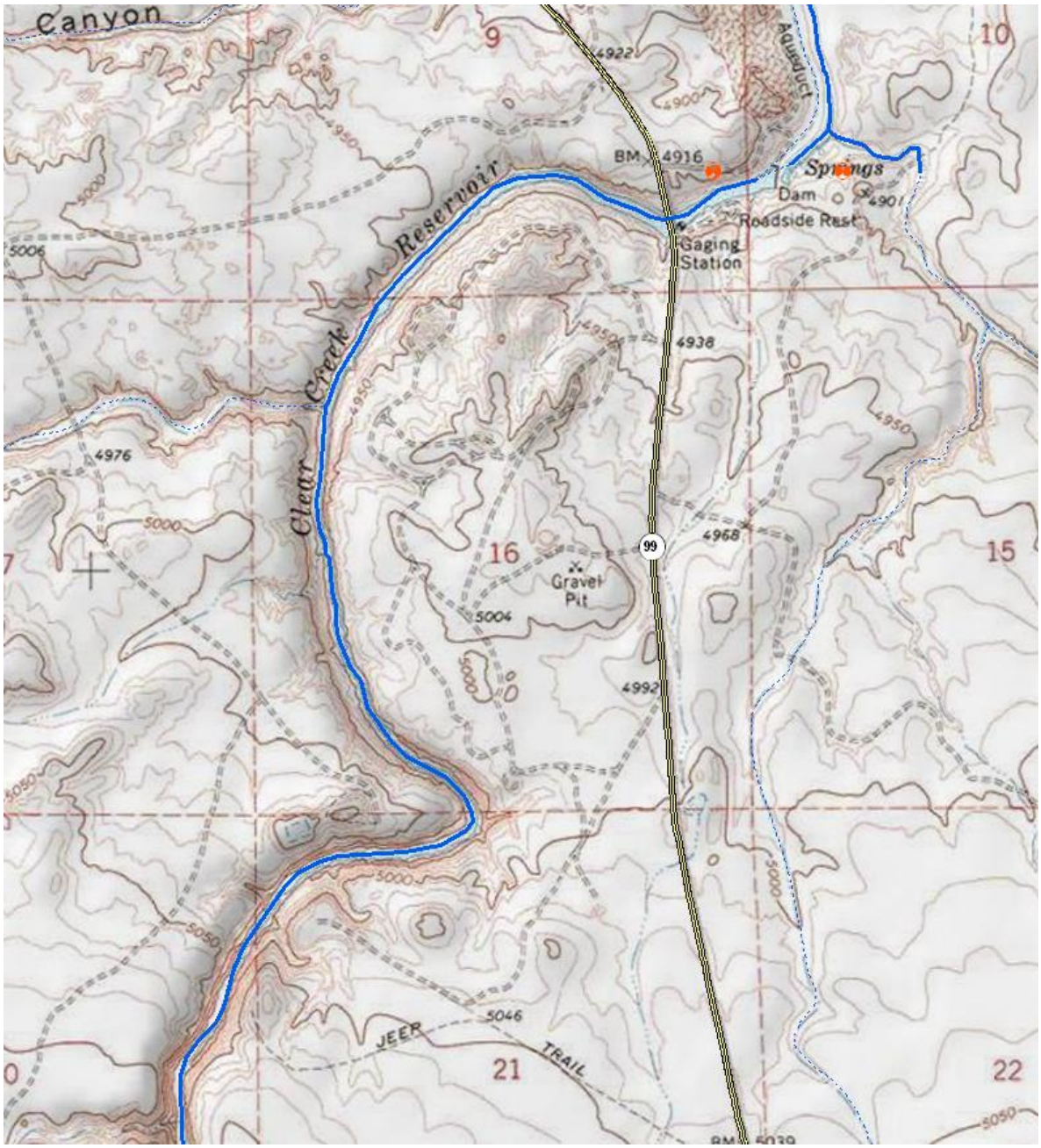

Figure 37. Map of Clear Creek Reservoir.

Figure 38. Clear Creek Reservoir, lower shallow portion

Figure 39. Clear Creek Reservoir at recreation site

Figure 40. Clear Creek Reservoir in upper canyon portion

The primary fishery is self-sustaining warm water with the secondary fishery being cold water for rainbow trout. The primary objective is naturally reproducing warm water fishery, while the secondary objective is put-and-take intensive use coldwater fishery for stocked rainbow trout. The warm water fishery is year around, while the coldwater put-and-take fishery is late spring, early summer (April through June) only.

Stocked trout are mostly caught out quickly and likely do not survive through the summer as they are not detected in surveys above or below the reservoir (Table 49, Table 50, Table 51 and Table 52). Water temperatures in Clear Creek Reservoir reach 26.7 degrees C according to M. Lopez (pers. comm.), exceeding the upper critical thermal tolerances for trout which is 25°C (Raleigh et al 1984). The timing of the stocking after the spill helps to keep the trout from escaping the reservoir. The fish cannot go downstream into the LCR after it stops spilling, and they would have a difficult time going far upstream after the flows decrease from the high snowmelt runoff because of the shallow channel morphology and elevated water temperatures.

Table 47. Clear Creek Reservoir stocking history.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1936	1936	2	18,110
Brown trout	1953	1992	8	52,600
Channel catfish	1974	1992	9	29,925
Largemouth bass	1935	1975	9	35,650
Rainbow trout	1953	2009	227	569,826
Total			255	706,111

The Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) identifies the management emphasis for Clear Creek Reservoir as intensive use coldwater and self sustaining warmwater sport fish. The desired species assemblage is identified as rainbow trout, largemouth bass, bluegill, channel catfish, and Little Colorado sucker. The warmwater fishes reproduce naturally within the reservoir and do not need to be stocked.

Angler creel surveys were conducted on site from January through December in 1999. These surveys showed 3,992 AUDs at the reservoir, with 9.1% of the overall catch of rainbow trout. Bullheads consisted of 57.2% of the angler catch and sunfish were 22.3% of the catch. Trout were caught in April through July, from stockings that occurred in April and May. One trout was checked in November; however this was likely from a stocking event that occurred in October of that year, not from earlier stocked trout holding over through the summer. Trout are no longer stocked in the fall. An angler mail out survey in 2001 showed 1,938 AUDs at Clear Creek Reservoir (Pringle 2004).

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked from April through June annually following spring runoff; numbers of trout stocked may be from 0 to 15,000 trout annually. Trout may be stocked multiple times per season, but focused within the late spring, early summer period following the spring runoff but before the warm water temperatures of the hot summer months.

Water Distribution/Connectivity
Clear Creek is perennial where it enters the reservoir, with a few cubic feet per second of flow (Clarkson and Marsh 2005a). The headwaters of the Clear Creek watershed are cold, perennial streams flowing through Ponderosa pine forest, while the middle reaches are seasonally intermittent in deep, steep walled canyons (Clarkson and Marsh 2005a). The main upper tributaries Leonard Canyon and East Clear Creek are located approximately 63 miles upstream of Clear Creek Reservoir. Surface water in the lower reaches of Clear Creek is intermittent in the upper few kilometers, but perennial flows are gradually sustained in a deep slot canyon toward the lower end and into the reservoir (Clarkson and Marsh 2005a). The source of this perennial flow results from the incision of the Clear Creek channel into the C-aquifer (Clarkson and Marsh 2005b). The watershed produces a heavy spring snowmelt runoff from the headwaters into the reservoir, which fills the reservoir and causes it to spill every spring. Following the snowmelt runoff, much of Clear Creek is reduced to dry streambed with isolated pools, except the perennial portion just above the lake. Water level in the lake begins dropping after the snowmelt runoff ceases and the City of Winslow begins drawing water from the reservoir.

Outflows from Clear Creek Reservoir occur when the lake spills over the spillway (Figure 41) in the spring or when the City of Winslow draws water for irrigation and domestic use. The spills occur only in the spring during snowmelt runoff, flowing down the very lower portion of Clear Creek for 0.5 miles to the confluence with the Little Colorado River, then down the Little Colorado River for approximately 167 miles to the Colorado River. At base flow, the middle Little Colorado River downstream of the Clear Creek confluence flows for a short distance and disappears into the sand near or just downstream of Winslow. The lake occasionally receives a lot of sediment washing down the narrow canyon during extreme flood events and the sediment is deposited in the wider part of the lake as the water slows down coming out of the canyon.

Figure 41. Clear Creek Reservoir spillway

The Little Colorado River upstream of the confluence with Clear Creek is typically perennial for 9 miles up to the confluence with Chevelon Creek due to the perennial flows in lower Chevelon Creek. The Little Colorado River upstream of Chevelon Creek is often dry at base flows and flows only during spring runoff and heavy monsoon events.

Surface water from the Clear Creek Reservoir does not reach the Little Colorado River when the reservoir is not spilling. Withdrawals from the reservoir by the City of Winslow go directly into a pipe that leads to the city and is not connected to the Little Colorado River. The timing and duration of withdrawals by the city is unknown. Trout may escape Clear Creek Reservoir

through irrigation releases; however, they would be transported within the pipe system to the town with no return possible to the Little Colorado River or release to other aquatic habitats.

Fish Movement

During the stocking season, most of the stocked trout are caught quickly, and the remainders likely do not survive in the reservoir through the hot months of July and August. Consequently, very few if any trout are expected to be present in the reservoir when it spills in the spring. Trout were historically stocked in the spring and fall, but now only stocked in the late spring or early summer to minimize overwintering and presence of trout when the reservoir spills in the spring. It is possible a trout might persist in the upper canyon portion of the reservoir, where water temperatures may be lower and which might allow over summer survival. Water temperatures are not measured in the canyon portion because of accessibility, thus, this information is not known.

If trout were present in the reservoir in the spring, they could potentially move upstream in Clear Creek. There are no permanent structural physical barriers to upstream movement of stocked trout between the reservoir and spinedace critical habitat in East Clear Creek. However, barriers to upstream movement are present seasonally due to the intermittent nature of the middle reaches of the stream. Elevated water temperatures in the lower perennial reach throughout much of the warmer part of the year also limit upstream migration of stocked trout.

Both distance and timing are impediments to trout moving upstream into occupied or critical habitat. Trout would not be able to swim upstream through dry streambed between isolated pools in the middle reaches during the summer or even the fall and winter. Thus, a trout would have to navigate the entire distance upstream over 63 miles to reach suitable trout habitat in East Clear Creek and Leonard Canyon during the high flows of the spring snowmelt runoff. The likelihood of this occurring is low because of the timing of trout stocking in the reservoir. Stockings occur in the late spring and early summer after the snowmelt runoff, when it is still cool enough in the reservoir and, as discussed above, few if any stocked trout are expected to overwinter.

When the reservoir spills in the spring, overwintering trout (please see discussion above) could go over the spillway into the Little Colorado River. Once in the LCR, a dispersing trout could swim either upstream towards the confluence of Chevelon Creek. Chevelon Creek is perennial where it joins the Little Colorado River. Escaping trout could also go downstream towards the Colorado River. As the spring runoff subsides, the LCR dries and becomes a warm, wide, shallow, sandy streambed for many miles, until flows eventually disappear into the sand at base flows. During spring runoff, the river flows continuously to the Colorado River, which is approximately 167 miles away. At the confluence of Chevelon Creek with the LCR the perennial flow is contained in a wide, shallow and sandy stream bed, which is difficult for a trout to navigate during base flows. It would be possible for a trout to navigate this area during high spring runoff when the temperatures are cooler. But there is no evidence showing that trout have

reached occupied habitat and critical habitat for spinedace in lower Chevelon Creek. No trout have been collected in numerous surveys at the lower end of Chevelon Creek (Table 54).

A diversion dam on lower Chevelon Creek, located 1.7 miles upstream from the confluence with the LCR, may be somewhat of a barrier to upstream movement of fish, however, it is likely not a complete barrier to trout which are known to be good jumpers and able to move upstream. However, trout have not been collected in numerous surveys in 12.8 miles of Chevelon Creek above the diversion dam where spinedace is considered (Table 55 and Table 56).

Community Description

Clear Creek Reservoir contains naturally reproducing warm water species year round, including largemouth bass, channel catfish, black bullhead, green sunfish, bluegill, fathead minnow, rock bass, and common carp (Table 48). Bullfrogs and crayfish are also present.

Table 48. Survey history in Clear Creek Reservoir.

Survey date and method	Species collected	Number collected	Size range (mm TL)
May 23, 1962 Boat shocker	Largemouth bass Rock bass Green sunfish Carp LC sucker Trout	8 3 29 Present Present Present	68-415 98-218 43-203 Not measured Not measured Not measured
March 10, 1999 Exp. gillnets (4)	Rainbow trout Bluegill Channel catfish Carp Little Colorado sucker Black bullhead	1 2 6 2 15 24	243 110-130 331-610 320-445 338-446 163-195
June 30, 2003 Boat shocker	Rainbow trout Largemouth bass Bluegill Green sunfish Carp Black bullhead Golden shiner	1 6 2 4 18 6 1	231 99-230 82-136 57-136 185-460 180-225 112
March 30, 2009 Exp. gillnet (4)	Largemouth bass Bluegill Channel catfish	1 3 1	393 121-164 451

	Carp	23	335-444
	Little Colorado sucker	7	312-373
	Black bullhead	2	163-172
May 21, 2009 Boat shocker	Rainbow trout	16	200-330
	Largemouth bass	29	81-390
	Bluegill	76	30-172
	Green sunfish	109	47-140
	Hybrid sunfish	7	85-100
	Carp	74	147-465
	Black bullhead	78	125-225

Thorough surveys of the creek conducted by the Department downstream of the National Forest boundary in 1999 and 2000 (Table 49) found Little Colorado sucker, roundtail chub, speckled dace, green sunfish, fathead minnow, canyon tree frogs, and unidentified garter snakes. A total of 74 sites were surveyed from 25.6 kilometers to 73.7 kilometers upstream of the bridge at Clear Creek Reservoir. No trout were collected. Nearly half the sites were dry at the time of survey. Additionally, no crayfish were observed throughout these surveys.

Table 49. Fish collected in Clear Creek in 1999 and 2000.

Surveys were conducted with a backpack electroshocker, green meanie gillnets, 1/8” mesh seines, and a dipnet. Twenty-eight sites were sampled with the backpack electroshocker (effort=8007 seconds). Three sites were sampled with green meanie gillnets (effort=5 netnights). Two sites were sampled with 1/8” mesh seines. Four sites were very small and sampled with a dipnet, no effort was recorded. Thirty-five sites were dry.

Species	Num. collected
Little Colorado sucker	185
Roundtail chub	129
Speckled dace	20
Green sunfish	20
Fathead minnow	500
Unidentified sucker	1
Unidentified fry	150
Total	1005

Two surveys were conducted in Clear Creek above the reservoir by the Bureau of Reclamation and Arizona State University for the Office of Surface Mining and Reclamation Enforcement in 2004 and 2005 (Clarkson and Marsh 2005a, Clarkson and Marsh 2005b) Those efforts found

Little Colorado sucker, roundtail chub, fathead minnow, green sunfish, rock bass, and crayfish (Table 50 and

Table 51). No trout were collected.

Table 50. Fish collected in Clear Creek in September 2004 (Clarkson and Marsh 2005a).

Species	Upper site	Middle site	Lower site
Little Colorado sucker	Rare (YOY)	7 (adult)	5 (adult)
Roundtail chub	1 (YOY)	-	-
Fathead minnow	Abundant	Common	-
Green sunfish	Abundant	Common	5 (adult)
Rock bass	-	-	32 (adult)

Table 51. Fish collected in Clear Creek in August 2005 (Clarkson and Marsh 2005b).

Species	Site 1	Site 2
Little Colorado sucker	158	31
Roundtail chub	20	2
Fathead minnow	-	Common
Green sunfish	383	670

A survey was also conducted in a reach of Clear Creek immediately downstream of Clear Creek Reservoir in 2005 (Clarkson and Marsh 2005b). Roundtail chub, fathead minnow, plains killifish, and common carp were collected from this area (Table 52). No trout were collected.

Table 52. Fish collected in Clear Creek below the reservoir in August 2005 (Clarkson and Marsh 2005b).

Species	Site 3
Roundtail chub	1
Fathead minnow	Common
Plains killifish	Abundant
Common carp	Rare

The Little Colorado River downstream of the confluence with Clear Creek, near the City of Winslow, contained only non-native fish when surveyed in July 2007 by the Department. No trout were collected. A subsequent Department survey in the same vicinity near Winslow in June

2009 had similar results with additional collection of 4 Little Colorado suckers. Again, no trout were collected (Table 53).

Table 53. Fish collected in the Little Colorado River downstream of the confluence with Clear Creek, near the City of Winslow.

Species	July 2007 (Weiss 2007b)	June 2009 (AGFD unpublished)
Plains killifish	1,587	104
Fathead minnow	703	39
Red shiner	10	22
Channel catfish	5	-
Bluegill	1	-
Green sunfish	1	-
Little Colorado sucker	-	4
Total fish	2,305	169

No trout have been collected in lower Chevelon Creek in many surveys in that area, likely due to the very warm water temperatures in the summer and distance downstream from stocking sites in the Chevelon headwaters (Table 54). The 1997 survey data (Dorum and Young 1995) provided no information on gear type. The 1983 surveys were conducted with 1/8” mesh seines, with 10 seine hauls per site (Minckley 1983). The 1990-1995 surveys were conducted with 1/8” mesh seines (Dorum and Young 1995). The 1996 survey was conducted over 200 meters with 1/8” mesh seines and the 1997 survey was conducted with a backpack electroshocker (Lopez et al 1998a). The 2002 and 2009 surveys were conducted with 1/8” mesh seines (AGFD unpublished data). The 2007 survey was conducted with 1/8” mesh seines (Weiss 2007a).

Table 54. Fish collected in lower Chevelon Creek at Hugo Meadow/Chevelon Wildlife Area

Species	Aug 1977	July 1983	June 1990	Aug 1993	June 1994	July 1995	Oct 1996	Nov 1997	July 2002	July 2007	June 2009
LC spinedace	6	154	55	2	3	46	9	0	0	0	0
LC sucker	10	0	0	34	21	0	0	0	0	0	0
Bluehead sucker	0	0	0	0	2	0	0	0	0	0	0
Speckled dace	0	0	0	52	10	14	4	3	0	0	0
Black bullhead	9	0	0	0	0	0	0	0	0	0	0

Yellow bullhead	1	0	1	0	0	0	0	0	0	0	0
Carp	92	4	5	4	Present	13	0	0	0	0	20
Red shiner	0	0	8	10,000+	378	211	1,787	539	201	1	168
Plains killifish	10	134	9	3	20	44	91	83	48	10	0
Channel catfish	12	3	0	4	0	0	0	0	0	0	1
Green sunfish	68	5	27	1,000+	6	0	4	40	26	12	0
Bluegill	0	83	0	0	0	0	0	0	0	0	0
Largemouth bass	12	0	0	0	0	0	0	0	0	108	88
Golden shiner	22	0	1	0	0	0	0	0	0	0	0
Fathead minnow	72	832	482	10,000+	1,243	1,222	402	202	240	0	310
TOTAL	314	1,215	588	21,000+	1,683	1,550	2,297	867	515	131	587

Upstream of the diversion dam on Chevelon Creek towards the McLaws Road Bridge is a large pool backed up by the diversion dam. This area is within the Little Colorado River valley, with much of the pool located on the Chevelon Wildlife Area. It consists of sand/silt substrates and has thick salt cedar stands along both banks. This reach contains native Little Colorado sucker, but is dominated by non-native fishes, including green sunfish, fathead minnow, plains killifish, common carp, red shiner, channel catfish, and black bullhead. No trout were found in 1997 and 1998 using gillnets, a canoe electroshocker, and seines (Lopez et al 1998a and Table 9).

Table 55. Survey summary of the shallow pool from the Diversion Dam to McClaws Road Bridge.

Date	LC sucker	Green sunfish	Fathead minnow	Plains killifish	Carp	Red shiner	Channel catfish	Black bullhead
7/1998	1	2			4			2
7/1998		40	75	20		21		
11/21/1997	3							
11/21/1997	16	11			2		3	28
11/21/1997	4	1			2		1	1
11/21/1997	9	11			1		1	6

Upstream of the diversion pool is another large deep pool located in a slot canyon. This pool extends upstream for 1.7 miles to a point just downstream of The Steps, a famous spinedace collection site. This deep pool is difficult to navigate and even more difficult to survey because of the depth, difficult access, and nearly no structure on which to attach gillnets. Limited surveys in this large pool in June 1998 with some gillnets resulted in the capture of Little Colorado sucker, green sunfish, and black bullhead, but no trout (Lopez et al 1998a and Table 10). An angling survey also found largemouth bass, green sunfish, and common carp in this large pool (M. Lopez, pers. comm.).

Table 56. Survey summary of the large deep pool between the McClaws Road Bridge and The Steps conducted in June 1998 with gill nets.

Date	Largemouth bass	Green sunfish	Black bullhead
6/1998 (3-2)	5	13	2
6/1998 (3-1)	2		

Permanent flow in Chevelon Creek for 8.7 miles from just above the very large slot canyon pool upstream to the confluence with Pony Canyon contains Little Colorado spinedace, Little Colorado sucker, bluehead sucker, speckled dace, green sunfish, fathead minnow, plains killifish, red shiner, golden shiner, black bullhead, yellow bullhead, and crayfish. The population of spinedace in and around The Steps area within this reach is large and robust, containing the highest densities of spinedace recorded in recent times, observed in schools up to several hundred spinedace.

Fisheries surveys conducted with a backpack electroshocker and seines did not collect trout within occupied spinedace habitat in Chevelon Creek from Pony Canyon to 1.7 miles above McLaws Road (Dorum and Young 1995; Lopez et al 1998a; Weiss 2007b; AGFD unpublished data).

There have been few rainbow trout collected in the middle reaches of Chevelon Creek, upstream of the confluence with Black Canyon (see the Chevelon Complex analysis). These rainbow trout in Chevelon Creek are most likely coming downstream from the Chevelon complex and most likely not upstream from Clear Creek Reservoir. The use of live baitfish is prohibited at Clear Creek Reservoir, and is prohibited in all of Coconino, Apache and Navajo counties.

Consultation species, Critical Habitat & Potential Impacts

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Leopard Frog

Local Analysis: Clear Creek Reservoir and the buffered stocking site area are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to stocked sportfish in Clear Creek Reservoir is moderate. There are no historical records for northern leopard frogs at Clear Creek Reservoir or within the 5 mile buffer around the reservoir (Figure 42, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and the habitat is less suitable due to the presence of crayfish and bullfrogs. However, the buffered stocking site has not been adequately surveyed and it is possible that northern leopard frogs occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in Clear Creek Reservoir is moderate. There are 2 historical records (1932 and 1963) for northern leopard frogs in Winslow, just outside of the buffered stocking site area and 4 from upstream; Clear Creek (Echinique Place) (1960), East Clear Creek (Mack's Crossing) (1971), East Clear Creek (Jones Crossing) (1970), and East Clear Creek (FS 96/95 Jct) (1972) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at these sites; however, the area has not been adequately surveyed and it is possible that northern leopard frogs still occupy the drainages into which Clear Creek Reservoir flows.

Chiricahua Leopard Frog

Local Analysis: Clear Creek Reservoir and the buffered stocking site area are within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to stocked sportfish in Clear Creek Reservoir is moderate. There are no historical records for Chiricahua leopard frogs at Clear Creek Reservoir or within the 5 mile buffer around the reservoir (Figure 42; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and the habitat is less suitable due to the presence of crayfish and bullfrogs. However, the buffered stocking site has not been adequately surveyed and it is possible that Chiricahua leopard frogs occupy this area.

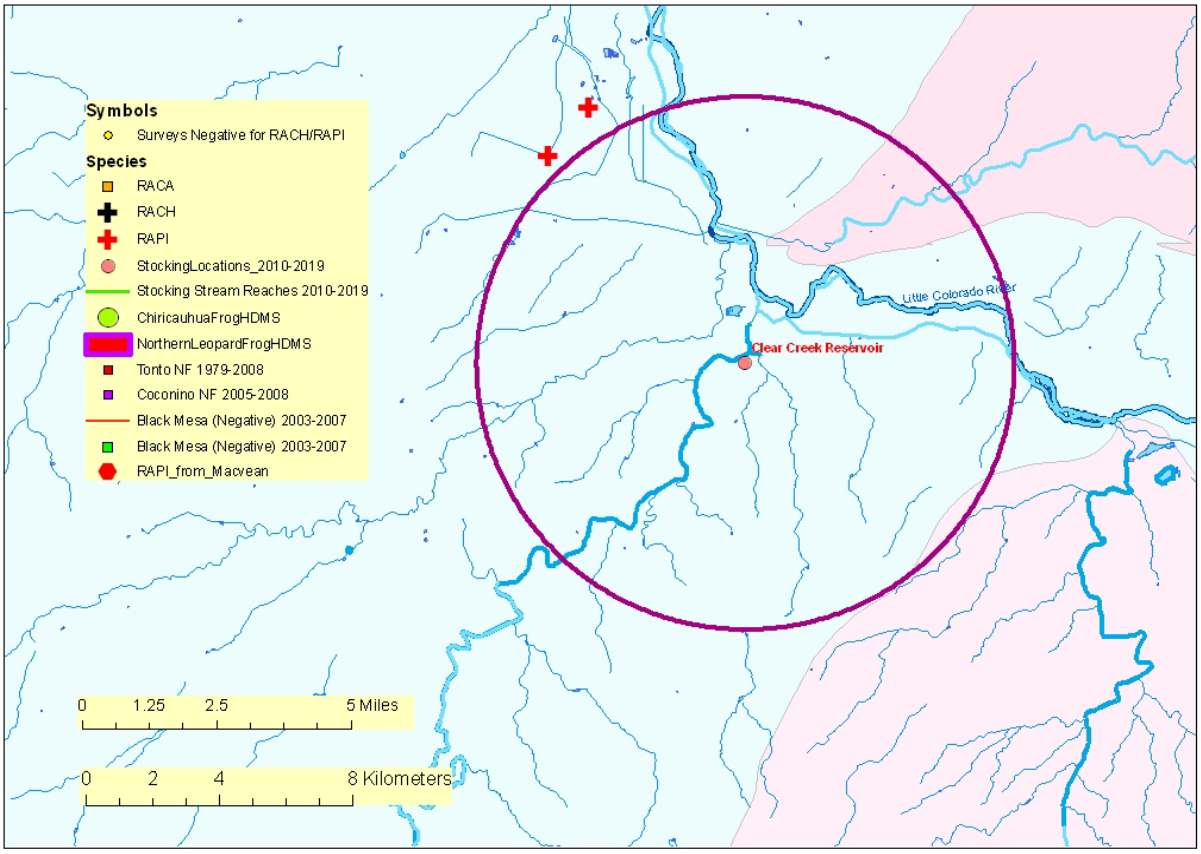

Figure 42. Map of Clear Creek Reservoir buffered stocking complex.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in Clear Creek Reservoir is moderate. There are 5 historical records for Chiricahua leopard frogs from East Clear Creek (Horse Crossing) (1961), Clear Creek (Echinique Place) (1960), East Clear Creek (Mack's Crossing) (1971), East Clear Creek (Jones Crossing) (1970), and East Clear Creek (FS 96/95 Jct) (1972) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at these sites however; the area has not been adequately surveyed and it is possible that Chiricahua leopard frogs still occupy the drainages into which Clear Creek Reservoir flows.

Humpback Chub and Critical Habitat

Suitable and designated critical habitat for the humpback chub occurs at the confluence of the Little Colorado and Colorado Rivers, approximately 167 miles away. Refer to the lower LCR complex analysis which describes the potential impacts and analysis to Humpback chub.

Little Colorado Spinedace and Critical Habitat

Spinedace historically inhabited Willow Creek (which has its confluence with Clear Creek about 45 miles upstream from Clear Creek Reservoir) but have not been found since 1966. Spinedace currently occupy small, perennial pool habitats in West Leonard Canyon, Leonard Canyon (including Dines Tank), Bear Canyon, Dane Canyon, and Yeager Canyon. The populations and available habitat are all relatively small throughout the watershed, but West Leonard and Leonard Canyons continue to be one of the most dependable locations to find spinedace in the entire watershed. Bear, Dane, and Yeager Canyon populations are sustained by translocation of spinedace from West Leonard Canyon and Dines Tank to these areas (USFWS 2008e).

In addition to the above in-stream populations of spinedace, there are currently two refuge populations of spinedace. A refuge population of East Clear Creek spinedace is located at the Flagstaff Arboretum and a refuge population of Little Colorado River spinedace is located at the Department's Grasslands Wildlife Area. Currently, there is not a refugia population for the Chevelon Creek sub-group, although it is expected to have a captive population established at Winslow High School in the near future.

Critical habitat for Little Colorado spinedace includes eighteen miles (29 km) of East Clear Creek in Coconino County located approximately 63 miles upstream of the reservoir; eight miles (13 km) of Chevelon Creek in Navajo County, located 0.5 miles down Clear Creek to the LCR, then up the LCR 9.1 miles to Chevelon Creek; and five miles (8 km) of Nutrioso Creek in Apache County (FR 52(179), Sept 16, 1987). The nearest designated critical habitat to this site is West Chevelon Creek approximately 40+ miles upstream from the reservoir.

Potential Impacts

Any stocked rainbow trout that escaped from Clear Creek Reservoir during natural events would not likely become established because the conditions in the creek and in the LCR during the warmer months as previously described would preclude survival. In support of this conclusion, numerous surveys have not detected trout in any of these areas-- a further indicator that the stocked trout do not persist in the streams above or below the lake.

If trout were to escape Clear Creek Reservoir and move upstream to interact with spinedace coming down the watershed from upstream areas, they may temporarily compete for food and space and potentially prey on eggs, fry and juvenile fish, but would soon die out because the pools get warm or dry up entirely. Fish surveys in lower Clear Creek have found no salmonids

(Clarkson and Marsh 2005a; Clarkson and Marsh 2005b; AGFD unpublished data). Due to the intermittent nature of the stream it is unlikely stocked trout would survive to ascend Leonard or Bear Canyons and reach occupied spinedace habitat, or East Clear Creek to reach critical habitat.

Spinedace potentially could move downstream during high flows and enter Clear Creek Reservoir and be exposed to competition for space and food with the broad suite of non-native fishes in the reservoir. Spinedace moving downstream in Clear Creek to the reservoir would be exposed to the greater threat of the large assemblage of naturally reproducing warm water species, including largemouth bass, channel catfish, black bullhead, green sunfish, rock bass and bullfrog adults and tadpoles in the reservoir. Additionally, it has been reported that spinedace populations are extremely unpredictable which makes management of them difficult because responses of the population to changes within the watershed cannot be measured with certainty (USFWS 2008e).

Spinedace dispersing downstream from the headwaters of the Clear Creek watershed could potentially reach Clear Creek Reservoir where they would join the assemblage of non-native fish species. Stocked trout would be present in the system only until water temperatures rise to lethal levels, whereas the warmwater assemblage is present year round.

While stocked trout were in the system, impacts may include predation and competition for food and space on both adults and young. Stocked trout may potentially travel upstream towards spinedace occupied habitat in Leonard Canyon and East Clear Creek, however, this potential is low because of the distance involved (67 miles), intermittent habitat during base flows, the difference in timing of the spring flows and stocking, supported by lack of trout records in the survey data in lower Clear Creek.

Stocked trout may potentially go downstream over the spillway, up the LCR to Chevelon Creek and enter spinedace occupied and critical habitat. However, this is also unlikely because of the timing of the spill in the spring and stocking after, and the lack of trout records in the survey data in all of lower Chevelon Creek. Any interactions between dispersing trout and spinedace would be on a rare occasion from an extremely small number of trout likely to get to occupied habitat, and they would not persist, except in Leonard Canyon and East Clear Creek.

It is possible for the progeny of stocked trout to interact with spinedace, but the stocked trout would have to travel upstream over 63 miles to suitable trout habitat for reproduction to occur, then the progeny could interact with spinedace occupying that same habitat, potentially competing for food and space. Robinson et al (2000) reported little dietary overlap between spinedace and large trout, but stated that overlap is more likely for fish of equal size, such as a spinedace and fingerling trout. Robinson et al (2000) also reported shifts in spinedace habitat use in the presence of rainbow trout.

There are no threats of hybridization with spinedace. Recruitment levels may be suppressed if a stocked trout were able to reach occupied and critical habitat 63 miles upstream, which is unlikely, by preying upon young spinedace.

An escaped stocked trout from Clear Creek Reservoir would not likely affect the dispersal of spinedace. If a trout ever were to make it to the lower end of spinedace range, it would likely be an isolated event that would not have the level of impact to restrict dispersal. The multitudes of other non-native fish species within Clear Creek that are not part of this proposed action are a much greater threat to spinedace dispersing downstream from Leonard Canyon and East Clear Creek. Clarkson and Marsh (2005a; 2005b) expressed concern of the overwhelming dominance of non-native fishes in lower Clear Creek, which did not include the mention or collection of rainbow trout.

Stocked trout in Clear Creek Reservoir are not reducing the connectivity between spinedace populations in the headwaters of Clear Creek and those in lower Chevelon Creek, because of their short time in the reservoir and the distance required to travel for interactions to take place. Rather, the multitudes of other non-native species (largemouth bass, green sunfish, black bullhead, channel catfish, and crayfish) in conjunction with the natural hydrographs of streams in this area and the existence of the dam forming Clear Creek Reservoir are the greater impediment to dispersal and connectivity between spinedace populations.

Potential Impacts to Critical Habitat

There were no Primary Constituent Elements identified for critical habitat for spinedace. Several activities were listed that might impact critical habitat (Federal Register, 1987) including activities that would deplete, lessen, or significantly alter the natural flow; extensively alter the channel morphology; and extensively alter water chemistry.

Although the stocking of rainbow trout would do none of those things, the presence of a few stocked trout in designated critical habitat might alter the biological features essential to conservation of the species. However, fish stocked at Clear Creek Reservoir would not be expected to impact critical habitat because trout are stocked after the snowpack runoff so trout are unlikely to leave Clear Creek Reservoir to go downstream. Also, trout cannot withstand the temperature extremes in the summer and would die out. If a few trout persist in the upper part of the reservoir, they would have to travel the entire 63 miles to critical habitat during a single runoff season because there is no intermediate suitable over-summering habitat. The distance, flow and conditions of potential movement periods would preclude trout reaching critical habitat. It is not expected that fish would be transported over the reservoir because the stocking comes after runoff and the temperatures cause mortality before the monsoon season arrives. However, if a fish left the reservoir downstream into the LCR and was able to reach Chevelon Creek critical habitat, 15 miles away, any impact would be for a short duration until the trout dies from thermal

stress resulting in very low severity because the few, if any, stocked trout would reach critical habitat. In addition to these reasons, rainbow trout have not been found in surveys above or below Clear Creek Reservoir, indicating they either are never present or are present only sporadically or in extremely low number.

Roundtail Chub

Known populations of roundtail chub in the Little Colorado River watershed are in Clear Creek above Clear Creek Reservoir (Voeltz 2002). Chub have been documented from a reach of Clear Creek about 14-38miles upstream from the reservoir and from East Clear Creek just below C.C. Cragin Reservoir. Stocked trout are not expected to reach East Clear Creek as described in the spinedace discussion above.

Potential impacts

It is possible for trout to swim a short distance upstream into the perennial stream where chub are known to occur or for a chub to disperse downstream into the reservoir; however, impacts by trout would have a short opportunity to occur since trout are in the system for such a short period before water temperatures rise to unsuitable levels. Clarkson and Marsh (2005b) describe the existing non-native warm-water fish assemblage which likely already limits the occupation or movement of roundtail chub in this system, providing for a limited opportunity for chub and trout to interact. Additionally, for the period this reach of stream is suitable for occupation by rainbow trout, they would also be suffering from the interactions with the non-native fish community, further limiting their opportunity for dispersal.

Any stocked rainbow trout that were to escape from Clear Creek Reservoir would not likely become established because they do not persist in the streams above or below the lake based on numerous surveys detailed above. The stocked trout could have a small, short-term impact on roundtail chub by predation on young chub or competition for space and food. If trout were to escape Clear Creek Reservoir and move upstream they may temporarily compete for food and space and potentially prey on eggs, fry and juvenile fish. However, they would die out as the pools become too warm.

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LOWER LITTLE COLORADO RIVER SUB-WATERSHED

JACKS CANYON COMPLEX

Physical Geographic Description

There are five reservoirs that make up the Jacks Canyon Complex: Soldiers Lake, Soldiers Annex Lake, Long Lake, Tremaine Lake, and Hay Lake (Figure 1). These lakes are interconnected by a complex series of irrigation canals and ditches (Figure 2, and Figure 3). The Jacks Canyon Complex of lakes is connected through a ditch system designed to catch runoff during periodic precipitation events, to store water for irrigation, and to water livestock. The approximately 40,000 acre drainage ranges in elevation from 8,532 feet at the top of Hutch Mountain to approximately 6,662 feet at the bottom of Hay Lake. Conveyance canals capture water from Sawmill Wash and transport water to the various lakes, dependant on need.

The canal system within the entire Jacks Canyon Complex was designed for water retention. Hay Lake is the downstream-most lake and only fills after all of the other lakes in this complex have been filled. Since 1991, Hay Lake has never been observed to spill into Jacks Canyon, including the wet years of 1993 and 2005. Chavez Pass Ditch can only receive outflow from a manually operated gate at the base of the dam on Soldiers Annex Lake, or from outflow from Long Lake, which has no record of ever spilling. In the unlikely event that water should spill, the distance to the LCR is approximately 50 miles through intermittent Diablo Canyon, and an additional 50 miles of intermittent stream before encountering any listed species or critical habitats within the LCR. A more detailed description is found under the Jacks Canyon Complex analysis section. The Jacks Canyon Complex is most likely a closed system because it has not been known to spill for nearly 20 years; however, it will be analyzed as an open system.

Hay Lake is part of the complex of reservoirs; however, the lake is not managed for fish nor proposed for stocking under this consultation.

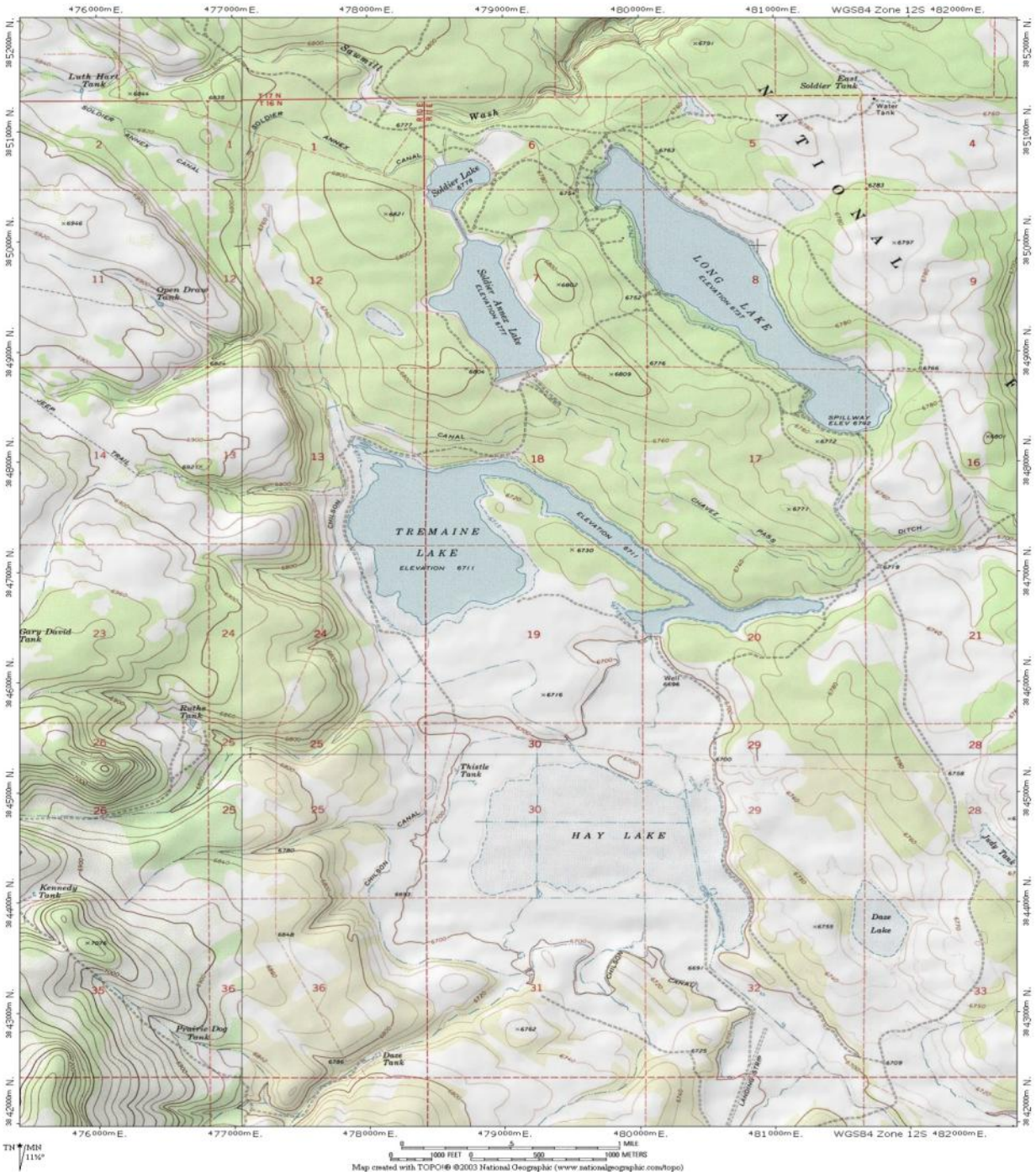

Figure 1. Jacks Canyon Complex topographic representation

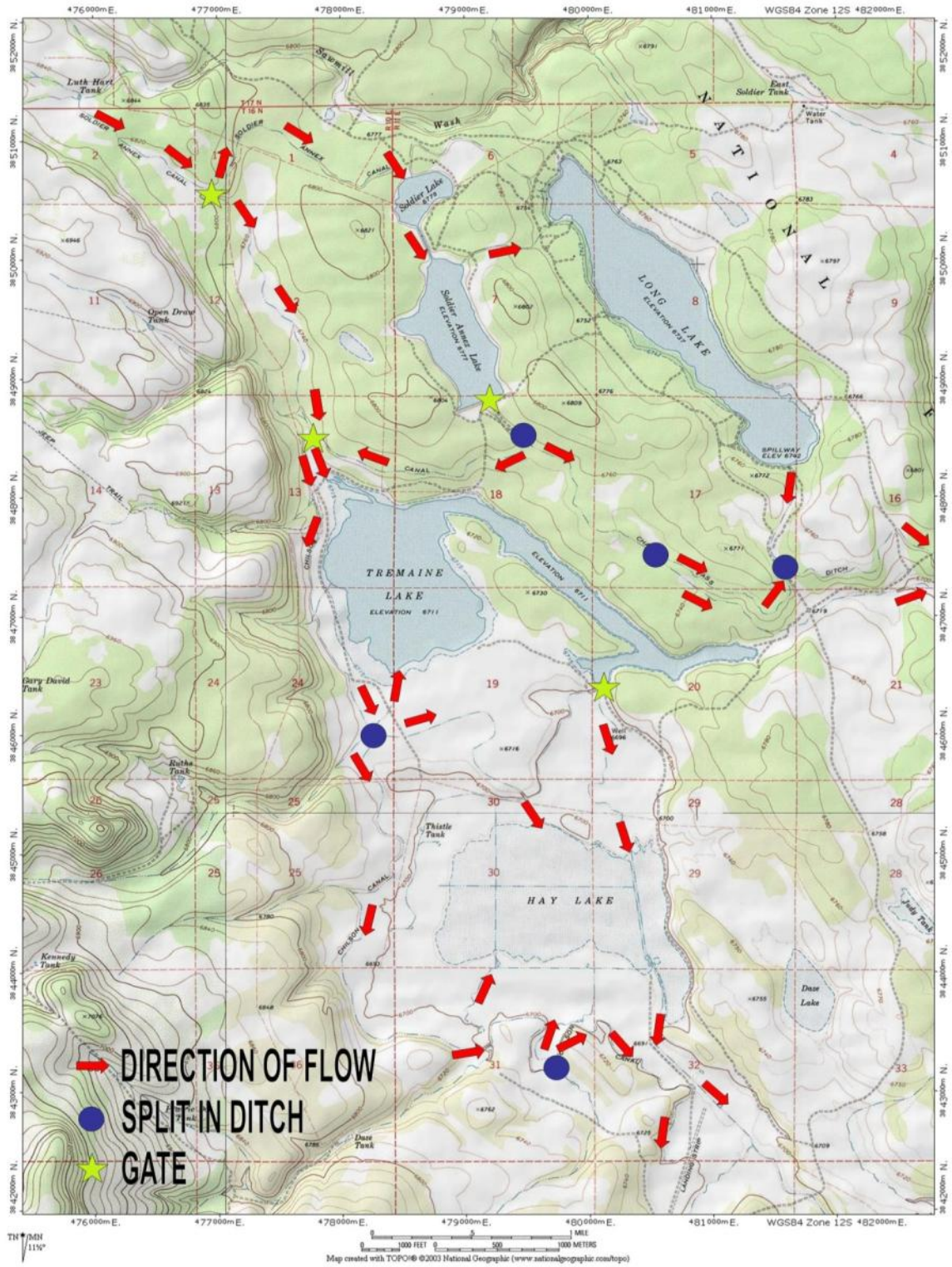

Figure 2. Jacks Canyon Complex direction of water flow via ditch systems.

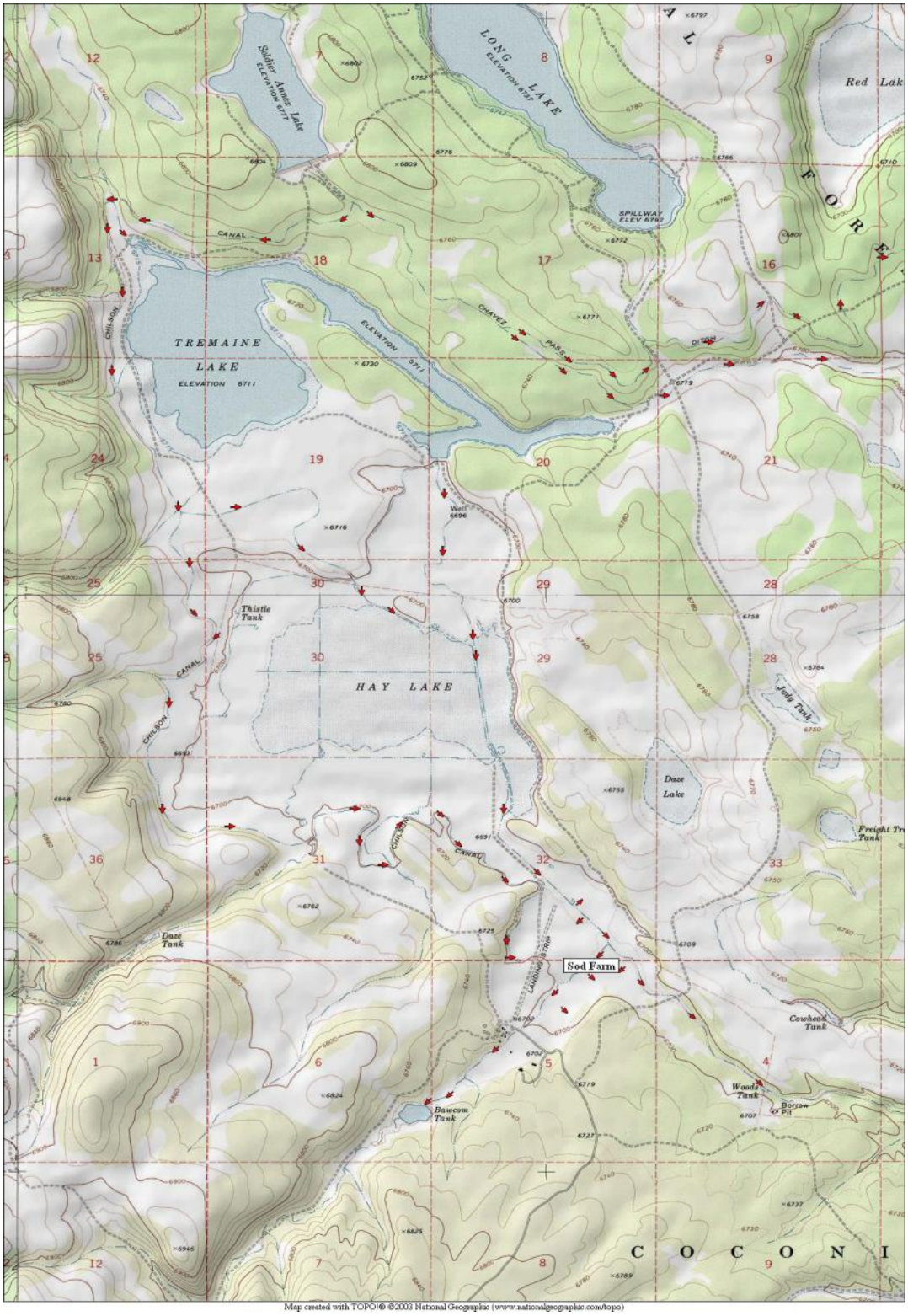

Figure 3. Chilson Canal Hay Lake side water flow direction (small red arrows)

Soldiers Lake

Site Description

Soldiers Lake is the furthest upstream of the series of 5 lakes in the Jacks Canyon Complex. Located in the southern portion of Coconino County, Soldiers Lake sits at an elevation of 6,778 feet. Soldiers Lake is located approximately 70 miles from the communities of Flagstaff and Payson, and approximately 45 miles from the city of Winslow. The lake sits exclusively on Coconino National Forest land, with primary water rights owned by the Hay Lake Ranch. Soldiers Lake is approximately 30 surface acres in size, approximately 40 surface acres when fully watered, and has an average depth of approximately eight feet, with a maximum depth of approximately 15 feet when fully watered. The lake receives runoff from the Sawmill Wash and surrounding drainages via Soldiers Annex Canal, which originates at Luth Hart Tank in the Diablo Canyon drainage. This canal can be diverted to supply water to either Soldiers Lake or to Tremaine Lake via the Chilson Canal.

Management of Water Body

Lake management historically included both warm and cold-water species (Table 1). The lake currently holds self sustaining populations of largemouth bass, bluegill, channel catfish, walleye, golden shiner, and northern pike. Current stocking clearance includes rainbow trout, channel catfish, bluegill, and largemouth bass. Overall fish numbers are low in Soldiers Lake, but overall fish size is large. Brown trout were last stocked in 1992 and warm water fishes in 1993-1994.

Table 1. Soldiers Lake Stocking History

Fish Species	First Year	Last Year	Num. of Stockings	Num. of Fish Stocked
Northern Pike	1965	1965	1	1,000
Channel Catfish	1957	1994	18	31,814
Bluegill	1937	1993	3	11,500
Largemouth Bass	1937	1993	4	12,574
Rainbow Trout	1935	1979	29	105,116
Black Crappie	1937	1937	1	300
Redear	1991	1991	2	3,000
Brown Trout	1962	1992	7	51,750
Walleye	1984	1984	1	126,000
Totals			66	343,054

The primary management would be for a self sustaining, naturally reproducing warm water fishery consisting of bluegill, channel catfish, largemouth bass and yellow perch. Secondary management is for a put-and-take cold water rainbow trout fishery. Warm water stockings have been primarily of fingerling-sized fish ranging from 20 to 10,000 fish, with no more than two

stockings in any given year. Cold water stockings have been primarily of catchable and sub-catchable sized fish, but have included fingerling stockings when there is opportunity for their survival and growth. Cold water stockings have ranged from 125 to 20,000 fish in any given year. Yellow perch has not previously been stocked by the Department (Table 2), is not currently present in Soldier's Lake or the drainage, but is present elsewhere in the Little Colorado River watershed in Upper and Lower Lake Mary, Rainbow Lake, River Reservoir and Becker Lake.

Table 2. Summary of all known yellow perch stockings in the Little Colorado River drainage of Arizona.

Lake Stocked	First year stocked	Last year Stocked	Num of Stockings	Number stocked
Lyman Reservoir	1979	1979	1	100000
Marshall Lake	1941	1966	2	717
Mormon Lake	1965	1993	12	39922
Morton Lake	1989	1989	1	80000
Ned Lake	1980	1980	1	112

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, yellow perch and bluegill for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times per year, but typically in spring and fall. Rainbow trout numbers would be from 0-25,000 fish annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and yellow perch (fry/fingerlings, sub-catchables) may be stocked as to augment the warm water fishery, or to reestablish the fishery after a catastrophic event. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Soldiers Lake receives runoff from Sawmill Wash and surrounding drainages via Soldiers Annex Canal. Runoff typically occurs during the spring months from snowmelt, but occasional heavy precipitation events at other times of year result in runoff through Sawmill Wash. Soldiers Annex Canal originates at Luth Hart Tank, from which the canal travels approximately 0.9 miles to a two-way board gate. From this gate, flow can either continue down Soldiers Annex Canal approximately 1.34 miles into the north end of Soldiers Lake, or head south approximately 1.5 miles to a split in the ditch where flow either heads west and south into Chilson Canal or south approximately 0.25 miles into Tremaine Lake. In the event of flooding, water from Soldiers Lake

will travel through a short 200 meter earthen ditch into Soldiers Annex Lake. For a further discussion of connectivity, see the complex analysis section.

There is no record of Soldiers Lake going completely dry; however, lake levels do fluctuate throughout the year due to frequent winds and porous soil, which are characteristic of this series of lakes.

Fish Movement
Fish in Soldiers Lake could potentially travel upstream in Soldiers Annex Canal on the north end of Soldiers Lake for approximately 1.34 miles until reaching the two-way board gate. Upstream movement of fish either ends at the gate if it is closed, or they could be diverted back downstream from the two-way board gate toward Chilson Canal and Tremaine Lake via a cut-off canal, or if open, they could continue up Soldiers Annex Canal approximately 0.9 miles into Luth Hart Tank. Further movement of fish upstream from Luth Hart Tank would terminate in the headwaters of the drainage. In the event of flooding, fish could also travel through a short 200 meter earthen ditch downstream into Soldiers Annex Lake. Movement of fish out of this lake into the upstream canal system is expected to be extremely difficult and not very likely to occur.

Community Description
Soldiers Lake is inhabited by a non-native, self sustaining, warm water fish community. The 2008 survey data (Table 3) indicated a small, low abundance, self-sustaining population of larger, therefore older, warm water sport fish. Four six panel gill nets were set for approximately 15 to 16 hours, according to the Department sampling protocol. Walleye, bluegill, channel catfish, and largemouth bass were collected during the survey. In 2009, survey data indicated larger numbers of shiner, pike and walleye in larger size ranges (Table 4). In addition, a small yet stable population of predominately adult golden shiner provides a forage fish for the warm water predatory species. Crayfish were also observed and present during the survey. A 2006 creel census recorded a total of four fish harvested by anglers: two channel catfish, one northern pike, and one largemouth bass. A total of seven anglers were interviewed at Soldiers Lake during the 2006 creel season, indicating current angler use of the lake is extremely low.

The lake provides little cover for juvenile fish to escape predation. The majority of the cover in the lake resides on the southern shoreline in the form of submerged junipers that have lost their needles.

Table 3. Soldiers Lake 2008 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	0	N/A

Largemouth Bass	1	415
Bluegill	1	247
Walleye	3	259-405
Channel Catfish	4	541-687
Golden Shiner	0	N/A
Crayfish	None recorded	N/A

Table 4. Soldiers Lake 2009 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	14	270-530
Largemouth Bass	1	405
Bluegill	2	225-236
Walleye	8	294-480
Channel Catfish	1	665
Golden Shiner	13	92-120
Crayfish	Visual observation	N/A

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked areas and fish movement potential up or downstream to areas where frogs may occur. Additional consultation species are discussed in the Jack's Canyon Complex Analysis. Potential impacts from the proposed action to candidate and listed species are described below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog

Local Analysis: Although Soldiers Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Soldiers Lake is low. There are no historical records for

Chiricahua leopard frogs from Soldiers Lake or within the buffered stocking complex. Five sites have each been surveyed once within the buffered stocking complex; one in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Lake is low, because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Soldiers Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Soldiers Lake is low. There are no historical records for northern leopard frogs from Soldiers Lake (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). The negative results of these surveys indicate that it is not likely that northern leopard frogs occupy Soldiers Lake, Dave's Tank, or the area within the buffered stocking complex (Figure 4). Furthermore, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Lake is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

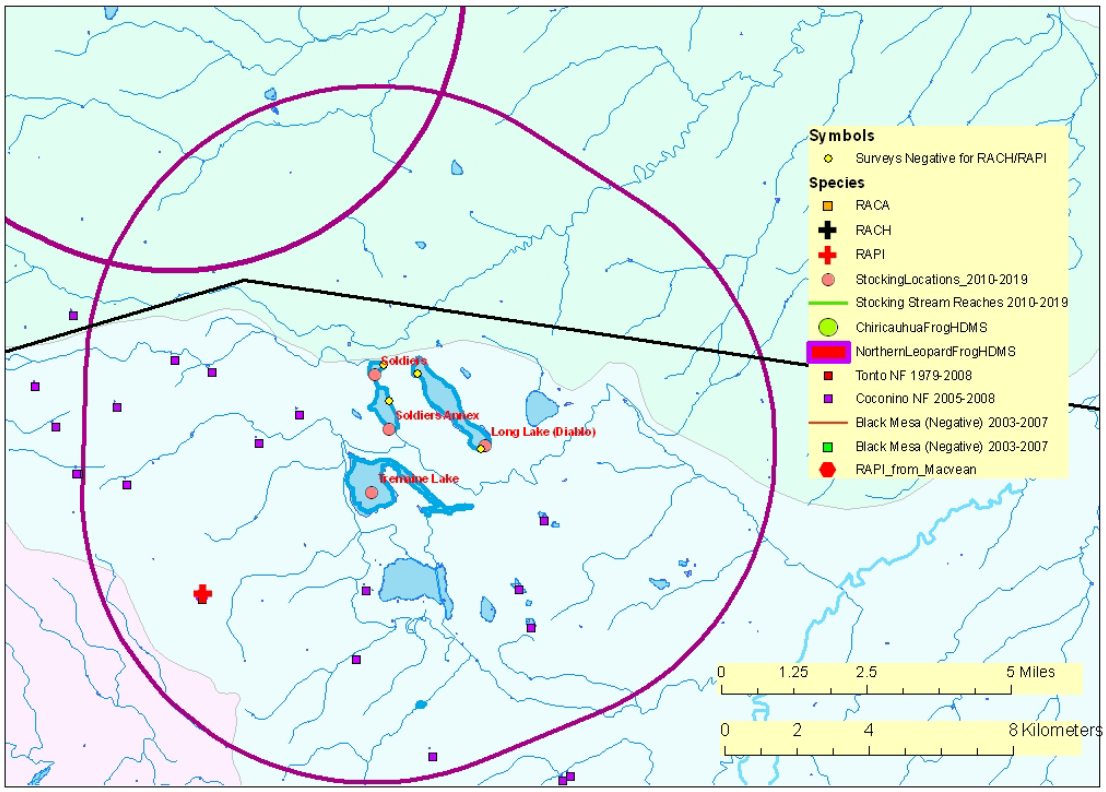

Figure 4. Map of Jacks Canyon buffered stocking complex.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Soldiers Annex Lake

Site Description

Soldiers Annex Lake is approximately 90 surface acres in size, approximately 147 surface acres when fully watered, and is located in the southern portion of Coconino County on the Bar T Bar Ranch, at an elevation of 6,777 feet. Soldiers Annex Lake has an average depth of approximately 5 feet, with approximately a 30 foot maximum depth when fully watered. Soldiers Annex Lake is located approximately 70 miles from the communities of Flagstaff and Payson, and approximately 45 miles from the city of Winslow. This lake is directly connected to Soldiers Lake by a short 200 meter earthen ditch.

Management of Water Body

Lake management historically included both warm and cold-water species (Table 5). Since 1994, no fish have been stocked into Soldiers Annex Lake. The lake currently holds self sustaining populations of largemouth bass, bluegill, channel catfish, walleye, and northern pike. Overall fish numbers are low in Soldiers Annex Lake, but overall fish size is large. Soldiers Annex Lake is currently cleared for the stocking of rainbow trout; however, rainbow trout have not been stocked since 1980.

The stocking regime covered by the period of this consultation would allow Soldiers Annex Lake to be managed as a cold water (rainbow trout) and warm water (bluegill, channel catfish, largemouth bass, and yellow perch) fishery. Fish would be stocked from the department hatchery system or private vendors.

Table 5. Soldiers Annex Lake Stocking History

Fish Species	First Year	Last Year	Num. of Stockings	Num. of Fish Stocked
Redear Sunfish	1991	1991	2	3,000
Channel Catfish	1957	1994	11	22,098
Bluegill	1993	1993	1	4,000
Largemouth Bass	1956	1993	3	12,724
Rainbow Trout	1968	1980	7	55,500
Walleye	1984	1984	1	252,000
Tadpoles	1968	1968	1	500
Totals			26	349,822

Primary management is for is a self sustaining, naturally reproducing warm water fishery featuring largemouth bass, bluegill, and channel catfish. Secondary management is for put-and-take, cold water rainbow trout fishery. Warm water stockings have been primarily of fingerling sized fish ranging from 20 to 252,000 fish, with no more than three stockings in any given year. Cold water stockings have been primarily of catchable and sub-catchable sized fish, but have included fingerling stockings when there is opportunity for their survival and growth. Cold water stockings have ranged from 500 to 10,000 fish in any given year, and would typically occur in spring and fall, however, may occur year round as water level, water quality and fish availability permit. Yellow perch has not previously been stocked by the Department (Table 2), is not currently present in Soldier's Lake or the drainage, but is present elsewhere in the Little Colorado River watershed in Upper and Lower Lake Mary, Rainbow Lake, River Reservoir and Becker Lake.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, yellow perch, and bluegill, for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times per year, but typically in spring and fall. Rainbow trout numbers would be from 0-25,000 fish annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchable) and yellow perch (fry/fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Soldiers Annex Lake only receives water when Soldiers Lake receives enough water to spill during snow melt and runoff season. In the event that Soldiers Annex Lake in turn fills and spills, outflow can either travel through a earthen ditch on the east side of the lake into Long Lake, or through a gate at the base of the dam, which must be manually opened on the south side of the lake, into the Chavez Pass Ditch system. Once water enters the Chavez Pass ditch system, water can be diverted manually into Tremaine Lake or into Hay Lake. During dry cycles Soldiers Annex Lake does not spill into Long Lake. There is no record of Soldiers Annex Lake going completely dry; however, lake levels do fluctuate throughout the year. The frequent winds and porous soil, which are characteristic of this series of reservoirs, cause lake levels to fluctuate throughout the year. For a further discussion of connectivity, see the Complex Analysis section.

Fish Movement

See the Soldiers Lake section for potential upstream fish movements. In the event of flooding, fish from Soldiers Annex Lake can either swim through a ditch on the east side of the lake approximately 0.6 miles into Long Lake, or through a gate at the base of the dam, which must be manually opened on the south side of the lake into the Chavez Pass Ditch system. This gate acts as a barrier to fish passage if left closed. Fish can travel down the Chavez Pass Ditch approximately 0.28 miles to the confluence with the Chilson Canal. From the confluence, fish could travel west and south into Chilson Canal or south approximately 0.25 miles into Tremaine Lake. For potential further downstream fish movements, see the Jacks Canyon Complex Analysis.

Community Description

Soldiers Annex Lake is inhabited by a self sustaining warm water community of non-native fishes. The most recent survey data indicate a small, low abundance, self sustaining population of predominately larger, therefore older, warm water sport fish (Table 6). Five 6 panel gill nets were set for approximately 15 to 16 hours, according to the Department sampling protocol. Northern pike, walleye, bluegill, channel catfish, and largemouth bass were collected during the

survey. In addition, a stable population of golden shiner provides a forage fish for the warm water predatory species. Crayfish were also observed and present during the survey. No amphibians were observed.

The lake provides little cover for juvenile fish to escape predation. The majority of the cover in the lake is in the form of aquatic vegetation located on the north end of the lake near the inflow from Soldiers Lake.

Table 6. Soldiers Annex Lake 2009 Gill Netting Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	8	398-631
Largemouth Bass	1	179
Bluegill	2	208-210
Walleye	19	332-492
Channel Catfish	4	503-611
Golden Shiner	75	92-165
Crayfish	Visually Observed	N/A

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked areas and fish movement potential up or downstream to areas where frogs may occur (Figure 4). Additional consultation species are discussed in the Jack's Canyon Complex Analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog

Local Analysis: Although Soldiers Annex Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Soldiers Annex Lake is low. There are no historical records for Chiricahua leopard frogs from Soldiers Annex Lake or within the buffered stocking complex (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Annex Lake is low, because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Soldiers Annex Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Soldiers Annex Lake is low. There are no historical records for northern leopard frogs from Soldiers Annex Lake. Five sites have each been surveyed once within the buffered stocking complex; one in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy Soldiers Annex Lake, Dave's Tank, or the area within the buffered stocking complex. Crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Annex Lake is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Tremaine Lake

Site Description

Located in the southern portion of Coconino County, Tremaine Lake is located approximately 70 miles from the communities of Flagstaff and Payson, and is approximately 45 miles from the city of Winslow. The lake sits exclusively on Coconino National Forest land off of Forest Service road 82 at an elevation of 6,737 feet. This relatively large lake, on average covering approximately 350 surface acres with approximately 544 surface acres when fully watered, and about 8.20 miles of shoreline, would be an ideal place for a fishery that can be managed in isolation from fish in the three adjacent lakes. Tremaine Lake has an average depth of 3 to 5 feet, with a 12 to 15 foot maximum depth around the dam. The lake is primarily used as an irrigation source, and can be subject to wide fluctuations in level as water demands for irrigation are met.

Management of Water Body

No fish have been stocked by the Department into Tremaine Lake, nor does the Department currently manage a fishery at Tremaine Lake. Current fish management is listed as “no intent to stock”. The lake currently holds self sustaining populations of illegally introduced common carp, green sunfish, bullhead catfish, and golden shiner.

Proposed Action

The Department proposes to stock channel catfish, largemouth bass, redear sunfish, and bluegill, for the period covered by this consultation

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), redear sunfish (fingerlings, sub-catchables), and bluegill (fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Tremaine Lake only receives water from various splits in the Chilson Canal, which includes flow from the Soldier Annex Canal as described in the Soldier Lake description or from outflow at the base of Soldiers Annex Lake. A complex of conveyance canals that capture water from Sawmill Wash on the Diablo Canyon drainage feed Tremaine Lake. Using the isolated ditch from Sawmill Wash, the lake can potentially be isolated from the rest of the lakes in the complex. A manually operated gate at the base of the dam on Tremaine Lake can allow flow to travel about 1.12 miles (1,795 meters) into Hay Lake. This is the only potential outflow for Tremaine Lake.

Fish Movement

See the Soldiers Lake and Soldiers Annex Lake sections for potential upstream fish movements. During wet climactic cycles or when irrigation and ditch systems are being utilized there is a potential for fish to move out of Tremaine Lake and into the Chilson Canal system. From here

fish can potentially move into the upper drainage and dead end at any number of tanks upstream, or move into Soldiers Lake. Conditions would have to be ideal with the gates opened in the correct orientation and direction to allow fish movement.

During wet climactic cycles or when irrigation and ditch systems are being used there is potential for fish to move out of Tremaine Lake downstream into Hay Lake. All outflow from Tremaine Lake ends up in Hay Lake. For potential further downstream fish movements, see the Jacks Canyon Complex Analysis.

Community Description
Tremaine Lake is inhabited by an abundant, illegally introduced, self-sustaining warm water community of non-native fishes (Table 7). Two 6 panel gill nets were set for approximately 15 to 16 hours, according to the Department sampling protocol. Common carp, green sunfish, bullhead catfish, and golden shiner were collected during the survey. Crayfish were also observed and present during the survey. No amphibians were observed. Of the 99 common carp collected, 90 were “mirror carp,” or carp with unusually large scales laid down in a sporadic pattern.

Table 7. Tremaine Lake 2009 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Common Carp	99	159-407
Green Sunfish	17	66-181
Bullhead Catfish	3	174-253
Golden Shiner	5	171

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen

or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog

Local Analysis: Although Tremaine Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Tremaine Lake is low. There are no historical records for Chiricahua leopard frogs from Tremaine Lake or within the buffered stocking complex (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Tremaine Lake is because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Tremaine Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Tremaine Lake is low. There are no historical records for northern leopard frogs from Tremaine Lake (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy Tremaine Lake, Dave's Tank, or the area within the buffered stocking complex and crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Tremaine Lake is low. There

are no recent historical records for northern leopard frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Long Lake

Site Description

Long Lake was constructed in the early 1940's through the alteration of a wet meadow. Long Lake is located in the southern portion of Coconino County approximately 70 miles from the communities of Flagstaff and Payson, and approximately 45 miles from Winslow. The lake sits exclusively on Coconino National Forest land at an elevation of 6,737 feet, with a spillway elevation of 6,760 feet. Long Lake on average covers 268 surface acres with 372 surface acres when fully watered, and it requires approximately 417 surface acres to reach an elevation to spill. Long lake has an average depth of 5 feet with a 25 foot maximum depth when fully watered. Long Lake is prone to low water levels and drying during drought conditions. From 1999 –2004 the state suffered drought conditions, causing many of the lakes in Northern Arizona to become susceptible to poor water quality and in some cases to completely dry up. In 2003, Long Lake suffered poor water quality causing a fish kill, and in late summer of 2004 completely dewatered.

Management of Water Body

Long Lake is currently managed as a put-grow-and-take rainbow trout fishery. The Department stocks between 0-20,000 catchable rainbow trout between the months of March through May. In addition, variable numbers of fingerling rainbow trout are stocked when available in the fall and spring.

Stocking activities permitted by this consultation would satisfy the support expressed by the public to stock rainbow trout, largemouth bass, bluegill, and channel catfish back into Long Lake. In the Department's Region II 2003 fisheries questionnaire, 86% of the 678 total respondents supported the restocking of this species mix into the lake once it refills. In addition, 46.8% of the total respondents supported "adding walleye to the species mix".

Lake management historically included both warm and cold-water species (Table 8); since 1992 only rainbow trout have been stocked. Long Lake is currently cleared for the stocking of rainbow trout, channel catfish, walleye, largemouth bass, bluegill, and yellow perch.

Table 8. Long Lake Stocking History

Fish Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Northern Pike	1965	1967	3	66,000
Channel Catfish	1965	1992	16	152,100
Bluegill	1941	1993	6	49,835
Largemouth Bass	1941	1975	10	146,837
Rainbow Trout	1965	2009	123	2,934,407

Black Crappie	1988	1988	1	172
Brook Trout	1976	1976	1	2,000
Brown Trout	1982	1985	3	127,750
Walleye	1982	1985	3	1,880,000
Tadpoles	1967	1967	1	8,125
Totals			167	5,367,226

Primary management is for a put-grow-and-take rainbow trout fishery. Cold water species are primarily stocked multiple times per season in the spring and fall with 0-20,000 stocked annually. Occasional summer stockings occur when lake levels and water quality permit.

Secondary management is for a naturally reproducing, self sustaining warm water fishery featuring largemouth bass, bluegill, walleye, yellow perch, and channel catfish.

Warm water species are not currently stocked into Long Lake and are a small by-product of fish movement from upstream Soldiers Lake and Soldiers Lake Annex. No warm water species have been stocked in Long Lake since 1993. Yellow perch has not previously been stocked by the Department (Table 2), is not currently present in Soldier's Lake or the drainage, but is present elsewhere in the Little Colorado River watershed in Upper and Lower Lake Mary, Rainbow Lake, River Reservoir and Becker Lake.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, walleye, yellow perch, and bluegill for the period covered by this consultation.

Rainbow trout (fingerlings, sub-catchable, catchable) would be stocked multiple times annually, but stocking will most likely occur in the spring. Numbers of trout to be stocked would be 0 to 20,000 catchables, variable numbers of sub-catchables, and variable numbers of fingerlings; not to exceed a total of 480,000 fish annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), walleye (sac fry, fingerlings), and yellow perch (fry/fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Long Lake is fed by a complex of conveyance canals transporting water from Soldier Lake and Soldier Annex Lake. Long Lake normally only receives water from these two sources and only

after both of them have filled completely. However, during heavy precipitation events, water from Soldiers Annex Lake will connect to Long Lake rather than overflow anywhere else. The primary source of inflow for the Jacks Canyon Complex is from annual snowmelt during the spring months. Although there is no record to date of Long Lake spilling, if it did spill, water leaving the lake would flow into Chavez Pass Ditch at the SE end and then through a series of small cattle tank and splits in the ditch system, ending up at Diablo Canyon, 56 miles from the confluence with the LCR. See the Jacks Canyon Complex Analysis for a more detailed description of the Chavez Pass Ditch system.

Fish Movement

See the Soldiers Lake and Soldiers Annex Lake sections for potential upstream fish movements. There is a potential for fish from Long Lake to travel up the 0.6 mile dirt ditch on the west side of Long Lake into Soldiers Lake Annex during precipitation events significant enough to cause Soldiers Lake Annex to fill. In order for Soldiers Lake Annex to fill, Soldiers Lake must also receive enough inflow to fill. Conversely, fish from Soldiers Lake and Soldiers Annex Lake can also move into Long Lake during heavy precipitation events. The “dam” or embankment on the downstream (northwest) end of Long Lake is an effective fish barrier for the movement of fish into Diablo Canyon. If the lake were to fill completely, the designed spillway at the SE end of the lake would spill into the Chaves Pass Ditch (Figure 5). However, this has never been known to occur. Additionally, there is no controlled outflow or release from Long Lake. For potential further downstream fish movements, see the Jacks Canyon Complex Analysis.

Community Description

The aquatic community of Long Lake can vary based on water levels and water quality of the lake. During wet cycles the fish community may include rainbow trout (when stocked), northern pike, largemouth bass, bluegill, walleye, and golden shiner. During drought cycles when water levels are low, and pH and temperatures are high, a warm water mix of species may be found. These warm water species are those that establish after moving downstream from Soldiers and Soldiers Lake Annex during cycles that are sufficiently wet enough to cause them to spill. Depending on the year, these species may become self sustaining until drought conditions cause the lake to dry, or until a fish kill occurs due to high temperatures, high pH levels, or low oxygen levels. Long Lake has periods where it is fishless due to drying and or poor water quality.

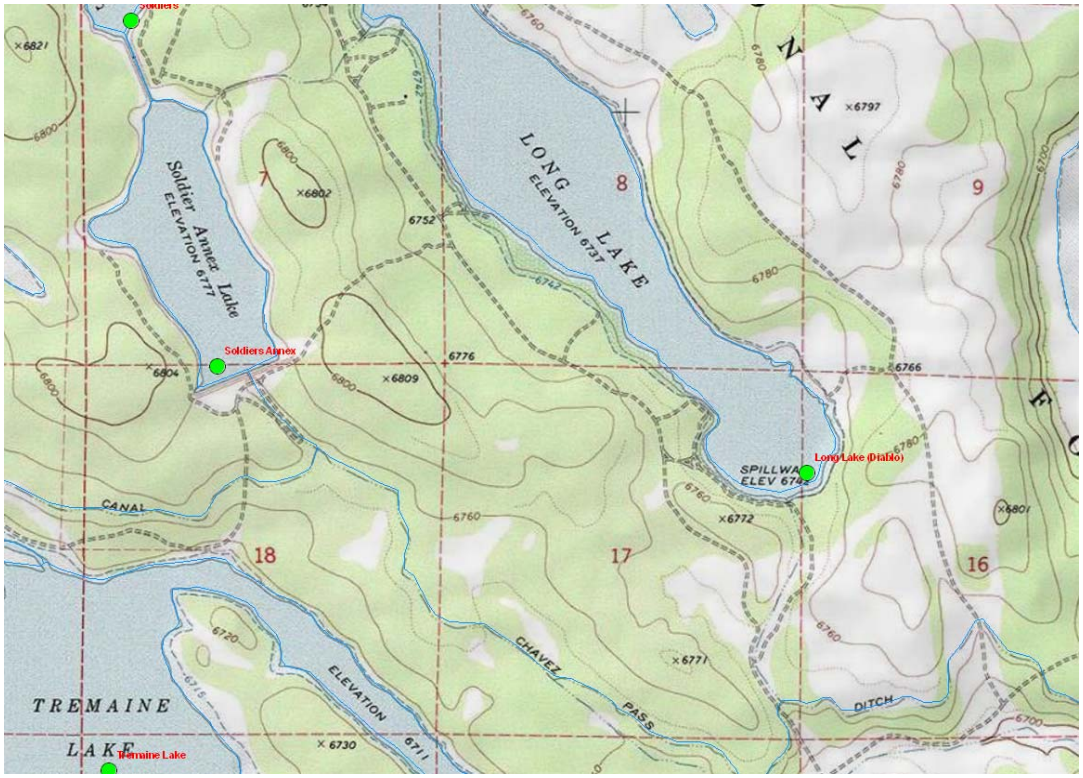

Figure 5. Close-up of Long Lake spillway and connection to Chaves Pass Ditch.

The most recent survey data of Long Lake indicate a mix of cold and warm water species (Table 9). Stocked rainbow trout were collected in addition to an abundant self-sustaining fathead minnow and golden shiner population, with a few adult northern pike and walleye present.

Table 9. Long Lake 2009 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	5	345-480
Largemouth Bass	0	N/A
Bluegill	0	N/A
Walleye	2	306-580
Channel Catfish	0	N/A
Golden Shiner	(only 1 measured many observed)	126

Crayfish	Many collected in gill nets. None counted	N/A
Rainbow trout	13	323-483

According to the Department's 2006 Long Lake Fish Report (Rinker et al. 2006), stocked rainbow trout made up the majority of the fish collected during gill netting surveys, with 223 trout caught, with a small subsample of 42 northern pike caught, representing several size classes ranging from 294 to 662 mm total length. These data support the cycle of a fish community of stocked trout and warm water fish that flush in from above impoundments.

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog

Local Analysis: Although Long Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Long Lake is low. There are no historical records for Chiricahua leopard frogs from Long Lake or within the buffered stocking complex. Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm is low, because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Long Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Long Lake is low. There are no historical records for northern leopard frogs from Long Lake. Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy Long Lake, Dave's Tank, or the area within the buffered stocking complex and crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

JACKS CANYON COMPLEX ANALYSIS

From 1999 –2004 the state suffered drought conditions, causing many of the lakes in Northern Arizona to become susceptible to poor water quality and in some cases to completely dry up. In 2003, Long Lake suffered poor water quality causing a fish kill, and in late summer of 2004 completely dewatered. The geology/soil type of the Jacks Canyon Complex is such that water seeps into the soil more quickly than in some other areas, leaving the soil dry. The windy conditions in this area also add to the evaporation of water resources.

Water Distribution/Connectivity

The Jacks Canyon Complex receives water primarily from Sawmill Wash via Soldiers Annex Canal during snowmelt runoff during the spring months of the year. Some spring snowmelt enters the complex from the surrounding drainage on the west and southwest side of the complex of reservoirs from a 40,000 acre drainage area. Once water is in the complex, it is diverted through a complex system of canals and ditches controlled by various manual gates, to supply water to stock tanks and retain water in agricultural fields.

There are two potential outflows from the Jacks Canyon Complex to the LCR: Jacks Canyon from Hay Lake, and Chavez Pass Ditch from Soldiers Annex Lake and Long Lake. Hay Lake was constructed for the sole purpose of water retention and only fills after all of the other lakes in this complex have filled. If water were to leave Hay Lake it would flow in the form of sheet runoff through a series of active agricultural fields prior to reaching an unnamed tributary to Jacks Canyon. Since 1991, Hay Lake has never been observed to spill into Jacks Canyon, including the wet years of 1993 and 2005. Chavez Pass Ditch can only receive outflow from a manually operated gate at the base of the dam on Soldiers Annex Lake, over its spillway or from outflow from Long Lake.

All tributaries are typically dry, only contributing flow to the canal system during snow melt or significant precipitation events. The irrigation and canal system is controlled by the Hay Lake Ranch. They limit flows through the Chavez Ditch System, according to irrigation and livestock needs and to fill all tanks along the system before water is released to Diablo Canyon.

Based on the description of the complex water conveyance system involved with the water management of these lakes, the distance to any listed fish species or critical habitat, and the absence of records documenting spill events, this complex of lakes is likely a closed system, However, because the potential does exist for fish escapement through the Chavez Pass Ditch in extreme and rare precipitation events, analysis of downstream impacts is also included.

Fish Movement

The upstream movement of fish from the complex can travel up the Soldiers Annex Canal to a manually operated gate. From this gate fish could travel into Luth Hart Tank and potentially up into the head waters of these drainages. Similarly, fish could travel up the various tributaries from Tremaine and/or Hay Lake up into the headwaters of the drainage.

The downstream movement of fish from the complex would be 5 miles through Chavez Pass Ditch to Lute Hart Tank where the ditch ends then heads east about 1.63 miles to a series of four tanks known as Perkins Tanks. The outflow from Perkins Tanks continues down the ditch about 0.52 miles to Red Tank. From Red Tank it is about 1.59 miles to a split in the ditch where an unnamed ditch travels north. The unnamed drainage travels about 0.43 miles to Pat Duke Tank. The ditch continues about 1.67 miles to the first of two tanks known as Twin Tanks. It is about 0.16 miles from the first tank to the second tank. From the second tank it is about 0.76 miles to Goslin Tank. The outflow from Goslin Tank terminates about 2.91 miles at Dog Valley Wash, which travels 4.4 miles west into Diablo Canyon. Diablo Canyon flow 46.02 miles before meeting up with the LCR. From this confluence of the LCR and Canyon Diablo, an additional 50+ miles of intermittent stream exist before reaching occupied habitat for humpback chub and critical habitat.

From the confluence of the Chavez Pass Ditch and Soldiers Annex Canal, fish can access Chavez Pass Ditch traveling 1.03 miles to a split in the ditch where an unnamed side channel travels about 2.41 miles and terminates at Antelope Tank. From where the unnamed side channel splits toward Antelope Tank, Chavez Pass Ditch continues about 0.95 miles to a split where the outflow from Long Lake enters the Chavez Pass Ditch system. Chavez Pass Ditch from where the outflow of Long Lake travels about 6.83 miles to a split in the ditch, where an unnamed drainage travels to the north. The unnamed drainage travels north about 1.92 miles to Bypass Tank. From Bypass Tank the unnamed drainage flows about 1.66 miles to Melbourne Dam. From Melbourne Dam it travels about 1.95 miles to Horse Pasture Tank. From there it travels about 0.80 miles to Mud Tank. The outflow from Mud Tank travels about 1.78 miles to where it drops into Diablo Canyon. Diablo Canyon meanders for about 55.98 miles to the confluence with the LCR.

From where the unnamed drainage splits off of Chavez Pass Ditch and heads North, Chavez Pass Ditch continues northeast about 3.15 miles (5,074 meters) to 14 Inch Tank. It is about 1.53 miles from 14 Inch Tank to New Tank. The outflow from New Tank travels about 1.04 miles to Upper Dog Valley Tank. Chavez Pass Ditch continues about 1.13 miles to Broken Dam Tank in Dog Valley Wash. Dog Valley Wash travels 6.1 miles west into Diablo Canyon and Diablo Canyon flows 46.02 miles before meeting up with the LCR.

Hay Lake is a fifth lake in this complex and although it is not a proposed stocking location, it plays an important role in preventing water or stocked fish from reaching sensitive habitats downstream in Jacks Canyon. Hay Lake is dry in most years, but when full it covers approximately 480 surface acres in size. Hay Lake has not been known to spill, but in the unlikely event that it did, it would flow down an unnamed drainage that runs about 10.01 miles to Jacks Canyon. Jacks Canyon is about 49 miles to its confluence with the LCR. There are about 35.5 miles of ephemeral/intermittent channel that separate the site and the LCR.

Based on these complicated connections, and the lack of recorded spills from Hay Lake and Long Lake, it is extremely unlikely that fish from the Jacks Canyon Complex would reach Diablo Canyon, let alone travel to the LCR.

Community Description

Soldiers Lake, Soldiers Annex Lake, and Long Lake are all interconnected and can potentially have the same aquatic community during wet climactic cycles. At any given time the aquatic community of these three lakes may contain largemouth bass, walleye, rainbow trout, bluegill, channel catfish, northern pike, golden shiner, and crayfish. The aquatic community of Tremaine Lake is currently different than the other three reservoirs in the system, except for golden shiner and crayfish. Common carp, bullhead catfish, and green sunfish all currently inhabit Tremaine Lake.

The aquatic community of Tremaine Lake remains different from both Soldiers Lake and Soldiers Annex Lake despite the potential upstream connection to them via Soldiers Annex Canal and through the Chilson Canal and Chavez Pass Ditch to the base of Soldiers Annex Lake. It is suspected that the aquatic community in Tremaine Lake is the result of illegal fish stocking of "mirror carp" and other species (see Tremaine Lake site analysis). This suggests that the gate system on Soldiers Annex Canal into Soldiers Lake, and the gate at the base of Soldiers Annex Lake Dam are sufficient barriers to fish movement into and out of Tremaine Lake.

Consultation Species, Critical Habitat & Potential Impacts
The Jacks Canyon Complex is most likely a closed system because it has not been known to spill for nearly 20 years; however it will be analyzed as an open system. Potential impacts from the proposed action to candidate and listed species are described below, and in the Lower LCR Complex Analysis Section for possible connection through the Chavez Pass Ditch to Canyon Diablo.

Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog
Local Analysis: Although the lakes in the Jacks Canyon Complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in these lakes is low. There are no historical records for Chiricahua leopard frogs from the lakes or within the buffered stocking complex. Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at some of the lakes, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or breached berms is low because there are

no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although the lakes in the Jacks Canyon Complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in these lakes is low. There are no historical records for northern leopard frogs from the Lakes (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy any of the lakes, Dave's Tank, or the areas within the buffered stocking complex and crayfish have been documented at some of the lakes, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or breached berms is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Humpback Chub and Critical Habitat

Suitable and designated critical habitat for the humpback chub occurs at the confluence of the Little Colorado and Colorado Rivers. Refer to the Lower LCR complex analysis which describes the potential impacts and analysis to the humpback chub under the extremely unlikely event that stocked fish in this complex are able to escape and move through the complex and extensive ditch and tank system to reach Canyon Diablo. However, the likelihood of fish from this complex ever reaching the LCR is extremely remote due to the distance, water conditions, water management regime imposed on the system by the Hay Lake Ranch and multiple falls on the LCR as described later.

CANYON DIABLO COMPLEX DESCRIPTION

PHYSICAL GEOGRAPHIC DESCRIPTION

Drainage area and elevations

The Canyon Diablo Complex is located in the southwest quadrant of the Little Colorado River (LCR) Watershed (Figure 6). The Canyon Diablo Complex is approximately 1,205 square miles in size, and ranges in elevation from 8,200 feet near the top of Rio de Flag, to 4,685 feet where it

connects into the LCR approximately 5.5 miles downstream from Corn Creek Wash, near the termination of State Highway 99 at Sunrise, Arizona.

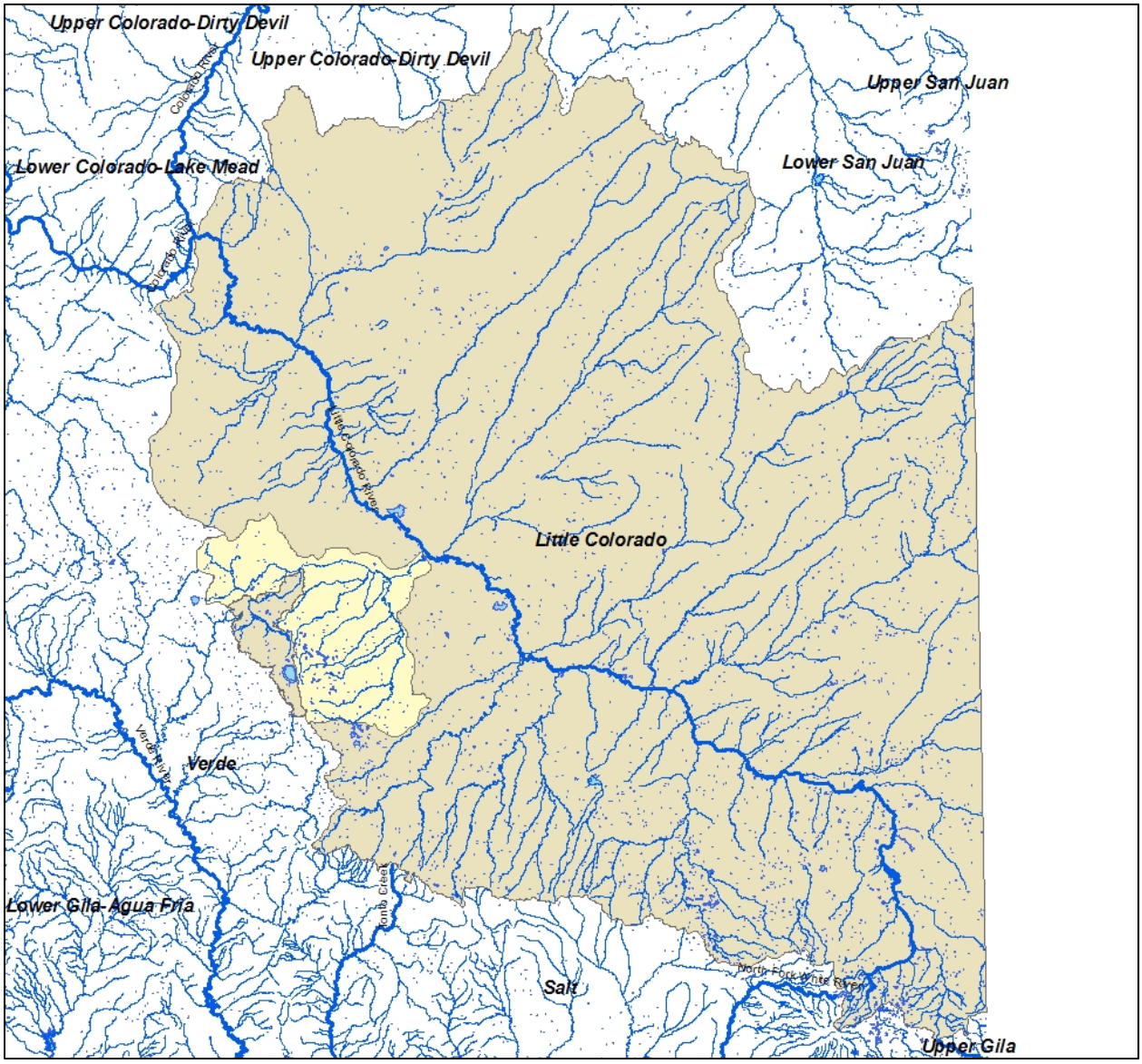

Figure 6. Location of the Canyon Diablo Complex (shaded yellow) in relation to the LCR watershed (shaded brown).

The Canyon Diablo Complex consists of six reservoirs that are managed for sport fisheries. The reservoirs are essentially comprised of three sub-watersheds: Kinnikinick Canyon, Coconino Lake/Ashurst Lake, and Rio de Flag (Figure 7). There are no known USGS flow gauging stations within this watershed complex.

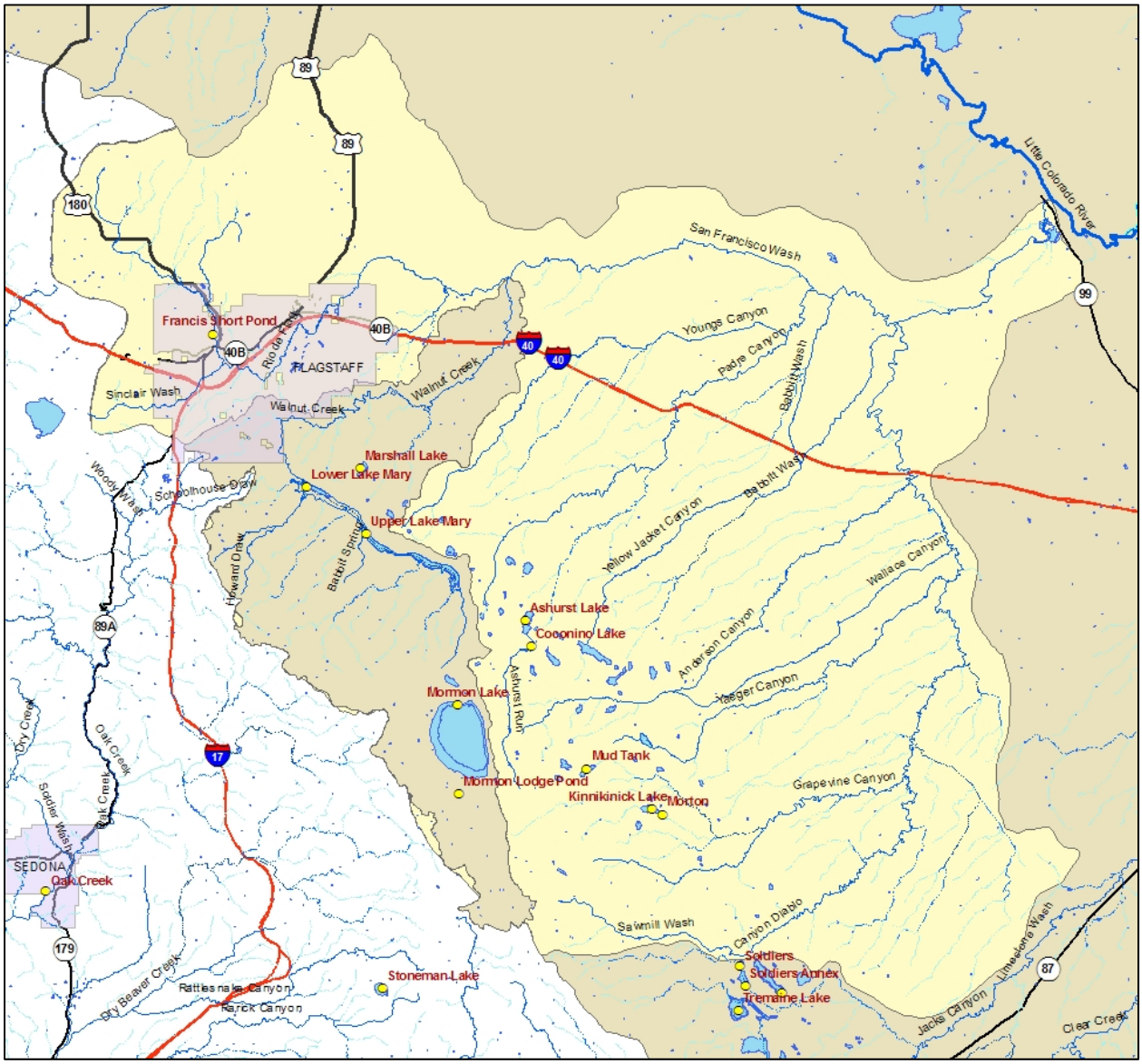

Figure 7. Canyon Diablo Complex (yellow) located within the Little Colorado River watershed; municipal areas are shaded in purple. The Walnut Creek sub-drainage stocking sites are considered closed and do not connect with the Canyon Diablo drainage.

The Kinnikinick Canyon sub-watershed consists of Kinnikinick Lake, Morton Lake, and Mud Lake (Figure 8). Kinnikinick Lake is located on the southern end of the complex and receives its water primarily from spring runoff from the surrounding area on Anderson Mesa via a ditch system. When Kinnikinick spills it fills Morton Lake, which is located directly downstream of Kinnikinick dam, and eventually drains into Kinnikinick Canyon. Mud Lake is located north of Kinnikinick Lake and just west of the road to Kinnikinick. Mud Lake fills from spring runoff from Anderson Mesa and when it spills, it spills through a poorly defined channel into Kinnikinick Canyon.

Kinnikinick Canyon eventually flows into Grapevine Canyon approximately five miles to the southeast of Morton Lake, and then Grapevine Canyon eventually ties into Diablo Canyon.

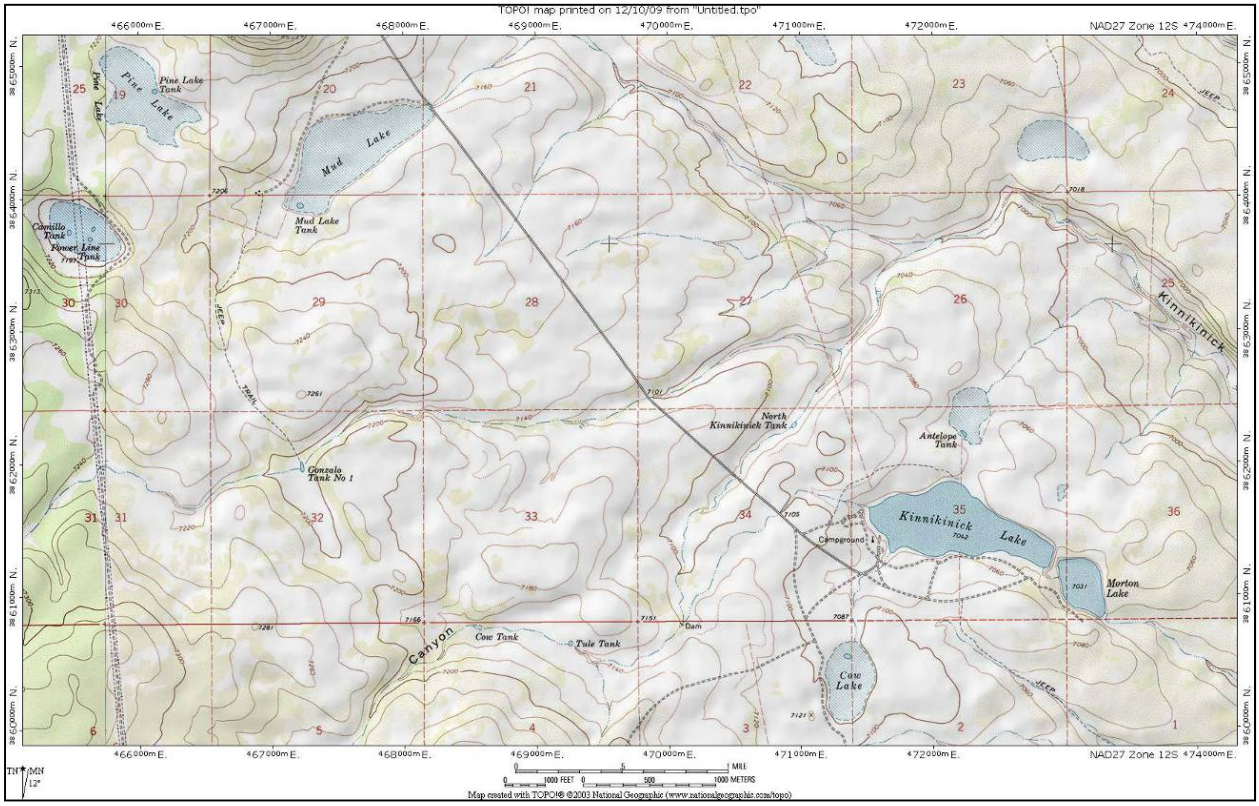

Figure 8. Topographic map indicating the location of Kinnikinick, Morton, and Mud lakes in Kinnikinick Canyon.

Coconino Lake collects water during spring runoff from a ditch system located in Ashurst Run (Figure 9); water from Coconino Lake flows north about ½ mile down a ditch to fill Ashurst Lake. Flow in the ditch is controlled by a head gate located at Coconino Dam. When Coconino Lake and Ashurst Lake spill they flow via a ditch system into Breezy Lake, a large wet meadow with no observed outlet; it is therefore considered a closed system.

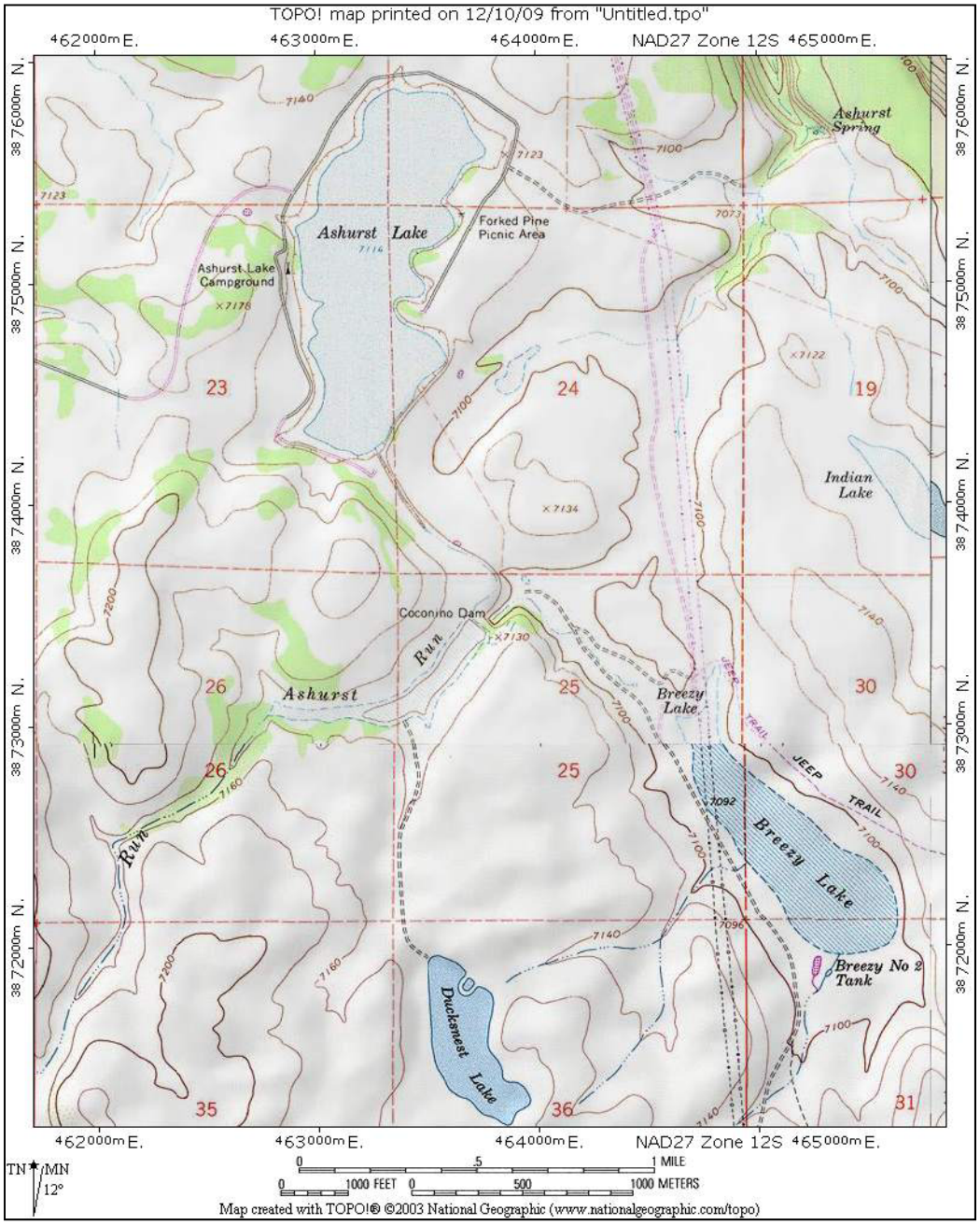

Figure 9. Topographic map indicating the Ashurst Run ditch system.

Frances Short pond sits in the Rio de Flag drainage within the city of Flagstaff. This pond captures runoff from the San Francisco Peaks, Elden Mountain, and A-1 Mountain sub-drainages north of Flagstaff. The Rio de Flag also collects drainage water from the City of Flagstaff downstream of Frances Short Pond. Any runoff from Frances Short Pond must travel approximately 40 miles through ephemeral washes, 26 culverts under roadways, over a single

roadway, through nine ponds, and across a golf course before it enters Diablo Canyon. Diablo Canyon is connected to the Lower LCR approximately 128 miles from the confluence of the LCR and the Colorado River.

Kinnikinick Lake

Site Description

Kinnikinick Lake is located approximately 9.7 miles off of Forest Highway #3 on Forest Service Road 82 in the Coconino National Forest, about 40 miles southeast of Flagstaff. The dam was built in 1954 and is fed by annual runoff from a 26,500 acre watershed on Anderson Mesa. Kinnikinick Lake sits at an elevation of 7,042 feet, has an average depth of 14 feet and a maximum depth of 22 feet, and encompasses 160 surface acres at maximum capacity (Figure 10; Figure 11). There is a Forest Service campground on the lake with 13 single unit campsites with tables, fire rings, cooking grills, and vault-type toilets. There is a gravel boat ramp located on the north end of the lake.

Figure 10 . Image of Kinnikinick and Morton lakes located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Figure 11. Photo of Kinnikinick Lake located within the Canyon Diablo drainage.

Management of Water Body

Kinnikinick Lake has been stocked dating back to 1936 and managed as a put-and-take rainbow trout fishery, and a put-grow-and-take brown trout and channel catfish fishery. In 1993 stocking of brown trout was halted, but was restarted in 2007. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Kinnikinick Lake is for sport fish management with a desired concept of Intensive Use Fishery (Young et al. 2001).

The primary fishery for Kinnikinick Lake is an intensive use coldwater put-and-take rainbow trout fishery and a put-grow-and-take brown trout fishery. Secondary Management is a channel catfish fishery (Table 10). Brook trout, cutthroat trout and Arctic grayling may be stocked opportunistically provide additional angling opportunity depending on fish availability.

Table 10. Stocking History for Kinnikinick Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked

Arctic grayling	1940	1940	2	6,050
Bluegill	1936	1936	1	9,000
Brook trout	1978	2007	6	45,000
Brown trout	1973	2009	35	211,737
Channel catfish	1970	2001	18	69,361
Cutthroat trout	1946	1991	11	796,450
Largemouth bass	1936	1936	1	950
Rainbow trout	1936	2009	359	2,416,220
Total			433	3,554,768

Proposed Action

The Department proposes to stock rainbow trout, brown trout, channel catfish, brook trout, cutthroat trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 50,000 annually.

Catchable, sub-catchable, fingerling sized brown trout will be stocked multiple times from September-November each year; numbers of brown trout stocked may be from 0-20,000 annually.

Catchable and sub-catchable channel catfish will be stocked from April – November; numbers of channel catfish stocked may be from 0-2,000 annually.

Catchable, sub-catchable, and fingerling brook trout may be stocked multiple times each year from April – November; numbers stocked may be from 0-50,000 annually.

Catchable, sub-catchable and fingerling cutthroat trout may be stocked multiple times each year from April – November; numbers stocked may be from 0-50,000 annually.

Catchable, sub-catchable and fingerling Arctic grayling may be stocked multiple times each year from March-November; numbers stocked may be from 0-50,000 annually.

Water Distribution / Connectivity

As mentioned above, Kinnikinick Lake is fed by annual runoff from Anderson Mesa via a first-order ephemeral stream with no known tanks or ponds. Kinnikinick Lake spills on the average twice every ten years and drains over the spillway into Morton Lake. According to Arizona Department of Water Resources (ADWR), the Kinnikinick spillway measures 860 feet long and 20.5 feet in height; thus flooding spillway events are broad and shallow.

Morton Lake has a maximum depth of 18 feet and on average covers 10 surface acres when it receives water. Morton Lake has a maximum surface area of 28.2 acres when full. Morton Lake fills and spills on average once every ten years.

Drainage from Morton Lake travels 1.77 miles down an unnamed ephemeral drainage into Kinnikinick Canyon. From Kinnikinick Canyon, ephemeral flows run 3.16 miles to Grapevine Canyon, and thereafter runs ephemerally through Grapevine Canyon 10.62 miles before connecting with Diablo Canyon. Ephemeral Diablo Canyon meanders for 49.10 miles before meeting up with the LCR.

Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during runoff events. Diablo canyon meets with the ephemeral Lower LCR approximately 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Fish Movement
During wet years when reservoirs fill completely, fish can travel downstream from Kinnikinick Lake over the Kinnikinick spillway into Morton Reservoir, which has happened an average of twice every ten years; Morton Lake spills once every ten years on average.

Below Morton Lake there are no identified perennial sections of creek (GIS data), nor tanks or ponds where fish could seek refuge through stochastic events. There are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling approximately 65 miles of ephemeral flow.

Community Description
Rainbow trout, brown trout, brook trout, golden shiner, fathead minnow and channel catfish are currently present in the lake (Table 11, Table 12 and Table 13). Based on stocking data and limited information from sampling data, channel catfish appear to be sustaining themselves as indicated through a variety in lengths, albeit at low numbers. The rainbow trout are presumed to be holdovers from numerous stocking events, but given a far narrower range in total lengths, it is unlikely they are capable of reproducing and recruiting in this lentic environment.

Table 11. 2004 Kinnikinick Lake gill net survey.

Species	Num.	Percent of Catch	Catch per Net Hour
Channel Catfish	60	80	.69

Rainbow Trout	14	18.7	.16
Golden Shiner	1	1.3	.01
Total	75	100	.86

Table 12. 2008 Kinnikinick Reservoir electrofishing data.

Species	Num.	Catch/Min	%of Total	Mean TL (mm)	Min-Max TL (mm)	Max WT (g)
Rainbow Trout	38	0.50	2.55	247.26	213-278	254
Channel Catfish	7	0.09	0.47	358.86	260-478	1,204
Golden Shiner	1,441	18.84	96.71	-	-	
Fathead Minnow	4	0.05	0.27	-	-	
TOTALS	1,490	-	-	-	-	

TOTAL EFFORT 4,590 SECONDS (76.50 MINUTES).

Table 13. 2009 Kinnikinick electrofishing data.

Species	Num.
Channel Catfish	3
Rainbow Trout	5
Golden Shiner	Not counted but present
Fathead Minnow	20
Brown Trout	1

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog

Local Analysis: Kinnikinick Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Kinnikinick Lake or other stocking sites within the complex is high. There are historical records for northern leopard frogs from 2 sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12; HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Kinnikinick Lake or Canyon Diablo buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

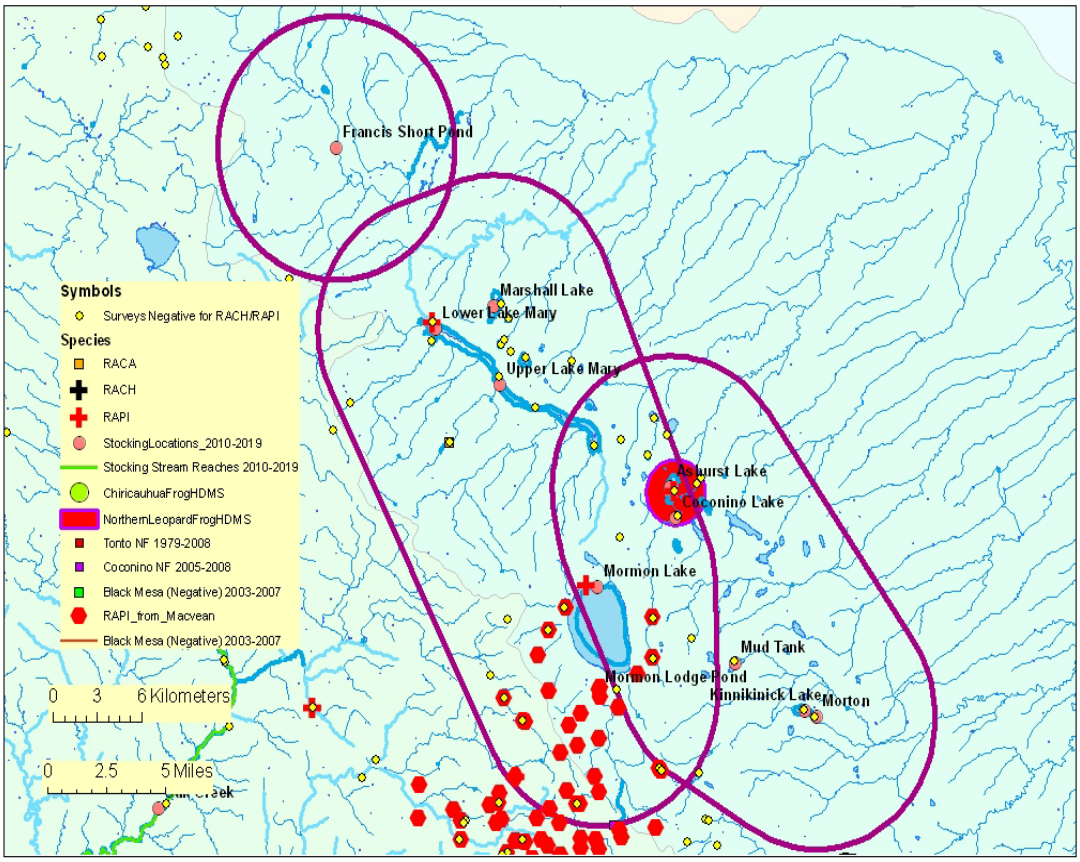

Figure 12. Map of Canyon Diablo buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Morton Lake

Site Description

Morton Lake is located on the Coconino National Forest directly downstream of the Kinnikinick Dam, about 40 miles southeast of Flagstaff (Figure 10; Figure 13). It has a maximum depth of 18 feet and an average surface area of 10 acres when it receives water from Kinnikinick Lake. Morton Lake spills on average once every ten years. Kinnikinick Lake is the only source of water for Morton Lake except for sheet flow run-off from the surrounding slopes.

Figure 13. Photo of Morton Lake.

Management of Water Body

The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Morton Lake is for sport fish management with a desired concept of Intensive Use Fishery (Young et al. 2001). Primary fishery management is a coldwater put and take rainbow trout fishery. Secondary fishery management is a channel catfish fishery (Table 14).

Table 14. Stocking history for Morton Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook Trout	1977	1977	1	5,000
Brown Trout	1992	1994	3	8,271
Rainbow Trout	1976	1998	10	14,053
Yellow Perch	1989	1989	1	80,000

Total	26	394,822

Proposed Action

Stock rainbow trout and channel catfish are proposed for the period covered by this consultation.

Catchable rainbow trout may be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 5,000 annually.

Sub-catchable channel catfish may be stocked multiple times each year from September-November; numbers of channel catfish stocked may be from 0-2000 annually.

Water Distribution/Connectivity

Drainage from Morton Lake travels 1.77 miles down an unnamed ephemeral course into Kinnikinick Canyon. Figure 14 depicts the Morton Lake spillway. Kinnikinick Canyon is ephemeral and meanders 3.16 miles to Grapevine Canyon. Grapevine Canyon is ephemeral and can run 10.62 miles before connecting with Diablo Canyon. Diablo Canyon is ephemeral and winds for 49.10 miles before meeting up with the LCR.

Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during runoff events. Diablo canyon meets with the ephemeral Lower LCR approximately 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Figure 14. Photo of Morton Lake spillway.

Fish Movement

Due to the dam, there is no upstream movement of fish from Morton Lake to Kinnikinick Lake. If Morton Lake fills and spills, the water drains downstream through almost 65 miles of ephemeral canyons. As mentioned above, there are no identified perennial sections of creek, nor tanks or ponds where fish could seek refuge through stochastic events. There are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling approximately 65 miles of ephemeral flow to enter the ephemeral portion of the Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Community Description

No fish surveys have been conducted on Morton Lake since 1991. The lake was dry from 2001-2005. However because Kinnikinick Lake spills into Morton Lake, any of the species found in Kinnikinick Lake can be found in Morton Lake when it has water, including rainbow trout, brown trout, brook trout, golden shiner, fathead minnow, and channel catfish.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog

Local Analysis: Morton Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Morton Lake or other stocking sites within the complex is high. There are historical records for northern leopard frogs from 2 sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Morton Lake or Canyon Diablo buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Mud Lake

Site Description

Mud Lake is a 7 acre tank located on the Coconino National forest about 35 miles southeast of Flagstaff and approximately 3 miles northwest of Kinnikinick Lake on Forest Road 82 (Figure

15). Spring runoff from Anderson Mesa fills Mud Lake and it spills through a culvert under the FR82 at the outlet and down a shallow channel into Kinnikinick Canyon.

Figure 15. Image of Mud Lake downstream from Kinnikinick and Morton lakes, located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Mud Lake has historically been stocked with rainbow trout, brown trout and channel catfish during wet years (Table 15). Mud Lake was last stocked in 1998 during a wet cycle, at which time it was managed as an intensive use water. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" is for sport fish management with a desired concept

of warm water fishery (Young et al. 2001). Current management is for an intensive use rainbow trout and channel catfish fishery when the lake has enough water to support fish.

Table 15. Stocking history for Mud Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1992	1994	3	14,000
Channel catfish	1988	1998	7	4,900
Rainbow trout	1970	1973	2	7,500
Total			12	26,400

Proposed Action

The Department proposes to stock rainbow trout and channel catfish for the period covered by this consultation.

Catchable rainbow trout may be stocked multiple times from April-November each year, when conditions allow; numbers of rainbow trout stocked may be from 0-5,000 annually.

Catchable channel catfish will be stocked each year from April – November, when conditions allow; numbers of channel catfish stocked may be from 0-1,000 annually.

Water Distribution/Connectivity

Mud Lake is reduced to a small stock tank found on its western edge over most years. During wet years the lake fills and can periodically support fish. The stock tank went dry during 2001-2002.

When Mud Lake spills it travels 3.5 miles down an unnamed shallow drainage to Kinnikinick Canyon. It then flows down Kinnikinick Canyon 7 miles to Grapevine Canyon. Grapevine Canyon is ephemeral and meanders 10.62 miles before connecting with Diablo Canyon. Diablo Canyon is ephemeral and meanders for 49.10 miles before meeting up with the LCR. Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during runoff events. Diablo Canyon meets with the ephemeral Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Fish Movement

If Mud Lake fills and spills, the water travels downstream through the almost 70 miles of ephemeral canyons. There are no identified perennial sections of creek (GIS data), nor tanks or

ponds where fish could seek refuge through stochastic events. There are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling approximately 70 miles of ephemeral drainages.

Community Description
Mud Lake has not been stocked by the Department since it went dry in 2001-2002. No surveys have been conducted at Mud Lake.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog
Local Analysis: Mud Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Mud Lake or other stocking sites within the complex is high. There are historical records for northern leopard frogs from 2 these sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970), although there are no historical records for northern leopard frogs from Mud Lake (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Mud Lake or Canyon Diablo buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Coconino Lake

Site Description

Coconino Lake is located about 20 miles southeast of Flagstaff in the Coconino National Forest on Anderson Mesa, at an elevation of 7,130 feet. The lake is approximately ½ mile south of Ashurst Lake and is accessible by a very rough dirt road that follows the ditch from Coconino Lake to Ashurst Lake. On average the lake covers 5 surface acres, 31 surface acres when fully watered, and has an average depth of 7 feet with a 30 foot maximum depth when fully watered (Figure 16). The lake collects water from a portion of Ashurst Run, with a total drainage area of 6,464 acres. No perennial stream input or outflow exists.

Figure 16. Image of Coconino Lake located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Prior to the mid 1990's, the lake was managed as a put grow and take rainbow trout fishery and was known for producing large trout (Table 16). The reservoir has been actively managed as a trout fishery but still supports an illegally stocked northern pike fishery. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Coconino Lake is for sport fish management with a desired concept of intensive use fishery (Young et al. 2001). If the lake is renovated to remove northern pike, or goes dry, the proposed management is to remain a put-grow-and-take trout fishery for rainbow trout and brown trout. Brook trout, cutthroat trout

and Arctic grayling may be stocked opportunistically provide additional angling opportunity depending on fish availability.

Table 16. Stocking history for Coconino Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1992	1992	1	1,000
Cutthroat trout	1991	1992	2	23,000
Rainbow trout	1956	2003	60	131,986
Total			63	155,986

Proposed Action

The proposed action is to stock rainbow trout, brown trout, brook trout, cutthroat trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 5,000 annually.

Catchable, sub-catchable, and fingerling brown trout, brook trout, cutthroat trout, and arctic grayling may be stocked each year from March-November: numbers stocked may be from 0-5,000 of each species annually.

Water Distribution/Connectivity

Coconino Lake receives most of its water as runoff from Ashurst Run. Two stock tanks/wet meadows in the upper part of Ashurst Run, Flying M Tank and VJ Tank, may connect to Ashurst Run during high flow events.

Coconino Lake is connected to Ashurst Lake via a ditch (Figure 9; Figure 17; Figure 18). Runoff between Coconino and Ashurst is controlled through a valve at Coconino Lake (Figure 19). The Department opens this valve during usually during March to April to fill Ashurst Lake. During most years, all of the runoff from Coconino Lake goes to Ashurst Lake. During wet periods when Ashurst Lake is full, runoff from Coconino Lake runs into the closed Breezy Lake, and a large meadow (Figure 20; Figure 21; Figure 22). There is no record of Breezy Lake or this meadow spilling. Ashurst Lake also spills into Breezy Lake and the meadow during wet years (see photos in Ashurst Lake section). Therefore, this system is considered closed.

Figure 17. Photo of the ditch between Ashurst and Coconino lakes.

Figure 18. Photo of the ditch between Ashurst and Coconino lakes showing water flowing into the south end of Ashurst Lake.

Figure 19. Photo of the runoff control valve at Coconino Lake through which water is released downstream to Ashurst Lake. The Department typically opens this valve during March to April to fill Ashurst Lake.

Figure 20. Photo of the Coconino Reservoir spillway when Ashurst Lake is full and Coconino spills instead into Breezy Lake.

Figure 21. Photo of the ditch through which water spills and flows from Coconino Lake and Breezy Lake.

Figure 22. Photo of water flows into Breezy Lake (visible at top of photo) from Coconino Reservoir.

Fish Movement

Fish from Coconino Lake may be able to move from the reservoir into Ashurst Run and the two upstream stock tanks, VJ Tank and Flying M Tank, during high flow events. However, the only fish collected from these tanks is fathead minnow. No stocked fish from downstream have been found in the upstream tanks. Fish from Coconino Lake can move into Ashurst Lake when the ditch between the lakes is flowing, and can also spill into Breezy Lake.

Community Description

According to anglers, northern pike are present in Coconino Lake. No fish surveys have been conducted. VJ and Flying M tanks contain fathead minnows. They have also supported northern leopard frogs in the past (Table 17). During leopard frog surveys 2000-2009, no fish were collected, but anecdotal observations indicate only fathead minnows are present (S. MacVean pers. comm.).

Table 17. Leopard frog survey history in tanks located upstream from Coconino Lake in Ashurst Run.

Site Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Flying M Tank	NS[1]	NS	NS	NS	NS	0	0	NS	1	0
VJ Tank	NS	NS	NS		NS	0	0	NS	1	NS

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level. Coconino Lake is a closed system to downstream fish movement, so fish stocked into Coconino Lake will not move into listed fish habitat.

Northern Leopard Frog

Local Analysis: Coconino Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Coconino Lake or other stocking sites within the complex is high. Although there are no historical records for northern leopard frogs from Coconino Lake, there are historical records for northern leopard frogs from 2 sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed the two sites upstream from these lakes

[1] NS=not sampled.

where fish can move regularly from 2005-2009 and has confirmed that northern leopard frogs occupied both sites in 2008; VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Coconino Lake or Canyon Diablo buffered stocking complex is low. Coconino Lake is in a closed system and stocked fish are not able to disperse outside of the buffered stocking complex.

Ashurst Lake

Site Description

Ashurst Lake is located on the Coconino National Forest on Anderson Mesa about 20 miles south of Flagstaff. Ashurst Lake sits at an elevation of 7,110 feet about sea level and usually covers 161 surface acres, but expands to 229 surface acres when full, has an average depth of 10 feet, with a 25 foot maximum depth when full (Figure 23; Figure 24). Water enters the lake through a diversion canal from Coconino Lake along with the area surrounding the lake, with a total drainage area of 8,329 acres. The dam was constructed in 1955 and the lake was filled in 1962, with renovation efforts in 1976-77. Ashurst Lake has two Forest Service campgrounds as well as a public boat ramp.

Figure 23. Image of Ashurst Lake located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Figure 24. Photo of Ashurst Lake located in the Canyon Diablo drainage.

Management of Water Body

Ashurst Lake was historically a put-grow-and-take rainbow trout fishery featuring the stocking of trout fingerlings (Table 18). Turbidity increased during the late 1960's and the growth rates of trout declined. The stocking of the lake changed from fingerling rainbow trout to catchable trout, and the current management is as a high intensity put-and-take rainbow trout fishery. In addition, fingerling and catchable channel catfish have been stocked opportunistically as fish were available. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Ashurst Lake is for sport fish management with a desired concept of intensive use fishery (Young et al. 2001).

The primary fishery management is high intensity cold water put-and-take rainbow trout fishery and a put-grow-and-take trout fishery; secondary management is a channel catfish fishery. Brook trout, brown trout, cutthroat trout and Arctic grayling may be stocked opportunistically to provide additional angling opportunity depending on fish availability.

Table 18. Stocking history for Ashurst Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	1969	1	50,000
Black crappie	1937	1937	1	500
Bluegill	1935	1947	8	44,500
Bream	1937	1937	1	3,500
Brook trout	1964	1983	11	295,154
Brown trout	1949	1971	2	36,500
Channel catfish	1987	1988	2	6,000
Cutthroat trout	1943	1991	6	217,460
Kokanee	1960	1964	3	154,540
Largemouth bass	1937	1947	5	29,777
Rainbow trout	1944	2009	445	4,791,015
Smallmouth bass	1939	1939	1	390
Sunfish hybrid	1947	1947	1	10,224
Total			557	5,639,560

Proposed Action

The proposed action is to stock rainbow trout, brown trout, channel catfish, brook trout, cutthroat trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 80,000 annually.

Catchable and sub-catchable channel catfish may be stocked each year from April – November; numbers of channel catfish stocked may be from 0-2,000 annually.

Catchable, sub-catchable, and fingerling brown trout may be stocked each year from March-November: numbers stocked may be from 0-50,000.

Catchable, sub-catchable, and fingerling brook trout may be stocked each year from March-November: numbers stocked may be from 0-50,000.

Catchable, sub-catchable, and fingerling cutthroat trout may be stocked each year from March-November: numbers stocked may be from 0-50,000.

Catchable, sub-catchable, and fingerling arctic grayling may be stocked each year from March-November: numbers stocked may be from 0-10,000.

Water Distribution / Connectivity

Water from runoff events in Ashurst Run flows into Coconino Lake where it can be diverted downstream in a ditch to Ashurst Lake. The gate on the dam at Coconino Lake can be manipulated to prevent flow from entering Ashurst Lake (Figure 19). If the gate at Coconino Lake is open when Ashurst Lake is full, Ashurst Lake can spill, which it did in 1995 and 2008. When Ashurst Lake spills, the water flows over the spillway to a ditch system that flows and collects in a low basin to the east of Ashurst Lake before flowing into Breezy Lake (Figure 9; Figure 25; Figure 26). Breezy Lake is a large meadow with no opportunity for flow to leave once it collects in the basin, making this a closed system.

Figure 25. Photo of Ashurst spillway; from this point water flows into Breezy Lake.

Figure 26. Photo of the basin behind Ashurst Lake; outflow from Ashurst travels through this basin towards the right side of the photo southeast to Breezy Lake.

Fish Movement

Fish from Ashurst Lake may be able to move upstream into Coconino Lake when the ditch between the lakes is flowing. Water and fish can spill into Breezy Lake as well, which is a closed system and goes dry most years.

Community Description

Surveys have not been conducted on Ashurst Lake since 1991. A creel census was conducted during 2009, and anglers reported catching rainbow trout, northern pike, and green sunfish. A large channel catfish was caught by an angler from Ashurst Lake and brought in to the Region II Game and Fish Office in 2008.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level. Ashurst Lake is a closed system. Fish stocked into Ashurst Lake do not move into listed fish habitat.

Northern Leopard Frog

Local Analysis: Ashurst Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Ashurst Lake or other stocking sites within the complex is high. In the buffered complex, there are historical records for northern leopard frogs from Ashurst Lake (1972) and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Ashurst Lake or Canyon Diablo buffered stocking complex is low. Ashurst Lake is in a closed system and stocked fish are not able to disperse outside of the buffered stocking complex.

Frances Short Pond

Site Description

In 1923 the City of Flagstaff constructed a dam in the Rio de Flag drainage to catch runoff from the San Francisco Peaks north of Flagstaff. The 2-acre pond, referred to as "the duck pond" by locals, was used primarily for recreation such as ice skating, swimming, and fishing. Over time the pond began to fill with sediment, and water was released through an outlet pipe during high flows.

During the spring of 1975 the U.S. Soil Conservation Service and students and teachers from Flagstaff Junior High School planned to utilize the pond as a wetland. The plan included constructing an island and planting aquatic vegetation to provide habitat for wildlife. In 1976 the pond became an outdoor study area for the adjacent schools (Figure 27; Figure 28). The Arizona

Bicentennial Commission recognized this outdoor study area as a Youth Bicentennial Project for the Flagstaff area, and in 1979 the Arizona State Parks Board placed the site on the Natural Area Register. In 1993 the duck pond was renamed after a Flagstaff Middle School teacher and City Council Member Frances Short.

In October of 2003 the Arizona Game and Fish Department Heritage fund provided a $30,000 grant to the City of Flagstaff and the Flagstaff Unified School District to restore Frances Short Pond. During the summer of 2005 restorations to the pond took place that included dredging the pond to increase storage capacity and to make it suitable for fish. Reclaimed water is used as a supplemental water source to maintain the pond water level year round.

Since 2005 management has been primarily for a “kids” oriented fishery focusing on the stocking of both cold and warm water species that are easy for kids to catch; for example, bluegill, channel catfish, and rainbow trout. Bag limits at the lake are similar to the Department’s Urban Program regulated waters, with limits of 4 trout, 4 channel catfish, 5 bluegill, and 2 largemouth bass with a minimum size of 13 inches. The pond is a very popular fishing and recreation area for the anglers and citizens of Flagstaff.

During the summers of 2008 and 2009 Frances Short Pond suffered partial fish kills due to high pH levels and/or low oxygen levels. To combat this problem the Department, in cooperation with the City of Flagstaff, funded installation of a solar powered aerator.

Frances Short Pond comprises approximately 2 acres and is located within the city limits of Flagstaff at Flagstaff High School, at an elevation of approximately 6,926 ft. Water enters the pond through annual snowmelt and runoff from the Rio de Flag drainage, capturing runoff from the San Francisco Peaks, Elden Mountain at Shultz Creek, and A-1 Mountain sub-drainages north of Flagstaff. The drainage area of the Rio de Flag upstream of Frances Short Pond is 30,000+ acres, including 3 mountains and five springs. Drainage elevation ranges from 12,200 feet at the top of Agassiz peak to 6,926 feet at Frances Short Pond.

Figure 27. Image of Frances Short Pond located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Figure 28. Photo of Francis Short Pond located in the Canyon Diablo drainage.

Management of Water Body

Frances Short Pond is currently managed as both a cold and warm water fishery, featuring a high intensity put-and-take rainbow trout and channel catfish fishery (Table 19). The secondary fishery is a warm water fishery featuring bluegill, hybrid sunfish, and largemouth bass. The lake currently holds self sustaining, naturally reproducing populations of bluegill sunfish, and largemouth bass, as well as stocked rainbow trout and channel catfish. Future warm water fishery management will focus on maintaining largemouth bass, redear sunfish and bluegill sunfish; hybrid sunfish are not proposed for stocking.

Table 19. Stocking history for Frances Short Pond.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	2007	2009	3	1,138

Channel catfish	2006	2009	10	4,042
Largemouth bass	2008	2009	2	423
Rainbow trout	2006	2009	31	13,911
Hybrid sunfish	2007	2007	1	400
Total			47	19,914

A creel census was conducted from April to June of 2008. During that time an estimated 1,056 rainbow trout were harvested by anglers, compared to the 3,000 stocked, which is roughly 35%. Similarly, an estimated 4,773 rainbow trout were caught from April to June of 2008, which is 159% of the total stocked during that time period (Table 9), and 46% of the total rainbow trout stocked since the pond's initial stocking in 2006.

Of the anglers interviewed during the 2008 and 2009 creel, 99.91% were using bait; only 0.09% were fly fishers. Of the remaining 3,717 trout that were caught but not harvested from April to June of 2008, an estimated 483 trout were killed due to hooking mortality using an estimated minimum 13% hooking mortality. Of the initial 3,000 trout stocked from April to June of 2008, an estimated 1,539 trout were either harvested or killed due to hooking mortality, leaving an estimated 1,461 trout remaining.

During the April to June 2008 creel census, 818 channel catfish were harvested by anglers, compared to the 1,720 stocked, which translates to roughly a 48% harvest rate. Similarly, an estimated 1,062 channel catfish were caught from April to June of 2008 or 62% of the total stocked during that time period. Of the 1,062 channel catfish caught, 77% were harvested by anglers. All of the angler's interviewed were targeting specifically for channel catfish during the 2008 and 2009 creel census, and all were bait fishing. Of the remaining 244 channel catfish that were caught but not harvested from April to June of 2008, an estimated 32 were killed due to hooking mortality using the minimum 13% hooking mortality associated with bait fishing. Of the 1,720 channel catfish that were stocked from April to June of 2008, an estimated 850 channel catfish were either harvested or killed due to hooking mortality, leaving an estimated 870 channel catfish remaining.

In July 2008 the pond experienced a fish kill due to low oxygen levels. Due to poor angler use and lack of available fish, the creel survey was terminated at that time. The creel survey was reinitiated during October and November of 2008 when water quality permitted stocking of rainbow trout. During that time, 1,000 rainbow trout were stocked, and an estimated 120 rainbow trout were harvested. However, an estimated 1,436 trout were caught, or 144% of what was

stocked during October and November 2008. Of the estimated remaining 1,316 rainbow trout that were caught but not harvested from April to June of 2008, an estimated 171 trout were killed due to hooking mortality. Of the 1,000 rainbow trout that were stocked from October to November of 2008, an estimated 291 rainbow trout were either harvested or killed due to hooking mortality, leaving an estimated 709 rainbow trout remaining. No channel catfish were stocked or caught during this time period.

Stocking efforts for rainbow trout began again in March of 2009 and ended in June of 2009 due to poor water quality. Similarly, two channel catfish stockings occurred beginning in May of 2009 and ending in June. The pond suffered a fish kill in July of 2009 due to low oxygen levels.

A creel census was conducted during August and September of 2009. During that time an estimated 438 rainbow trout were harvested and 2,169 were caught by anglers, although no trout were stocked during this time period; however 2,145 trout were stocked from March to June of 2009. Of the 2,145 trout stocked in 2009, approximately 21% were harvested and 101% were caught; this indicates that many anglers practice catch and release. Of the estimated 1,731 rainbow trout that were caught but not harvested from August to September 2009, an estimated 225 were killed due to hooking mortality. Of the 2,145 trout that were stocked from March to June of 2009, an estimated 663 were harvested or killed by hooking mortality, leaving and estimated 1,482 rainbow trout remaining.

During August to September 2009, 113 channel catfish were harvested by anglers, compared to the 1,542 stocked from April to June of 2009, or roughly 7%. Similarly, an estimated 395, or 26%, channel catfish were caught of those stocked from April to June 2009. Of the remaining estimated 282 channel catfish that were caught but not harvested, an estimated 37 were killed due to hooking mortality. Of the 1,542 channel catfish that were stocked in April to June of 2009, roughly 150 were harvested or killed due to hooking mortality in August and September of 2009.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, bluegill sunfish and redear sunfish for the period covered by this consultation.

Catchable rainbow trout will be stocked each year from March to November and multiple times per season; numbers of rainbow trout stocked may be from 0 – 8,000 annually.

Catchable channel catfish will be stocked each year from April to July and multiple times per season; numbers of catchable channel catfish stocked may be from 0-2,500 annually.

Largemouth bass (fingerlings, sub-catchables, catchables) and bluegill (fingerlings, sub-catchables) may be stocked as needed at any time during the year and multiple times per season

to augment the fishery or to recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Redear sunfish (fingerlings and sub catchables) would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

The Inner Basin of the San Francisco Peaks contains an aquifer that supplies much of the municipal water for the city of Flagstaff. Water is piped southward to the city from a series of wells tapping the basin's aquifer. Five springs contribute to snowmelt flow from the San Francisco Peaks: Chimney Spring, Little Leroux Spring, Big Leroux Spring, and Taylor Spring. Flow from Elden Mountain is drained via Schulz Creek and includes Onion Spring. Runoff from the north side of A-1 mountain ends up in the Rio de Flag. The Rio de Flag drainage typically runs during annual snowmelt from the surrounding areas, but can flow during significant precipitation events. Flow from this upper basin ends up in Frances Short Pond. Frances Short pond also periodically receives “high grade” Class A reclaimed water from city supplies to keep level of the pond up during dry periods.

According to GIS data, Flagstaff reservoirs reside east and west of Shultz creek, but dam height ranges from 15 to 23.8 feet. There may be extremely small pools of water upstream along the Rio de Flag, but there’s no opportunity for fish to escape the drainage.

Outflow from Frances Short Pond is typically in response to snowmelt runoff during the spring months. In the event of flooding, outflow from Frances Short Pond flows across the surface of Aztec road on the south side of the pond and travels approximately 1.65 miles down ephemeral Rio de Flag through the city of Flagstaff to the confluence of ephemeral Sinclair Wash. Flow through this section of the drainage is typically turbid and contains debris such as trash, sediment, gravel from snow removal efforts, oil and other automotive fluids.

From its confluence with Sinclair wash, Rio de Flag continues approximately 1.04 miles to a perennial pump back pond just north of Interstate 40, from the sewage treatment plant. From this pond intermittent flow travels approximately 0.31 miles under Interstate 40 to a small pond below a sewage sub-station. Rio de Flag continues approximately 2.60 miles to an approximately 2.36 acre perennial pond at the outflow of a sewage disposal center. From the sewage disposal pond it is approximately 0.36 miles down Rio de Flag to a series of two unnamed ephemeral ponds. From these unnamed ponds, Rio de Flag continues approximately 0.37 miles onto a golf course just north of Butler Avenue. Flow continues through the golf course 0.73 miles to an unnamed pond on the golf course. From the golf course pond outflow travels 1.12 miles to where outflow from a 1.88 acres unnamed pond travels approximately 200 meters into the Rio de Flag.

From the unnamed pond it is 0.77 miles to ephemeral Big Fill Lake that, when fully watered, impounds approximately 13.67 acres.

Outflow from Big Fill Lake travels approximately 0.07 miles to a second unnamed ephemeral reservoir that is approximately 5.42 acres when fully watered. From the second unnamed reservoir Rio de Flag continues approximately 8.21 miles to two small unnamed ephemeral tanks of less than 1 acre each. From these tanks the Rio de Flag continues approximately 0.09 miles to its confluence with ephemeral Wildcat Canyon at the head waters of ephemeral San Francisco Wash.

In all, outflow from Frances Short Pond to its confluence with San Francisco wash crosses 27 different road ways and the railroad three times; of these all but one pass under these travel routes through culverts. San Francisco Wash travels approximately 20.22 miles to its confluence with ephemeral Locust Canyon. San Francisco Wash continues approximately 1.17 miles to its confluence with ephemeral Padre Canyon. It is approximately 6.60 miles from this confluence down Padre Canyon to its confluence with ephemeral Diablo Canyon. From its confluence with Padre Canyon, Diablo Canyon is approximately 10.43 miles to an unnamed ephemeral reservoir. Outflow from this impoundment travels approximately 1.20 miles to the confluence with the LCR (see the Lower LCR Analysis).

Fish Movement

The upstream movement of fish from Frances Short Pond is possible during spring runoff and precipitation events significant enough to cause Rio de Flag to run. Fish moving upstream from the pond would encounter major roadways, including highway 180, and neighborhoods. Fish moving upstream could potentially take any number of side drainages before reaching any headwaters. It is unlikely that fish will be able to move upstream through the various obstacles through the typically dry channel and arrive at the headwaters of the drainage. Fish in the headwaters would not persist due to the typically dry nature of the drainage.

In the event of flooding water from Frances Short Pond could potentially travel across the surface of Aztec road (Figure 29 and Figure 30) on the south side of the pond and travel approximately 1.65 miles down ephemeral Rio de Flag through the city of Flagstaff under 19 roadways and one railroad to the confluence of ephemeral Sinclair Wash. It is highly unlikely that stocked fish would survive multiple road crossings and highly turbid runoff associated with annually snowmelt significant enough to cause Frances Short Pond to spill. Habitat conditions are extremely poor even if standing water develops along the way.

From its confluence with Sinclair wash, Rio de Flag continues approximately 1.04 miles to a perennial pump back pond just north of Interstate 40 from the sewage treatment plant. From this pond intermittent flow travels approximately 0.31 miles under Interstate 40 to a small pond below a sewage sub-station. Green sunfish and fathead minnow have been observed in this

stretch on the Rio de Flag (AGFD Region 2 personnel observations) although the source was unknown. From the small pond below the sewage station, fish could potentially travel down the Rio de Flag approximately 2.60 miles to an approximately 2.36 acre perennial pond at the outflow of a sewage disposal center. Once there, it is highly unlikely that fish could survive the harsh limnological conditions associated with the sewage disposal center.

There are no identified perennial sections of creek (GIS data), nor tanks or ponds where fish could seek refuge through stochastic events below the confluence with San Francisco Wash area. Also, there are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling ephemeral drainages and enter the ephemeral portion of the Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Figure 29. Frances Short Pond Spillway.

Figure 30. Frances Short Pond Stocking Area.

Community Description

The current fish community of Frances Short Pond includes largemouth bass, bluegill, channel catfish, and rainbow trout. Hybrid sunfish were initially stocked into the pond in March of 2007, but none have been recorded during sampling or creel efforts since 2007. Northern pike were first collected in 2007, which the Department attempted to capture and remove through netting (Table 20). Pike were collected again in November of 2007 when a Flag Middle School class was conducting sampling efforts of the pond using a backpack electrofishing unit and trammel nets (Table 21). Since 2007 no northern pike have been reported or collected during creel or sampling efforts of the pond. Black crappie were first collected in the spring of 2008 by anglers but none were collected during creel or sampling in 2009. Frances Short Pond did suffer partial fish kills during the summers of 2008 and 2009.

Due to the intensive use (angler catch, harvest, and hooking mortality) and prevalent fish kills associated with Frances Short Pond (See Management of Water Body section) there is a minimal chance of long term fish survival in Frances Short Pond. Moreover, if fish escapement occurs from Frances Short Pond, a myriad of obstacles (road crossings, sewage treatment plants, golf courses, etc) and harsh environmental conditions (typically dry ephemeral drainages, waterfalls,

etc) likely limit fish survival downstream to the LCR (See above description in Water Distribution / Connectivity section).

Table 20. August 2007 Northern Pike Removal efforts.

Species	Num.	Length Range
Northern Pike	9	435-771
Rainbow trout	2	238-246

Table 21. Department sampling data from November 2007 at Frances Short Pond.

Species	Num.	% of Total	Mean Length	Min-Max Length	Mean Weight	Min-Max Weight
Northern Pike	1	1.67	87 cm	87 cm	6,804 g	6,804 g
Rainbow trout	9	15	23.6 cm	19-26.5 cm	149.33 g	45-215 g
Bluegill	50	83.33	7.2 cm	2.1-11.2 cm	6.46 g	0.1-24 g
TOTAL	60	100	-	-	-	-

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog
Local Analysis: Although the Frances Short Pond buffered stocking site is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to fish stocked in

Frances Short Pond is low. There are no historical records for northern leopard frogs from Frances Short Pond or within the 5 mile buffer around the stocking site; however, there have been no surveys in this area (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Frances Short Pond buffered stocking site has not been adequately surveyed to be able to determine whether northern leopard frogs occupy this area or not, but due to the urban environment and the presence of non-native fish, it is likely that northern leopard frogs do not occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Frances Short Pond buffered stocking complex is low. There are records for northern leopard frogs from 1987 and 1992 at Veit Spring and Pond Lake, which is located in the headwaters of Rio de Flag. Although it is likely that northern leopard frogs occupy this site, it is not likely that dispersing fish could disperse that far upstream from the stocking location.

CANYON DIABLO COMPLEX ANALYSIS

The Canyon Diablo Complex consists of six reservoirs that are managed as sport fisheries. The reservoirs can be placed into three sub-watersheds: Kinnikinick Canyon sub-watershed, Coconino Lake/Ashurst Lake, and Rio de Flag.

The Kinnikinick Canyon sub-watershed consists of Kinnikinick Lake, Morton Lake, and Mud Lake. Kinnikinick Lake can spill into Morton Lake, and eventually into Kinnikinick Canyon. Mud Lake (Mud Lake) is north of Kinnikinick Lake and also flows into Kinnikinick Canyon. Kinnikinick Canyon can flow into Grapevine Canyon which then flows into Diablo Canyon.

Coconino Lake collects runoff from Ashurst Run, and when Coconino Lake and Ashurst Lake spill, they flow via a ditch system into Breezy Lake, a large wet meadow with no observed outlet. Thus, Coconino Lake and Ashurst Lake are within a closed system

Frances Short pond sits in the Rio de Flag drainage within the city of Flagstaff, and drainage passes down to San Francisco Wash approximately 50 miles of ephemeral drainage to Canyon Diablo and approximately 15 miles before entering the ephemeral Little Colorado River.

The Canyon Diablo Complex analysis consists of the brief segment of drainage from the confluence of Canyon Diablo and San Francisco Wash approximately 12 miles from the LCR.

Water Distribution / Connectivity

Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during periodic flooding or runoff events, mostly in the spring due to snow melt.

Outflow from Frances Short Pond can travel down the Rio de Flag drainage to San Francisco Wash, and from there it travels to Padre Canyon to Diablo Canyon, and eventually into the LCR approximately 65 total miles from the outflow of Frances Short Pond.

The San Francisco Wash, Padre Canyon, Diablo Canyon, and the majority of the Rio de Flag drainage are ephemeral. A small section of the Rio De Flag drainage that flows downstream of the Flagstaff waste water treatment plant is perennial.

Within the Complex Analysis area, there are no known fish populations due to the ephemeral nature of the drainage.

Fish Movement
Fish from the Ashurst/Coconino Lake group cannot move downstream of Breezy Lake and cannot reach Diablo Canyon or the LCR. Fish may be able to move upstream of Coconino Lake into VJ Tank and Flying M Tank.

Fish from the Kinnikinick Canyon group could move downstream of the stocking sites into usually dry Kinnikinick Canyon and eventually into the LCR via usually dry Grapevine Canyon (10.6 miles) and usually dry Diablo Canyon (49.1 miles).

Runoff from Frances Short pond can travel approximately 40 miles through ephemeral washes, over a road, through 26 culverts under roadways, through nine ponds, and across a golf course before it enters Diablo Canyon. It is unlikely that fish survive the environmental conditions between Frances Short Pond and Canyon Diablo. Any fish that survive to the confluence of Diablo Canyon and the LCR could enter the ephemeral Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Community Description
There are very few perennial waters where fish could reside after escapement from any of the waters in this complex; however, there is little data from drainages downstream of stocking sites. There is neither known listed nor candidate fish species in these reaches.

Because flooding events are relatively infrequent, and due to a gauntlet of ephemeral washes/tanks/roadways and other obstacles along the routes, uncertain habitat suitability for catfish, trout, and bluegill, the likelihood is extremely small that any fish (stocked or wild) could survive the extreme environmental conditions necessary to travel these ephemeral washes through Diablo Canyon and/or San Francisco Wash, and arrive at the confluence of Diablo Canyon and the LCR.

If any fish did survive, they could enter the Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis) which in itself is an ephemeral reach.

Consultation Species or Critical Habitat
There is no listed, candidate or proposed species occurrences within the Canyon Diablo drainage other than northern leopard frogs which is evaluated above at each site specific stocking location.

Potential impacts to humpback chub in the Little Colorado River are addressed in the Lower LCR analysis.

Northern Leopard Frog

See Local and Broad Scale analyses under each stocking location.

WALNUT CREEK COMPLEX DESCRIPTION

The Walnut Creek complex is composed of 4 lakes proposed for stocking (Figure 31). From south (upstream) to north (downstream) the lakes are Mormon Lodge Pond (located inside the Mormon Lake Basin), Upper Lake Mary, Marshall Lake, and Lower Lake Mary. Mormon Lake was originally proposed for stocking but has been removed from further consideration, although still depicted in the map. When Lower Lake Mary spills, the water flows down Walnut Canyon to Santa Fe Dam, where the flow stops and the water percolates into the ground. No water has been observed spilling from Santa Fe Dam, and this dam has been observed during wet periods including observation in 1993 during an extremely wet period with high runoff (S. Hedwall, FWS pers. com.). The entire Walnut Creek Complex is a closed system.

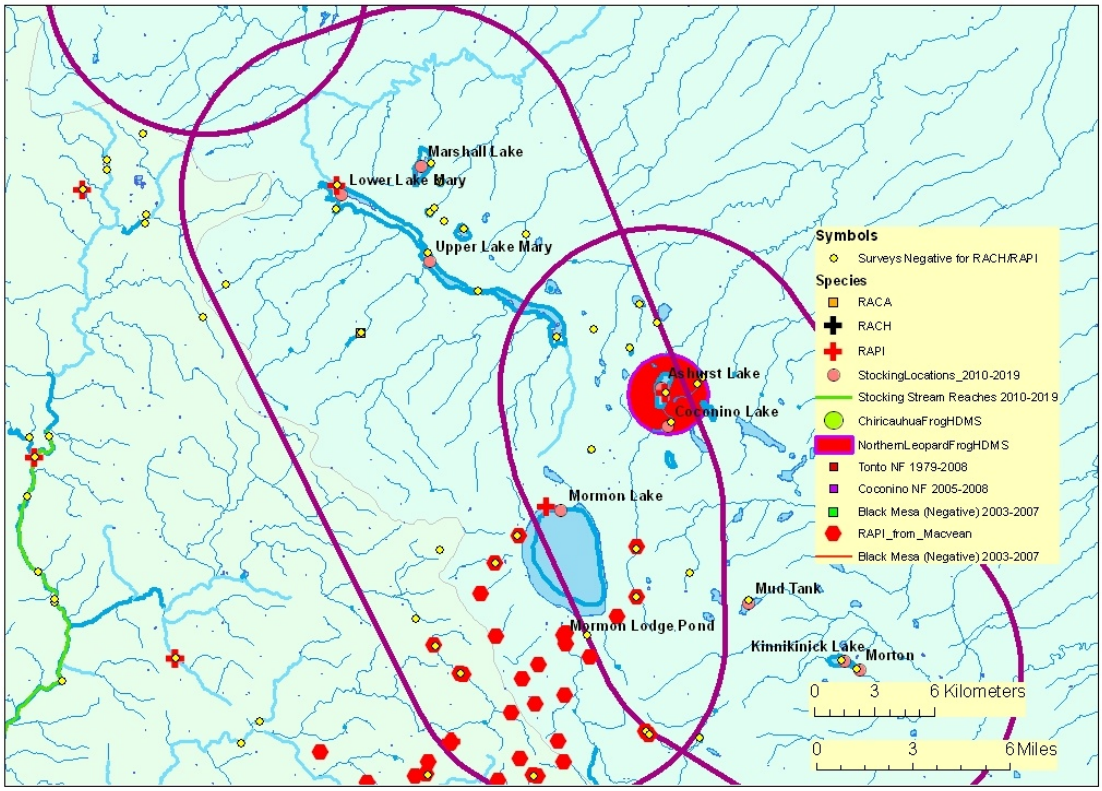

Figure 31. Map of Walnut Creek buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and

intermittent). The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Mormon Lodge Pond

Site Description

Mormon Lodge Pond is located about 40 miles southeast of Flagstaff next to the Mormon Lake Lodge in Mormon Lake Village. It is a small pond, and on average covers about 0.15 surface acres; it is located in the Mormon Lake basin just above Mormon Lake's high water mark (Figure 32), and is filled by runoff from the nearby area, water pumped from a nearby stock pond, and/or well water.

The pond is on private property owned by Forever Resort, but is managed as a fishery by the Department. When water levels and quality are sufficient to support fish, Mormon Lodge Pond is a popular fishing spot for local anglers and guests of the Mormon Lake Lodge Resort.

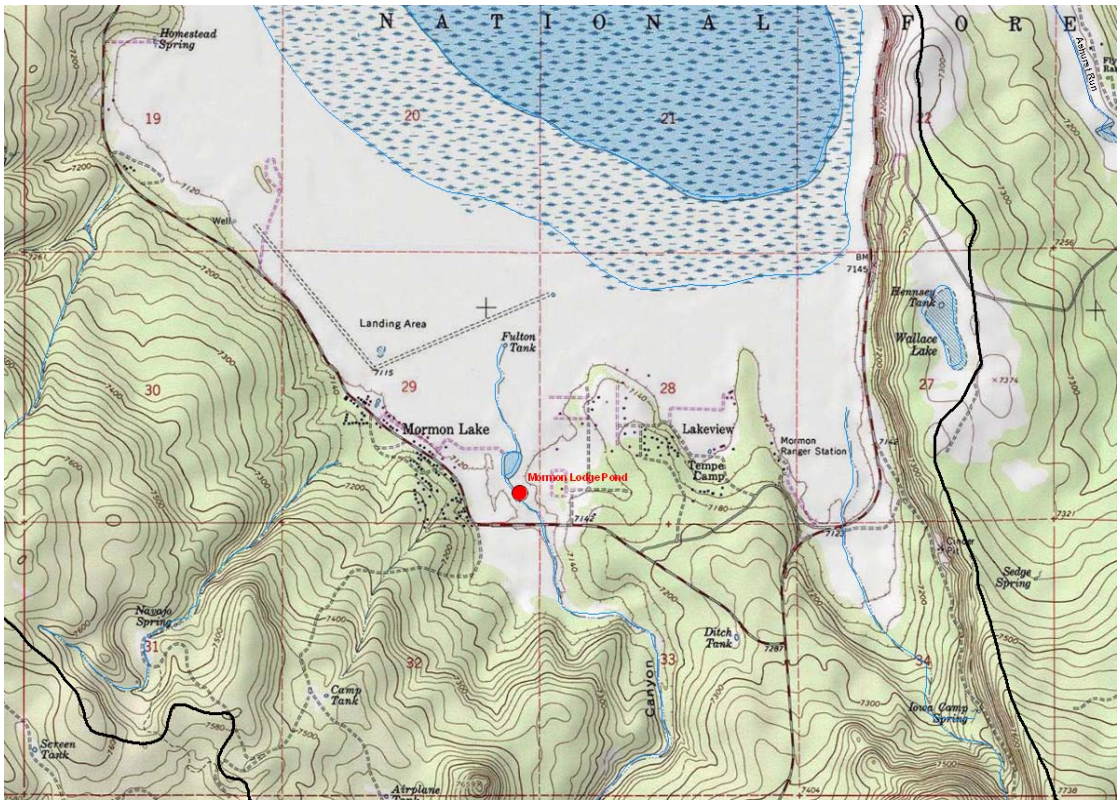

Figure 32. Mormon Lodge Pond topographic map.

Management of Water Body

Lake management emphasizes stocking of cold water species following precipitation events sufficient to support a fishery (Table 22). Mormon Lodge Pond is a popular fishing spot targeting cold water species. Rainbow trout are primarily stocked in the spring and early summer while temperatures and pH levels are sufficient to sustain trout. Stocking efforts typically end in June due to high pH and temperature levels. However this trout fishery can be marginal in some years, and the Department desires the ability to provide a secondary warm water fishery. The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Mormon Lodge Pond is for sport fish management with a desired concept of Intensive Use Fishery.

Table 22. Mormon Lodge Pond Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1992	1992	1	1,000
Cutthroat trout	1991	1992	2	23,000
Rainbow trout	1956	2008	83	142,736
Total			63	166,736

Proposed Action

The Department proposes to stock rainbow trout, bluegill sunfish and redear sunfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked each year from March to November; numbers of rainbow trout stocked may be from 0 – 4,500 annually.

Bluegill sunfish (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables) are proposed for stocking as needed at any time during the year, and at multiple times per season for establishment of a new warm water fishery, to augment the fishery once started, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Mormon Lodge Pond is within Mormon Lake Basin, and is filled by runoff from the area adjacent to the pond. It can also be filled by pumping water from a nearby stock pond or with well water. In the event of an overflow, the pond spills into Mormon Lake, which is a closed system.

Fish Movement

In the event of an overflow from Mormon Lodge Pond, fish would go to Mormon Lake. Because Mormon Lake does not spill the fish would go no further than the lake.

Community Description

Mormon Lodge Pond is currently stocked with rainbow trout. No fish surveys have been conducted at the pond, but anglers have not reported catching any species besides rainbow trout from the pond.

Consultation Species or Critical Habitat
Mormon Lodge Pond is a closed system with no opportunity for fish to escape and enter occupied fish habitat.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog
Local Analysis: Mormon Lodge Pond and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Mormon Lodge Pond or other stocking sites within the complex is high. Although Mormon Lodge Pond is a closed system, there are occupied northern leopard frog sites in the area of Mormon Lodge Pond and within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 4 of these sites; Lower Lake Mary (1963), Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993) or Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

Marshall Lake

Site Description

Marshall Lake is located off of Forest Road 182 on the Coconino National Forest adjacent to Lower Lake Mary (Figure 34 and Figure 35), about 15 miles southeast of Flagstaff. Spring runoff from the surrounding basin fills the lake in wet years. When watered, the lake on average covers about 35 surface acres with a maximum observed capacity of 70 to 205 surface acres when fully watered. The lake sits at an elevation of 7,112 feet and has an average depth of about 7 feet, with a maximum depth of about 14 feet at full capacity.

There are a number of primitive campsites near the east side of the lake. A 10 horsepower maximum is the motor size restriction. The northwest side of the lake is closed to vehicular traffic to protect waterfowl nesting habitat. No toilets, tables, or drinking water is available. Camping next to the lake is not allowed, but camping is allowed on the other side of the road.

Figure 33. Marshall Lake

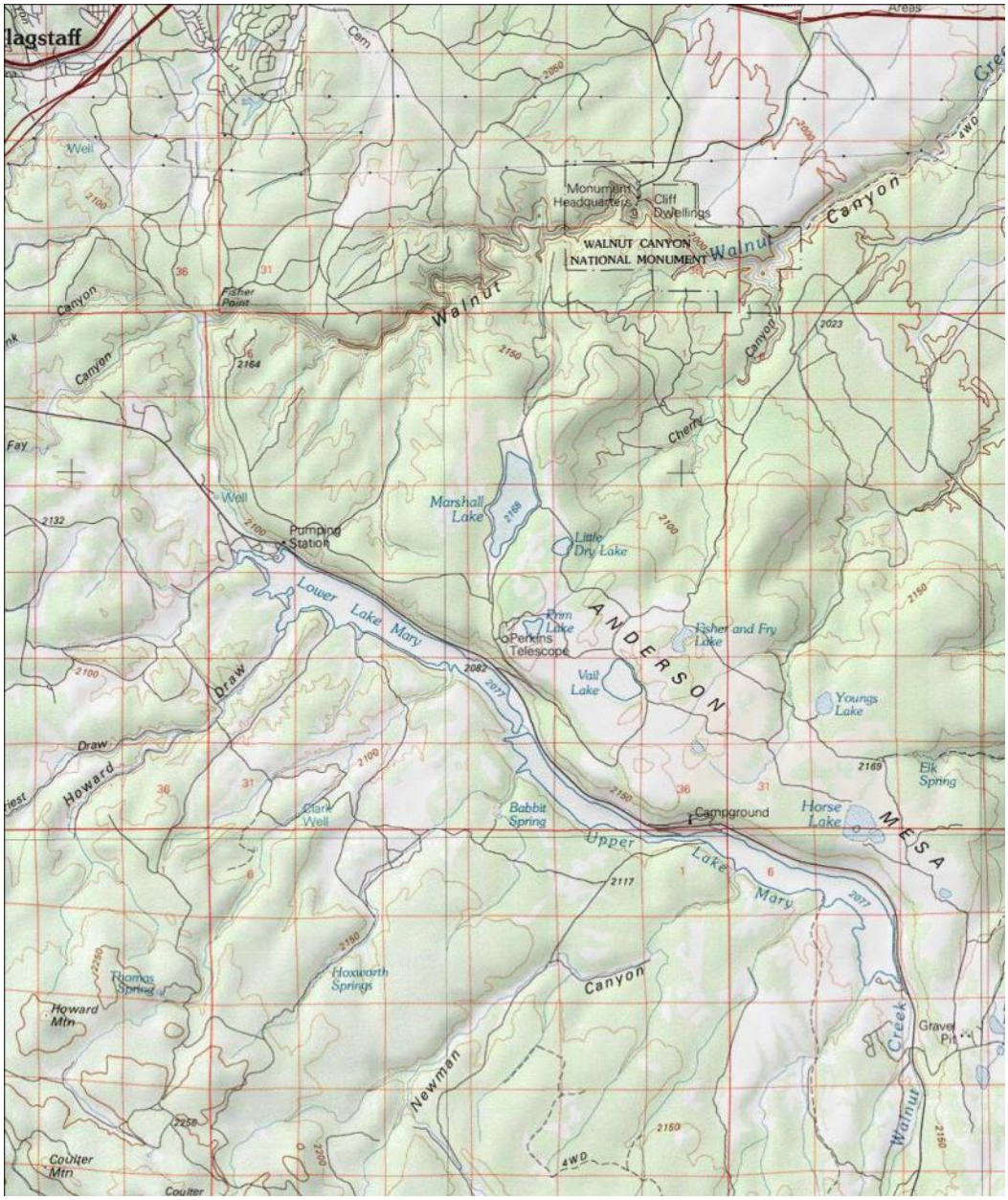

Figure 34. Upper and Lower Lake Mary and Marshall Lake

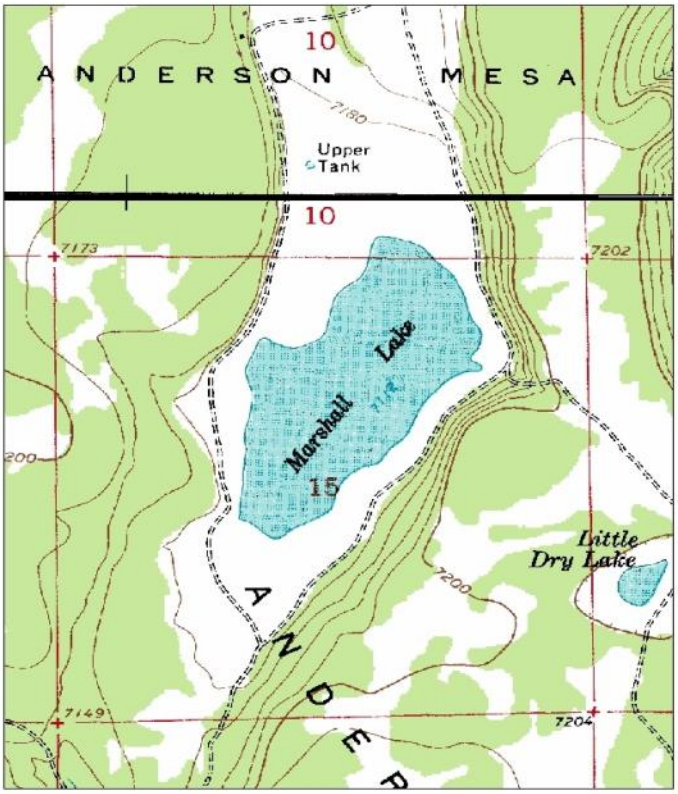

Figure 35. Marshall Lake topographic representation.

Management of Water Body

Historic lake management emphasized stocking of cold water species, with isolated yellow perch and channel catfish stockings following precipitation events sufficient to fill the lake adequately to support a fishery (Table 23). Over the years, Marshall Lake has been used as a temporary fishery relying on wet climactic cycles for water. Due to the large fluctuations in water level and lack of water permanence a new lake phenomenon occurs every time the lake refills. This situation creates a highly productive lake capable of producing large fish in a short amount of time. When full, the lake is a prime fly-fishing location. The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Marshall Lake is for sport-fish management with a desired concept of a basic yield featured species fishery.

Proposed Action

The Department proposes to stock rainbow trout, brook trout, and Arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked each year from March to November; numbers of rainbow trout stocked may be from 0 – 10,000 annually.

Fingerling brook trout would be stocked from March to June each year; numbers of brook trout stocked may be 0-1,000 annually.

Fingerling Arctic grayling would be stocked from March to June each year; numbers of brook trout stocked may be 0-1,000 annually.

Table 23. Marshall Lake Stocking History.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	2008	2	5,500
Channel catfish	1994	1994	1	1,500
Rainbow trout	1968	2009	79	244,957
Tadpole	1968	1968	1	500
Brook trout	2008	2008	1	252
Yellow perch	1941	1966	2	717
Total			85	249,880

Water Distribution / Connectivity

Marshall Lake usually has some water in it after spring runoff, but only contains enough water to support fish during wet years. After very wet years, or if multiple wet years occur in succession, the lake will hold enough water to maintain a sport fishery over winter, but during most years the lake experiences winter kill. According to the topographic map for the area, Marshall Lake would have to reach a level approximately 20 feet above its maximum observed elevation to spill into Lower Lake Mary. The surface of Marshall Lake at its highest observed elevation is at about 7112 feet. In 1993, it was the wettest year in recent history with high runoff, and Marshal Lake did not cross the road that leads to a ranch on the north side of the Lake at an elevation of about 7115 feet. Marshall Lake is located in a deep basin with a small watershed. The hillside on the downstream side is steep, rocky and shows no evidence of water flow (Figure 36 and Figure 37). There is no evidence the Lake has reached the approximately 7130 foot elevation necessary to spill; therefore Marshall Lake is considered a closed system.

Figure 36. Down slope side of Marshall Lake to Lower Lake Mary (seen in the background).

Figure 37. Upstream view of drop towards Lower Lake Mary

Fish Movement
Marshall Lake is a closed system with no opportunity for fish to escape.

Community Description
Marshall Lake was dry in the fall of 2009.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses

(resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog

Local Analysis: Marshall Lake and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Marshall Lake or other stocking sites within the complex is high. Although Marshall Lake is a closed system, there are occupied northern leopard frog sites within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 4 of these sites; Lower Lake Mary (1963), Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993) or Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

Upper Lake Mary

Site Description

Upper Lake Mary is located in the Coconino National Forest about 15 miles southeast of Flagstaff (Figure 34). The dam was constructed in 1941 and raised higher in 1952. It impounds approximately 6 mi of Walnut Creek, with an average of 800 surface acres and a maximum of 1228 acres. Walnut Creek is an ephemeral system that drains approximately 33,000 acres from

an area north of Mormon Lake to the southern end of Upper Lake Mary and flows mainly during spring runoff. Other ephemeral drainages flow into the lake from the west and south during runoff events. Spills occurring from Upper Lake Mary drain directly into Lower Lake Mary.

Lake Mary Narrows Recreation Area provides excellent access facilities for disabled anglers by means of paved lakeshore ramps. Two developed campgrounds, Lake View and Pine Grove, are nearby. There are two paved boat ramps at the parking area near the dam, and a lakeside picnic area and another boat ramp at Lake Mary Narrows Recreation Area, in addition to its paved fishing access ramps.

Management of Water Body

Upper Lake Mary is managed primarily as a self-sustaining warm water fishery. It is secondarily managed as a put-and-take rainbow trout fishery and a put-grow-and-take fishery for brown trout and cutthroat trout (Table 24). The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Upper Lake Mary is for sport fish management with a desired concept of warm water Fishery.

Table 24. Upper Lake Mary Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1936	1951	7	56,380
Bream	1937	1937	2	4,500
Brown trout	1949	1974	18	431,109
Channel catfish	1968	2001	32	369,969
Coho salmon	1973	1973	2	40,000
Cutthroat trout	1966	1967	2	60,360
Fathead minnow	1978	1987	1	10,000
Largemouth bass	1935	1951	13	99,800
Kokanee	1962	1962	3	150,862
Northern pike	1969	1980	13	314,280
Rainbow trout	1947	2002	139	4,644,123
Redear sunfish	1951	1951	3	40,000
Smallmouth bass	1942	1942	1	14,000
Walleye	1975	1990	13	3,548,519
Yellow bass	1979	1979	1	102
Total			250	9,784,004

Proposed Action

Channel catfish, rainbow trout, brown trout, brook trout, cutthroat trout, bluegill sunfish, and redear sunfish are proposed for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow trout, would be stocked from March to November each year depending on suitable water levels and quality as well as fish availability;

numbers of trout would be up to 160,000 fish annually. The primary goal would be to stock rainbow trout, however if other species including brown trout, brook trout or cutthroat trout became available, they may be stocked opportunistically; no more than a total of 160,000 trout would be stocked annually.

Catchable and sub-catchable channel catfish would be stocked from April to July each year; numbers of catchable channel catfish stocked may be from 0-10,000 annually.

Channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Walnut Creek is an ephemeral system that drains approximately 33,000 acres from an area north of Mormon Lake to the southern end of Upper Lake Mary, and flows mainly during spring runoff. Other ephemeral drainages flow into the lake from the west and south during runoff events. Spills occurring from Upper Lake Mary drain directly into Lower Lake Mary (Figure 38 and Figure 39).

Figure 38. Upper Lake Mary spillway

Figure 39. Downstream of Upper Lake Mary spillway looking at Lower Lake Mary

Fish Movement

The only fish movement occurring within the complex is the movement of fish over the spillway from Upper Lake Mary to Lower Lake Mary.

Community Description

Aquatic Species in Upper Lake Mary include bluegill, black crappie, channel catfish, yellow perch, walleye, yellow bass, northern pike, golden shiners, and fathead minnows according to the 2003 fish surveys and angler reports in Table 25 and Table 26 (Benedict et al. 2002[2]).

Table 25. Fish Sampled by Gillnetting in Upper Lake Mary June 2003

Species	Num. of fish	Catch per hour
Walleye	9	.084
Northern Pike	10	.093

[2] Report is Mis-titled. Work was actually conducted in June 2003.

Yellow Bass	4	.04
Black Crappie	1	.01
Channel Catfish	15	.14
Golden Shiner	33	.31

Table 26. Fish Sampled by Electrofishing in Upper Lake Mary June 2003

Species	Num. of fish	Catch per EFU (900 Seconds)
Walleye	7	.98
Northern Pike	3	.42
Yellow Bass	1	.14
Black Crappie	3	.42
Bluegill	1	.14
Yellow Perch	4	.56

Consultation Species or Critical Habitat
Upper Lake Mary spills into Lower Lake Mary, which is considered a closed system with no opportunity for fish to escape and enter occupied fish habitat (see Walnut Creek Complex Analysis).

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog
Local Analysis: Upper Lake Mary and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Upper Lake Mary or other stocking sites within the complex is high. Although

there are no historical records for northern leopard frogs from Upper Lake Mary itself, there are occupied northern leopard frog sites within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 4 of these sites; Lower Lake Mary (1963), Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993) or Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

Lower Lake Mary

Site Description

Lower Lake Mary is a 0-750 acre lake located on Walnut Creek, 10 miles southeast of Flagstaff (Figure 6). The dam was constructed in 1905. The lake receives runoff from several ephemeral drainages south and west of the lake and from Upper Lake Mary when it spills. During years when Upper Lake Mary spills (Figure 38 and Figure 39), the majority of the flow into the lake is from Upper Lake Mary.

Access to this lake is directly off Forest Highway 3 at the Lower Lake Mary Picnic Area and Boat Launch, which is only open during the summer. This day-use area is a great picnic location with of tables, and grills under ramadas.

Management of Water Body

Primary fishery is high intensity cold water put-and-take or put-grow-and-take rainbow trout fishery, depending on hatchery fish availably and watery quality and levels; the secondary management is for a warm water fishery (Table 27). Catchable, sub-catchable, and/or fingerling rainbow trout are stocked multiple times during the stocking season. The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Lower Lake Mary is for sport fish management with a desired concept of warm water/intensive use fishery.

Table 27. Lower Lake Mary Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	1969	1	50,000
Black crappie	1949	1959	4	1,989
Bluegill	1957	2008	9	34,474
Brown trout	1992	1992	1	522
Channel catfish	1957	2008	9	45,703
Largemouth bass	1948	1993	13	74,286
Northern pike	1965	1980	6	204,090
Rainbow trout	1966	2008	117	844,368
Redear sunfish	1991	1993	3	20,576
Total			163	1,276,008

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill sunfish, and redear sunfish for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow trout would be stocked from March to November each year; numbers of rainbow trout stocked may be from 0 – 120,000 annually.

Catchable channel catfish would be stocked from April to July each year; numbers of catchable channel catfish stocked may be from 0-5,000 annually.

Channel catfish (fingerlings, sub-catchables), bluegill sunfish (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub catchables) may be stocked as needed to augment the fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Lower Lake Mary sits on a fault system that causes much of its water to leak into the ground. As a result, it is an ephemeral system that rarely maintains water more than one year, except in high water high runoff years. When Lower Lake Mary spills, the water flows down Walnut Canyon to Santa Fe Dam where the flow stops and the water percolates into the ground (see Walnut Creek Complex Analysis).

Fish Movement

The only fish movement occurring within the complex is the movement of fish over the spillway from Upper Lake Mary to Lower Lake Mary and the movement of fish downstream of Lower

Lake Mary in Walnut Creek during spills approximately 15 miles to Santa Fe Dam where Walnut Creek then goes dry.

Community Description
In years where water levels are high, Lower Lake Mary may support populations of stocked rainbow trout along with any of the species found in Upper Lake Mary that may have been spilled over the Upper Lake Mary Dam. In the fall of 2009, the lake was essentially dry and no fish were present.

The most recent sampling data from Lower Lake Mary indicated a rainbow trout fishery was present with northern pike also being abundant prior to the lake drying up in 2007 (Table 28). Golden shiners and one black crappie were also collected by that survey.

Table 28. Lower Lake Mary 2005 Electrofishing/Creel Data.

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	42	205-383
Golden Shiner	5	51-100
Rainbow trout	90	229-530
Black Crappie	1	57

Lower Lake Mary held water for 4 years between the Fall of 1992 and the Fall of 1996; electrofishing surveys were conducted in 1993, 1994 and 1995. Table 29 provides the results from those sampling events.

Table 29. Relative abundance of fish sampled by species using electrofishing 1993-1995 during high water years.

Year	Black Crappie	Northern Pike	Rainbow Trout	Bluegill	Other*
1993	56.3%	11.9%	7.9%	7.3%	16.%6
1994	24.1%	26.5%	19.3%	19.3%	10.8%
1995	31.9%	41.8%	2.2%	1.1%	23.1%

* Other species sampled included brown trout, redear sunfish, yellow perch, walleye, largemouth bass, and golden shiner.

Consultation Specie or Critical Habitat
Lower Lake Mary is a closed system with no opportunity for fish to escape and enter occupied fish habitat.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog

Local Analysis: Lower Lake Mary and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Lower Lake Mary or other stocking sites within the complex is high. There is a historical record for northern leopard frogs from Lower Lake Mary from 1963. Although, northern leopard frogs were not observed during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993), there are occupied northern leopard frog sites within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 3 other sites; Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

WALNUT CREEK COMPLEX ANALYSIS

Mormon Lodge Pond (located inside the Mormon Lake Basin), Upper Lake Mary, Marshall Lake, and Lower Lake Mary make up the Complex. Mormon Lodge Pond, and Marshall Lake are closed systems. Upper Lake Mary receives runoff from a 30,000 acre watershed north of the Mormon Lake Basin and spills directly into Lower Lake Mary. When Lower Lake Mary spills, the water flows down Walnut Canyon 15 miles to Santa Fe Dam, where the water is impounded and percolates into the ground.

Water Distribution / Connectivity

Mormon Lodge Pond is within a closed basin and does not connect to Walnut Creek. Marshall Lake is also within a closed basin. Spills from Upper Lake Mary drain into Lower Lake Mary; Lower Lake Mary occasionally spills down Walnut Canyon. Since 1991, Lower Lake Mary has spilled twice, including in 1993, during an extremely wet year with high runoff. Outflow from Lower Lake Mary spills about 0.18 miles down its spillway into Walnut Creek. The water then flows down Walnut Canyon to Santa Fe Dam located near the eastern edge of Walnut Canyon National Monument. The flow ends at Santa Fe Dam (Figure 40) where the water percolates into the ground because of a series of faults. (S. Hedwall, FWS pers. com.). No water has been observed spilling from Santa Fe Dam over recent years. The entire Walnut Creek Complex is a closed system.

Fish Movement

The only fish movement occurring within the complex is the movement of fish over the spillway from Upper Lake Mary to Lower Lake Mary and the movement of fish downstream of Lower Lake Mary in Walnut Creek during spills to Santa Fe Dam where Walnut Creek then goes dry.

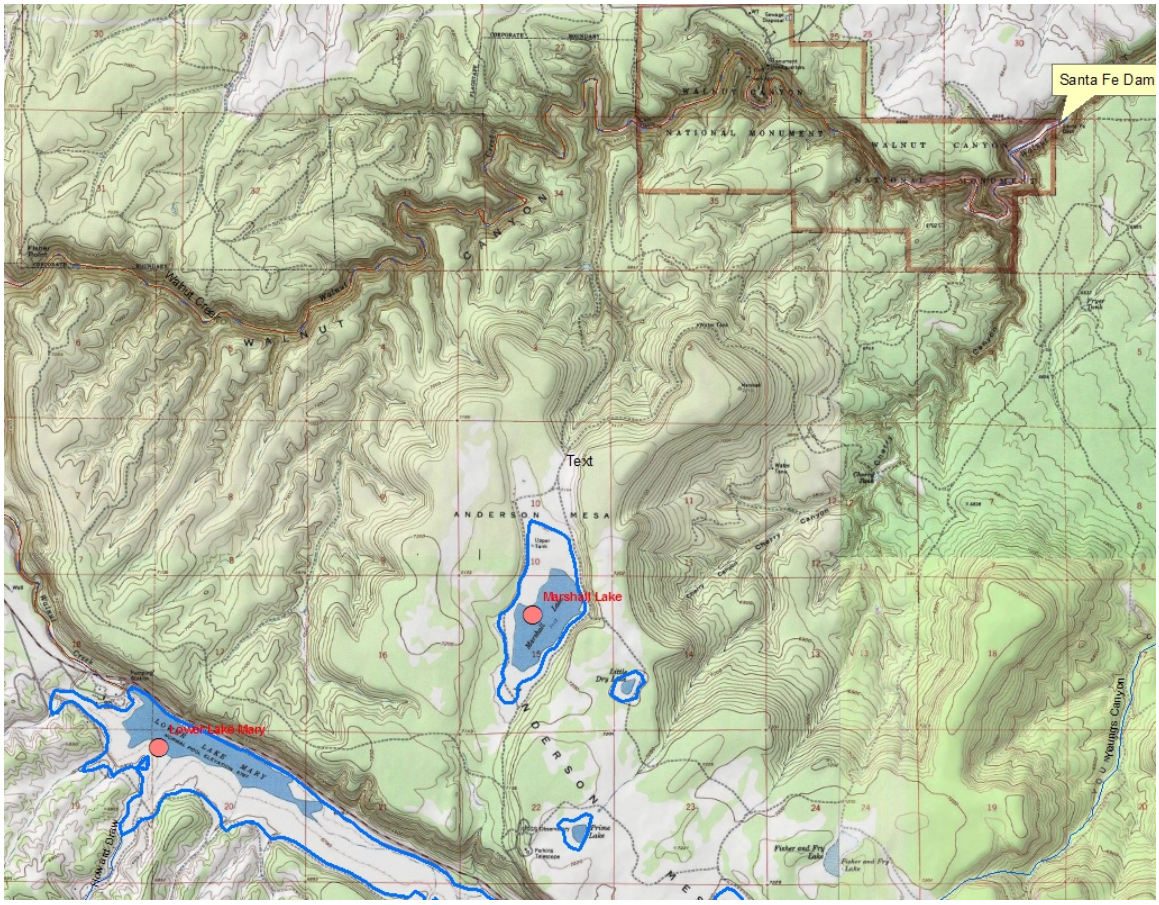

Figure 40. Santa Fe Dam location on Walnut Creek

Community Description

Aquatic Species in Walnut Creek complex include rainbow trout plus all of the species found in the only permanent water in the complex; bluegill, black crappie, channel catfish, yellow perch, walleye, yellow bass, northern pike, golden shiners and fathead minnows, along with the yellow bullhead found in the private pond near Double Springs Campground on the edge of Mormon Lake. Northern leopard frogs are currently found at Dairy Springs in the Mormon Lake Basin and outside of the complex on Anderson Mesa.

Consultation Species or Critical Habitat

The entire Walnut Creek Complex is considered a closed system, so there are no potential impacts to listed fish species.

Northern Leopard Frog

See Local and Broad Scale analyses under each stocking location.

LOWER LITTLE COLORADO RIVER ANALYSIS OF IMPACTS

Sub-Watershed Description

The Little Colorado River watershed covers approximately 21,706 mi^2 in northeastern and central Arizona and 5,337 mi^2 in northwestern New Mexico according to the NRCS National Watershed Boundary dataset. The perennial flows in the watershed occur in the upper 77.67 miles and lower 13.05 miles before joining the Colorado River (Benke and Cushing 2006). The Little Colorado River watershed consists of 47 reservoirs and 4 streams proposed for stocking. The Little Colorado River complex is separated into 9 drainages; from upstream to downstream they are as follows: West Fork Little Colorado River, Little Colorado River above Lyman Lake, Upper Little Colorado River, Schoen's Dam, White Mountain Lake, Chevelon Creek, Clear Creek, Jack's Canyon, and Canyon Diablo (Figure 41).

The West Fork Little Colorado River complex contains six lakes (White Mountain Reservoir, Lee Valley Lake, Mexican Hay Lake, River Reservoir, Bunch Reservoir, and Tunnel Reservoir) and two sections of stream (Little Colorado River at Greer and West Fork Little Colorado River at Sheep's crossing) that are proposed for stocking. Located in the eastern portion of the state this drainage collects run-off from Mt. Baldy and forms the uppermost headwaters of the Little Colorado River. Elevations of this drainage range from over 11,000 feet near the top of Mt. Baldy to 7,525 feet at its confluence with the Little Colorado River. The West Fork Little Colorado River drainage enters the Little Colorado River upstream of Lyman Lake. Proposed species for stocking include rainbow trout, apache trout, and arctic grayling.

The Little Colorado River above Lyman Lake complex contains six lakes (Pratt Lake, Carnero Lake, Hulsey Lake, Nelson Reservoir, Becker Lake, and Lyman Lake) that are proposed for stocking. This drainage drains downstream of the West Fork Little Colorado River drainage into Lyman Lake (an impoundment of the Little Colorado River itself). Rainbow trout, Apache trout, and Arctic grayling are proposed for stocking in this drainage.

The Upper Little Colorado River complex contains two lakes (Concho Lake and Little Ortega Lake) both of which are closed systems with no outlets or possibility of fish movement downstream. Proposed stocking includes rainbow trout, largemouth bass, bluegill, and channel catfish.

The Schoen's Dam complex contains six lakes (Woodland Lake, Mountain Recreation Complex, Rainbow Lake, Scott's Reservoir, Show Low Lake, and Fools Hollow Lake) and one stream (Show Low Creek) that are proposed for stocking. This drainage flows into Silver Creek and eventually into the Little Colorado River downstream of Lyman Lake. Rainbow trout, brook trout, cutthroat trout, Apache trout, channel catfish, bluegill, and largemouth bass are proposed for stocking.

The White Mountain complex contains four lakes (Sponseller Lake, Little Mormon Lake, Whipple Lake, Long Lake (Show Low) and one stream (Silver Creek) that are proposed for stocking. This drainage flows into White Mountain Reservoir (an impoundment of Silver Creek) at its downstream end. The confluence of Silver Creek and the Little Colorado River is downstream of Lyman Lake. Rainbow trout, Apache trout, and channel catfish are proposed for stocking.

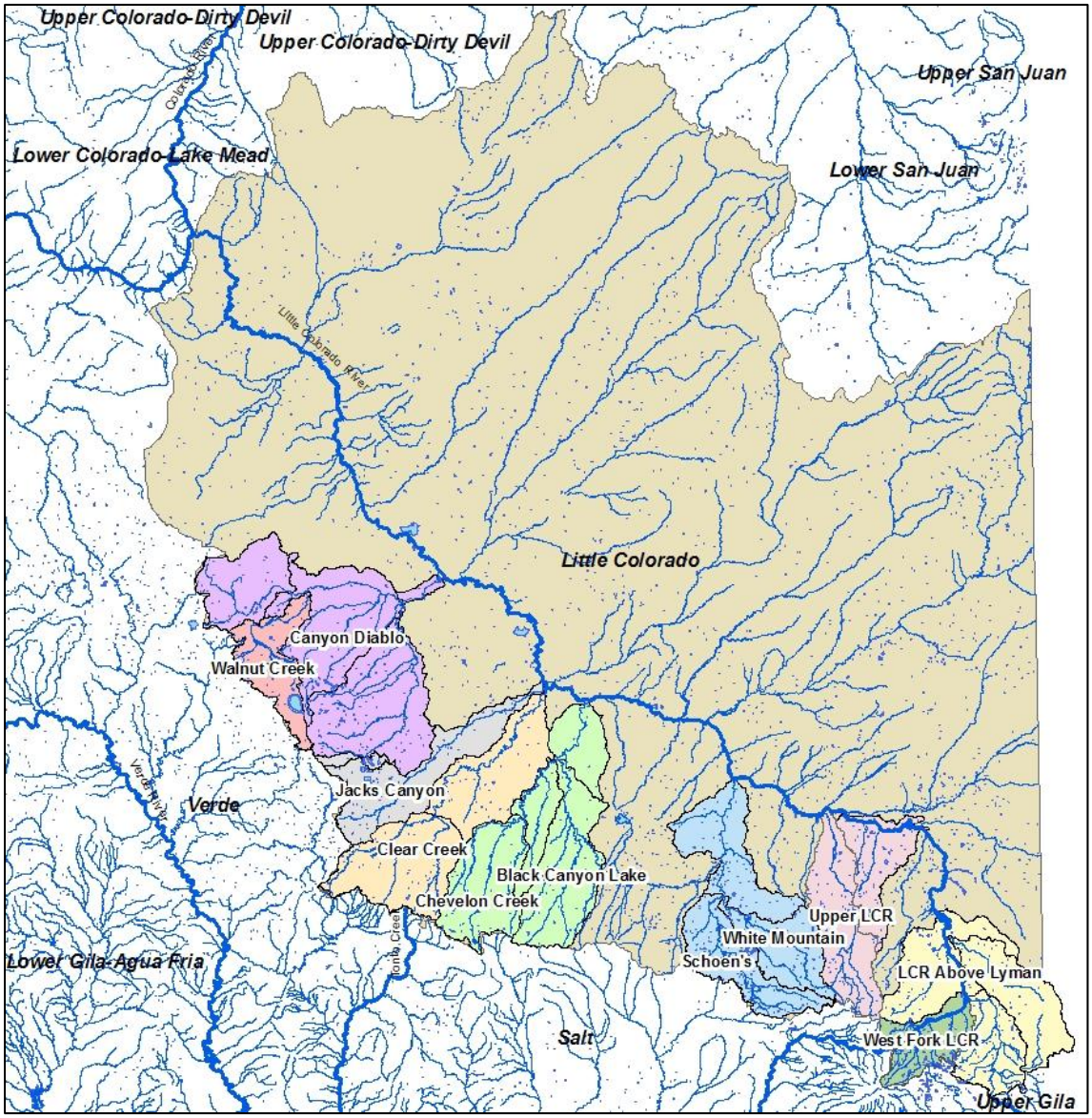

Figure 41. Map indicating the drainages of the Little Colorado River that contain complexes of waters (both lakes and stream reaches) proposed for stocking fish.

The Chevelon complex contains five lakes (Black Canyon, Long Tom, Willow Springs, Woods Canyon, and Chevelon Canyon Lake) that are proposed for stocking. The drainage flows into

Chevelon creek upstream of its confluence with the Little Colorado River. The Chevelon Creek confluence with the Little Colorado River is downstream of the confluence of Silver Creek and the Little Colorado River. Rainbow trout, brook trout, and Arctic grayling are proposed for stocking.

The Clear Creek complex contains four lakes (C.C. Cragin, Knoll Lake, Bear Canyon Lake, and Clear Creek Reservoir) that are proposed for stocking. Outflow from the entire drainage flows into Clear Creek Reservoir. Outflow from Clear Creek Reservoir connects with the Little Colorado River downstream of the Chevelon Creek Confluence. Rainbow trout and Arctic grayling are proposed for stocking.

The Jacks Canyon complex contains four lakes (Soldiers, Soldiers Annex, Long Lake, and Tremaine Lake) that are proposed for stocking. The entire drainage is a closed system with no possibility of fish movement or survival downstream. All water is retained within the drainage for irrigation and livestock watering needs. Rainbow trout, largemouth bass, channel catfish, bluegill sunfish, yellow perch, walleye and redear sunfish are proposed for stocking.

The Canyon Diablo complex contains eleven lakes that are proposed for stocking. Morton Lake, Kinnikinick Lake, Mud Lake flow into the LCR via Canyon Diablo and Frances Short Pond flows into San Francisco Wash before entering Canyon Diablo and finally the Little Colorado River. Ashurst and Coconino lakes are also a closed system with no possibility for fish movement downstream to Diablo Canyon. Mormon Lodge Pond, Upper Lake Mary, Lower Lake Mary, and Marshall Lake lie within the closed system of Walnut Canyon; flow goes subsurface below Santa Fe Dam, and there is no possibility for fish movement downstream. Of the lakes that are not within closed systems, rainbow trout, channel catfish, brown trout, brook trout, cutthroat trout, arctic grayling, bluegill sunfish, redear sunfish and largemouth bass are proposed for stocking.

Water Distribution/Connectivity

The Little Colorado River runs 573 km (356.05 miles) through northeastern Arizona from its headwaters in the West Fork LCR complex in the White Mountains of Arizona to its confluence with the Colorado River in Grand Canyon National Park (Figure 41). The Little Colorado River is ephemeral throughout most of its watershed. Exceptions include the headwaters and the final 13.05 miles of the river upstream from its confluence with the Colorado River. The final 13.05 miles) is fed by springs in redwall limestone, primarily Blue Springs, and provides base flow of approximately 198 ft^3/s (Minckley, 1990).

Since 1980, the U.S. Geological Survey has operated at least 17 flow gauges on tributaries and the main channel of the Little Colorado River between the dam at Lyman Lake and the Little Colorado River's confluence with the Colorado River. The dates the gauges have been operational varies, with some gauges (e.g., Clear Creek and Chevelon Creek) only being

operational for a short period of time while some of the main channel Little Colorado River gauges have been continuously operational. Complex relationships exist between bank storage, reservoir storage, water lost to seepage, unknown diversions, and unrecorded sources of water; and modeling the relationship between water sources and floods in the Lower Little Colorado River is not a simple additive process. The modeling process is also confounded by incomplete data sets and the large size of the watershed, and caution should be used when attempting to understand these relationships.

According to USGS 24K topographic maps, there are at least 30 large, named drainages that flow into the Little Colorado River between Lyman Lake and the Cameron gauge. Only five of those named drainages (Little Colorado River above Lyman Lake, Silver Creek, Chevelon Creek, Clear Creek, and Diablo Canyon) have locations that are being stocked, while 10 of those named drainages flow partially or completely through the Navajo Nation (Figure 42). Stocked drainages (at the 12-digit HUC level) comprise 1011 mi^2 which is 3.7% of the entire Little Colorado River watershed. Stocked drainages at the 10-digit HUC level comprise 4,582 mi^2 of watershed or 16.9% of the entire LCR watershed. Tribal ownership comprises 63.9 % of the land ownership within the Little Colorado River basin (ADWR 2009). Very little data exist regarding the current fishery management, historic fishery management or current distribution of native and non-native fishes within the majority of the Little Colorado River watershed that is managed by several Native American tribes.

Hydrograph data from the Cameron gauge (http://waterdata.usgs.gov/nwis/rt) along with available data from gauges on the Navajo Nation suggest that many floods recorded at Cameron originated on the Navajo Nation. Only two gauges (Moenkopi Wash, Dinnebito Wash) on the Navajo Nation have a long time series, and both appear to have contributed to recent floods (2001–2009, Figure 43). Moenkopi Wash and Dinnebito Wash are located downstream of Grand Falls and upstream of the gauging station at Cameron. It is suspected that Grand Falls is a natural barrier to downstream fish movement, although there is some evidence that fish may be able to pass over Grand Falls (Stone et al. 2007). When looking for sources of non-native fishes and without consideration of complicating factors of hydrology or biological limitations or distributions, logic would dictate that one should look to the closest and most proximal sources as having a higher likelihood of contribution non-native species in the lower Colorado River.

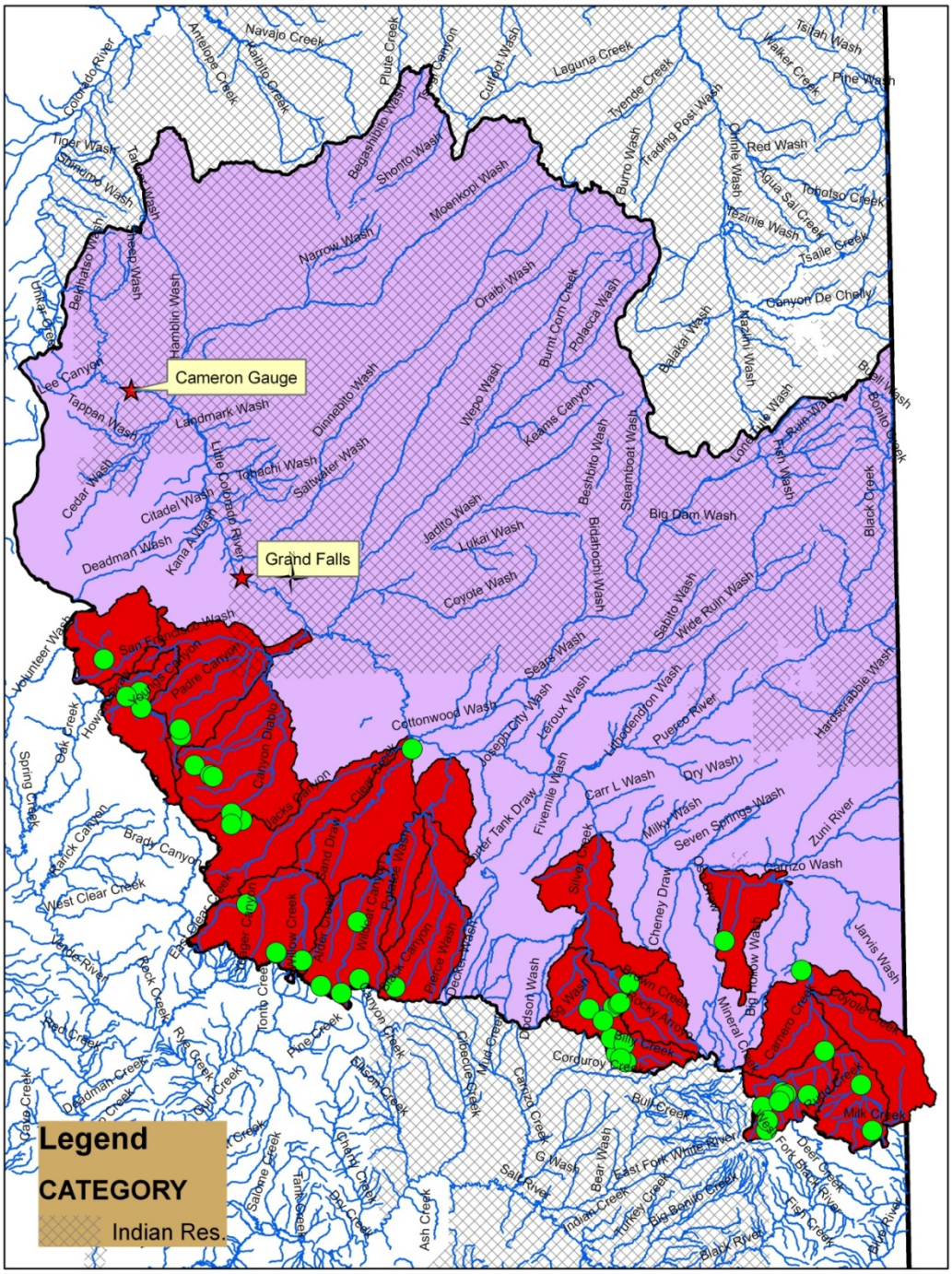

Figure 42. Little Colorado River watershed in Arizona.

Purple polygon is the LCR watershed; red polygons identify watersheds at a 10 digit HUC level containing the green dots which identify locations proposed for stocking. Crosshatch identifies Indian reservations.

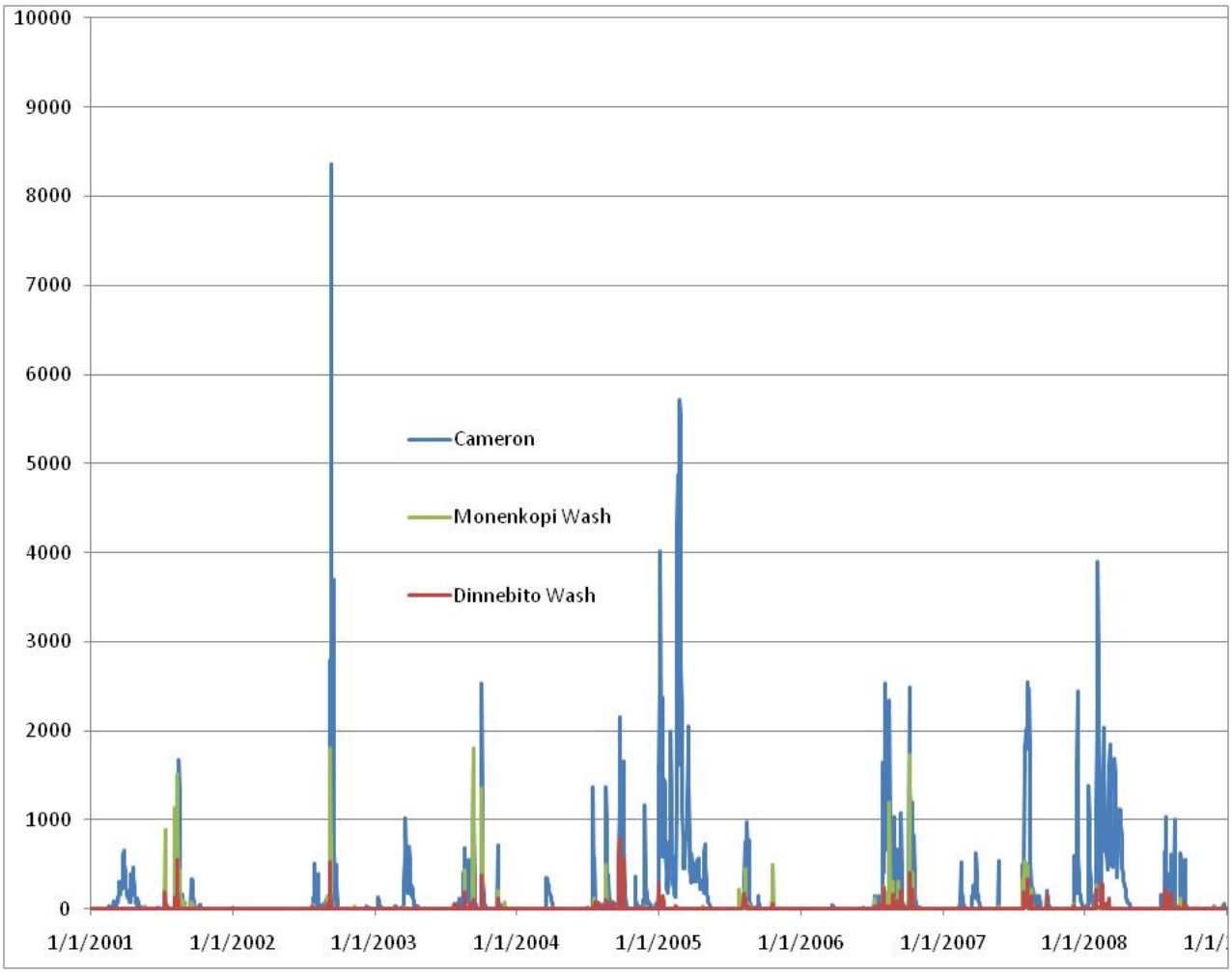

Figure 43. Flow data (cfs) from Cameron (Lower Little Colorado River main channel), Moenkopi Wash, and Dinnebito Wash (2001–2009.)

Moenkopi Wash and Dinnebito Wash are located 9 miles and 40.6 miles, respectively, upstream of Cameron.

Water Distribution/Connectivity Upstream of the Stocked Drainages

The West Fork Little Colorado River drainage consists of 5 main drainages (Hall Creek, West Fork Little Colorado River, Lee Valley Creek, East Fork Little Colorado River, and the South Fork Little Colorado River) forming the uppermost headwaters of the Little Colorado River. The West Fork Little Colorado River drainage is composed of 8 stocking sites in the headwaters of the Little Colorado River from upstream to downstream they are as follows Lee Valley Reservoir, Sheep's Crossing, Little Colorado in Greer, River Reservoir, Tunnel Reservoir, Bunch Reservoir, White Mountain Reservoir, and Mexican Hay Lake. Lyman Lake is approximately 27

miles downstream from the confluence of the South Fork Little Colorado River and the Little Colorado River (the downstream most outflow from the drainage).

The Little Colorado River above Lyman Lake drainage contains four stocking sites that can potentially make hydrologic connections to the Little Colorado River. These stocking sites from upstream to downstream most they are as follows Hulsey Lake, Nelson Reservoir, Becker Lake, and Lyman Lake. Lyman Lake sits at the downstream end of the drainage. From Lyman Lake the Little Colorado River has permanent flow for about 15 miles to the city of St. Johns then is mostly intermittent to Silver Creek approximately 80 miles downstream.

The Upper Little Colorado River drainage contains two proposed stocking sites. These sites, Little Ortega and Concho Lake, form two distinct areas due to their isolation. Little Ortega has no hydrologic connections to the Little Colorado River. Concho Lake is functionally a closed system with no possibility of fish escapement downstream.

The Schoen's Drainage contains 6 reservoirs and 1 section of creek that can potentially make hydrologic connections with the Little Colorado River. These stocking sites from upstream to downstream most are as follows Woodland Lake, Rainbow Lake, Scott's Reservoir, Show Low Lake, Show Low Creek, and Fools Hollow Lake. From the Confluence of Show Low Creek and Silver Creek it is about 30 + miles to the confluence of Silver Creek and the Little Colorado River.

The White Mountain Drainage contains one reservoir and one section of creek that can potentially make hydrologic connections to the Little Colorado River. These stocking sites from upstream to downstream most are as follows Little Mormon Lake and Silver Creek. Both of these stocking sites flow down to White Mountain Lake. From White Mountain Lake Silver Creek continues approximately 30 miles to its confluence with the Little Colorado River (43 miles upstream of the Chevelon confluence and 52 miles upstream of the Clear Creek Confluence).

The Chevelon drainage contains 5 reservoirs that can potentially make hydrologic connections to the Little Colorado River. From upstream to downstream they are as follows Willow Springs Lake, Woods Canyon Lake, Long Tom, Chevelon Canyon Lake, and Black Canyon Lake. Black Canyon Lake at the downstream end of the drainage spills to the West Fork of Black Canyon to Black Canyon to Chevelon Creek 13.5 miles upstream of the Little Colorado River and 47.9 miles downstream of Chevelon Canyon Lake. The confluence of Chevelon Canyon and the Little Colorado River is about 45 miles downstream from the confluence of Silver Creek and the Little Colorado River. Perennial flow continues from the confluence of Chevelon Creek and the Little Colorado River for 9.1 miles to the confluence with Clear Creek.

The Clear Creek drainage contains 4 reservoirs that can potentially make a hydrologic connection to the Little Colorado River. From upstream to downstream most they are as follows C.C. Cragin, Knoll Lake, Bear Canyon Lake, and Clear Creek Reservoir. Out flow from C.C. Cragin, Knoll Lake, and Bear Canyon Lake all end up in Clear Creek Reservoir. Outflow from Clear Creek Reservoir travels approximately 1.25 miles to the Little Colorado River which is about 80 miles upstream of Grand Falls on the Little Colorado River.

The Jacks Canyon complex likely is a closed system with very limited or no possibility for fish movement or survival downstream of the drainage as described in the complex analysis. The confluence of Jacks Canyon with the Little Colorado River is 1.6 miles downstream of the Clear Creek confluence.

The Diablo Canyon drainage contains four reservoirs that can potentially make hydrological connection with the Little Colorado River. From upstream to downstream most they are as follows Mud Lake, Kinnikinick Lake, Morton Lake, and Frances Short Pond. Diablo Canyon is connected to the Lower Little Colorado River approximately 128 miles from the confluence of the Little Colorado River and the Colorado River. Diablo canyon meets with the ephemeral Lower Little Colorado River approximately 24 miles upstream of Grand Falls and about 114 miles upstream of Blue Springs.

Fish Movement

Three of the 10 complexes proposed for stocking in this consultation in watersheds that flow into the Little Colorado River are closed systems and stocked fish exposure to the lower Little Colorado River will not occur. Only three of the remaining 7 complexes (Schoen's Dam, White Mountain and Canyon Diablo) are proposed for stocking fish species with biological life histories that allow for the potential for transport, exposure, and potential impacts to humpback chub in the lower LCR. These species include channel catfish, largemouth bass, redear sunfish, bluegill sunfish, rainbow trout and brown trout. Other species proposed for stocking in the watershed such as Apache trout, Arctic grayling or brook trout are either in closed systems or have never been detected in the intervening waterways or in the Little Colorado River.

Within the Schoen's Dam complex, six reservoirs are proposed for stocking one or more of these species: Woodland Lake, Rainbow Lake, Show Low Lake, Fools Hollow Lake, Scott's Reservoir, and Mountain Meadow Recreational Area (Table 36). Within the White Mountain Complex, four reservoirs and 1 stream reach are proposed for stocking, of these only Clear Creek and Little Mormon Lake are open systems, and only Little Mormon Lake is proposed to have channel catfish stocked.

Within the Canyon Diablo complex, four reservoirs are proposed for stocking one or more of these species: Mud Lake, Kinnikinick Lake, Morton Lake, and Frances Short Pond.

Much of the Little Colorado River Basin is periodically connected to the lower Little Colorado River through flooding. Any fish escaping stocked location would have to travel approximately 70 – 150 miles through heavily sediment-laden flood waters, over Grand Falls (191 ft tall), and over Chute falls to reach the occupied humpback chub habitat and critical habitat in the lower Little Colorado River and mainstem Colorado River.

Community Description

Lower Little Colorado River Fish Assemblage near the Confluence with the Colorado River.

The Little Colorado River between its confluence with the Colorado River and Atomizer Falls, 15.5 km (9.63 miles) upstream of the confluence, is home the largest spawning aggregation of the endangered humpback chub in the Grand Canyon (Figure 44). Because of the importance of this reach, it has likely been the most intensively sampled reach of river in the state over the past two decades, with intensive fish sampling occurring since 1977. Sampling data from the Little Colorado River in the Grand Canyon Monitoring and Research Center database spans from 1977 to 2008. The most intense sampling in the Little Colorado River did not begin until after 1990. Numerous (57,664) samples using multiple gears have been collected (Table 30 and Table 31). Since 1977, a total of 289,571 fish comprising 18 species have been captured in the lower Little Colorado River (Table 32 and Table 33).

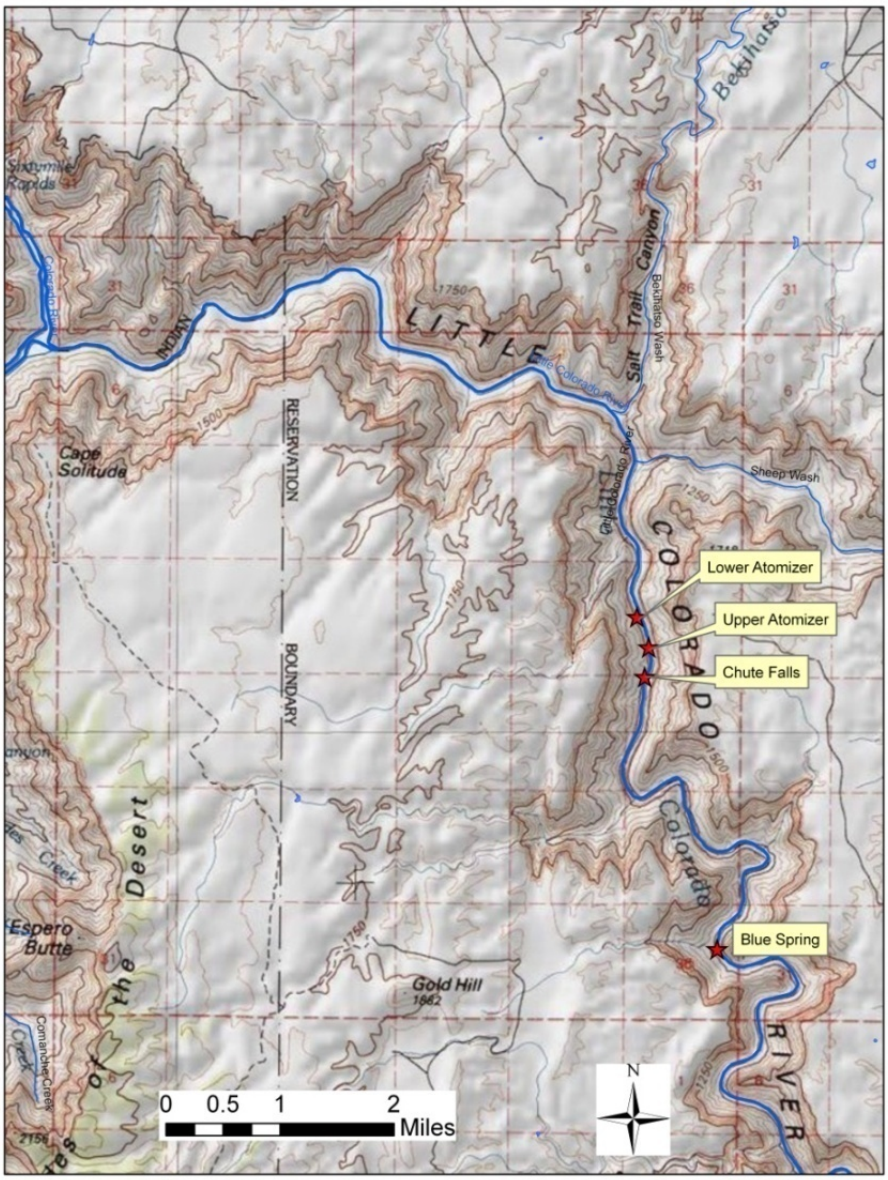

Figure 44. Lower Little Colorado River showing perennial reach from Blue Spring to the Colorado River.

Table 30. Summary of Gear used by year in the Lower Little Colorado River (1977-2008). Codes defined in Table 31.

	AHP	AN	BL	BS	DH	DIP	EL	GFH	HB	HL	HN	HND	HS	HS2	HS4	HW	LS	LT	MB	MH	MHS	MT	SEN	SG	SS	TD	TK	TL	TM	TN	TRA	total
1977											1																					1
1978		1		9			1				1						2													2		16
1979				1													3													4		8
1980											3											66			136	207						412
1981		1									6											161			191	192						551
1984																									33	7						40
1985		4				3					3														6	11						27
1986		7				10																			5	14						36
1987											142														34	85						261
1988		3		30		18					399																			179		629
1989		2				4					454														9	177						646
1990		6		50		5					356						7					88								72		584
1991	1066	15		9	12	88				87	1519	1	3				2			138		278	53		159					111	207	3748
1992	2231	1				146					792									689		521	56		401		1	1		2	194	5035
1993	2002	10	11	3		1734					1200							102		1400		832	128	2	161					5	141	7731
1994	2037	10	1			1023					945						5		1	903		406	43		246						103	5723
1995	1200	11									788							156		383		32			222			16			55	2863
1996				8							750									364		439		2	2			4				1569
1997				3							753									183		371							15	1		1326
1998	69			3				586			431	2								349		217	26					7		8	1	1699
1999	134							497												415		487	12				6	1			4	1556
2000												1	2680							20		22	6				6	1				2736
2001	8								1058				1278			7				300							6	58				2715
2002								376	1801				335	36	17					181	180											2926
2003								479	126				1995																		2	2602
2004		2						299	133				2162																			2596
2005								269	170				1800								360											2599
2006								312	183				2067																			2562
2007		1						269	300				2160																			2730
2008								274	368				1095																			1737

Total samples 57664

Table 31. Gear codes used on Table 1.

GEAR_TYPE	DESCRIPTION
AN	Angling
AQ	Aquarium net
BI	Bi-directional Trap Net - In
BL	Bag seine, large, 30' X 6' X 1/4" (1/8" bag mesh)
BO	Bi-directional Trap Net - Out
BP	Backpack electrofishing
BS	Bag seine, small, 15' X 6' X 1/8" (1/32" bag mesh)
BX	Bag Seine, Very Large, 100' x 8' x 1/8"
DH	D-Hoop Net
DIP	Dip net, unspecified
DNL	Dip net, Large Mesh, 3/16"
DNS	Dip net, small mesh, 1/16"
DR	Drift net, invert
DT	Trammel Net, Drifting, Unspecified
EL	Electrofishing
FR	Frame net
GF	Gill net, floated, record area sampled
GFH	Hoop net, AGF, large, 3' diameter, 1/4" mesh
GM	Gill net, 100' X 6' X 2"
GN	Gill Net, Unspecified
GP	Gill net, 100' X 6' X 1.5"
GX	Gill net, 100' experimental
GY	Gill net, 50' X 6' X 1.5"
GZ	Gill net, 60' experimental
HB	Hoop Net, Baited
HDL	Hydrolab
HDLL	Hydrolab with logger
HL	Hoop net, large, 4' diameter
HM	Hoop net, medium, 3' diameter
HM2	Hoop net, medium, 3' diameter, 2" square mesh
HM3	Hoop net, medium, 3' diameter, 3" square mesh
HN	Hoop net, 3' X 5' X 3/8" X 40' Without Wings
HND	Hand trap
HS	Hoop net, small, 2' diameter
HS2	Hoop net, small, 20" diameter, 2" square mesh
HS4	Hoop net, small, "Miller net turtle trap", 3' diameter, 4" square mesh
HW	Hoop Net, With 40' Wings, 3' x 5' x 3/8"

ICM	ICM meter
KS	Kick screen
KSE	Kick seine, 3' X 3' X 1/32"
LL	Long line (traught line)
LS	Seine, Larval
LT	Light Trap, Larval
MB	Minnow Trap, Baited
MG	Minnow Trap, Ganged
MH	Mini-hoop net, 50cm X 4' X 3/8"
MHS	Mini-hoop Net, Bait in Dennis Stone's Socks
MN	Minnow Trap
MT	Minnow trap
PP	Dip Net, Larval
SA	Seine, 10' X 3' X 1/8"
SB	Seine, 30' X 4' X 1/4"
SC	Seine, 15' X 4' X 1/8"
SEN	Seine, unspecified
SG	Seine, 30' X 5' X 1/4"
SL	Straight Seine, Large, 30' X 6' X 1/16"
SLT	Slat trap, square, Mississippi style 48" long, 24" x 1/5" openings
SPG	Spear Gun
SS	Straight Seine, Small, 15' X 4' X 1/8"
ST	Trammel Net, Used as Seine
SU	Surber
SX	Straight Seine, Very Large, 50' x 6' x 1/16"
T50	Trammel net, 50' X 6' , unknown mesh
T75	Trammel net, 75' X 6' , unknown mesh
TD	Trammel Net, Drifted
TF	Trammel net, floated, record area sampled
TK	Trammel net, 75' X 6' X 1" X 12"
TL	Trammel net, 75' X 6' X 1.5" X 12"
TM	Trammel net, 50' X 6' X 1" X 12"
TN	Trammel net, 50' X 6' X 1.5" X 12"
TRA	Trammel Net, Unspecified
TRN	USFWS transect
TS	Trammel Net (set)
TW	Trammel net, 75' X 6' X 0.5" X 10"
TY	Trammel net, TK with attached floats
TZ	Trammel net, TL with attached floats

Table 32. Species and number of fish captured by year in the Little Colorado River 1977-2008 (codes defined in Table 33).

	BBH	BHS	BNT	CCF	CRP	FHM	FMS	FRH	GSF	GSH	HBC	PKF	RBS	RBT	RGK	RSH	SPD	STB	SUC	TAD	YBH
1977											6										
1978				1	18		14				707										
1979					1		2				59			1							
1980	3	270		9	10	164	36				1174	3					2008		465		
1981	3	540		6	3	1195	80				1069	159					2092		382		
1984	1	12		6	16	1	253				610						5				
1985		595		35	3	4	227				398			4			7		1		
1986		149		12	4	1	228				682			1			6		1		
1987		106		15	15	1	207			1	684			6			146				
1988		172		20	3	12	232				1091			4			285				
1989		427		86	2	32	343				2075		1	4		2	502		3		
1990		280	2	20	345	25	346	1			1811	185	5	6			669	1	8	29	
1991	3	2101	3	146	54	46	1182		1		11056	11	3	48			5903		300		2
1992	3	1560	2	85	69	122	827	12			9652	30	3	10			3480		1		3
1993		3716	2	29	87	95	1686				20919	3	7	77			9141		59		1
1994	4	3120	3	64	45	793	1642		1		13810	4	8	43	1		4686		2		3
1995	3	1083	2	46	22	197	1004				4694	6	15	30			1374		145		9
1996		987		10	109	1898	331				592	107		11		51	1358		2		
1997		54		14	76	1185	157				253	549		3		121	451	1			1
1998	5	118		27	48	206	93				1205	18		17		70	533				1
1999		165		16	21	45	205				784	9		13		222	1043				4
2000	3	589		30	89	517	77				1901	8		21		46	1266				54
2001	28	338		34	98	1927	996		1		7492	11		12		131	2318				58
2002	21	1818		20	279	944	1206				9141	8	1	13		45	3227				36
2003	33	959		42	343	425	909		1		4155	19		3		199	5149				29
2004	66	916		33	43	786	689		1		7507	103		12		169	13161				
2005	77	501		43	220	425	332		1		4984			1			13919				
2006	147	1578	1	27	155	4021	697		2		6986	11		1		50	10428				
2007	149	4251		21	67	440	1329	1	1		7105	31		1		41	5272				
2008	52	3400		11	2	209	958				4915	2					3610				

Total fish 289571

Table 33. Species codes used on Table 32.

SPECIES_CODE	COMMON_NAME	GENUS	SPECIES
BHS	BLUEHEAD SUCKER	CATOSTOMUS	DISCOBOLUS
BBH	BROWN NULLHEAD	AMEIURUS	MELAS
BNT	BROWN TROUT	SALMO	TRUTTA
CCF	CHANNEL CATFISH	ICTALURUS	PUNCTATUS
CRP	COMMON CARP	CYPRINUS	CARPIO
FHM	FATHEAD MINNOW	PIMEPHALES	PROMELAS
FMS	FLANNELMOUTH SUCKER	CATOSTOMUS	LATIPINNIS
FRH	FLANNELMOUTH/RAZORBACK HYBRID		
GSF	GREEN SUNFISH	LEPOMIS	CYANELLUS
GSH	GOLDEN SHINER	NOTEMIGONUS	CRYSOLEUCAS
HBC	HUMPBACK CHUB	GILA	CYPHA
PKF	PLAINS KILLIFISH	ZEBRINUS	FUNDULUS
RBS	RAZORBACK SUCKER	XYRAUCHEN	TEXANUS
RBT	RAINBOW TROUT	ONCORHYNCHUS	MYKISS
RGK	RIO GRANDE KILLIFISH		
RSH	RED SHINER	CYPRINELLA	LUTRENSIS
SPD	SPECKLED DACE	RHINICHTHYS	OSCULUS
STB	STRIPED BASS	MORONE	SAXATILIS
SUC	UNIDENTIFIED SUCKER	N/A	N/A
TAD	TADPOLE		
YBH	YELLOW BULLHEAD	AMEIURUS	NATALIS

Fish Assemblages in the Colorado River (Glen and Grand Canyons)

The confluence of the Little Colorado River and Colorado Rivers is 76 miles downstream of Glen Canyon Dam. The intentional and unintentional stocking of nonnative fish in the Colorado River began long before the 1900s, and the ratio of non-natives to natives was high before the construction of Glen Canyon Dam (USGS 2005). It is likely that channel catfish was the most abundant species in the Colorado River within Glen and Grand Canyons prior to the construction and filling of Glen Canyon Dam. The Grand Canyon Monitoring and Research Center maintains a database of fish observations in the Colorado River spanning the years 1978–2008. Multiple gears types have been utilized to capture 195,146 fish comprising 36 species (Table 34 and Table 35).

Table 34. Species and number captured by year in the Colorado River from 1978–2008 (species codes defined in Table 35).

	SPECIES_CODES																	
Year	BBH	BGS	BHS	BKC	BKT	BNT	CCF	CRP	CTT	FHM	FMS	FRH	GSF	GSH	HBC	LMB	MOS	PKF
1978		1	17		19	6	16	508			54		1			2		
1979																		
1980			41		7	1		64	6	106	16				72			
1981	1		158		6	5		101	7	589	144				326			4
1984			9		121	64	11	549	1	129	311				42			
1985			354		150	240	13	911	2	3688	784			4	421	2		3
1986			107		41	115	6	431	1	277	358			1	3			
1987			134		35	1		8		398	104				196			
1988			197		228			52		117	358			2	16			
1989			292		8			1		180	137				5			
1990			15		41	45	18	120		56	45				106			21
1991	2		230		3	612	54	937		392	871	2			1042			29
1992	3	22	493	2	10	599	103	991		2911	1478	2	2		1191	23	10	52
1993	3	2	2747	3	3	303	169	473		2911	2944	1	6	1	7701	12	24	17
1994			2231		1	4		25		6405	938		1		1329			61
1995		2	325	3	1	20	195	377		3523	723		6		718	31	12	97
1996			339			15	2	81		3204	736		4		594			135
1997			11			20	2	62		492	537				118			50
1998			42			131		32		263	481		1		345			8
1999			20			95	3	42		57	106				303			2
2000	2		2716			1535	25	669		7428	2986		2		337	8		39
2001	2		58			328	21	63		15	496				443			
2002	3		90			645	31	393		356	1324				222			311
2003	2		342			929	23	664		940	2599		1		1130			230
2004	57		450			732	41	466		1556	3642		2		2085			368
2005	103		2117			290	63	492		2994	6266		1		3412			88
2006	119	1	2429			101	169	843		3995	7298		5		1960		217	449
2007	28		1068			68	6	128		1390	1678		2		586			164
2008			157			6		2		654	348				3			8

	SPECIES_CODES (continued from previous page)																		
Year	**RBT**	**RGK**	**RSH**	**RSS**	**RTC**	**SHR**	**SMB**	**SPD**	**STB**	**SUC**	**TFS**	**TRT**	**UID**	**UIF**	**UIS**	**UTC**	**WAL**	**YBH**	**TOTAL**
1978	378																		624
1979	2																		0
1980	88							6											319
1981	180		10					70		386			3						1810
1984	2520							30	2		1								1270
1985	8181							805		2		1				1		2	7383
1986	4208							151		7									1498
1987	625							778										1	1655
1988	3975							639	1	5									1615
1989	508							264		33									920
1990	4317							38	1	14		3	1						524
1991	7494							1409	18	191			118				1		5911
1992	5342		425					1300	17	341	61		68				2		10106
1993	6071		127					4366	63	1080	7		2408						25371
1994	3840							1774	3	37			1						12810
1995	3292		495	1	2			1985	80	11	18		4						8629
1996	6460		21					1845	1	12								1	6990
1997	4641		20					86											1398
1998	4549		43					397					1					1	1745
1999	4030		11					89										1	729
2000	13025	1	51					5784	17	110			4						21714
2001	9119		3					7	2										1438
2002	7032		28					1527	4	8			1					1	4944
2003	17260		17					1614	2	679			2					12	9186
2004	13114		24					4319	1	107			4	1				5	13860
2005	7442		276			1	5	3733	59	43	1			1	79			9	20033
2006	4217		858				3	3797	137	19				18	40		1		22459
2007	2796		18					2372		1			1		6		3		7519
2008	1234		8					1350							149		1		2686
																		Total	195146

Table 35. Species codes used on Table 34.

SPECIES_CODE	COMMON_NAME	GENUS	SPECIES
BGS	BLUEGILL	LEPOMIS	MACROCHIRUS
BHS	BLUEHEAD SUCKER	CATOSTOMUS	DISCOBOLUS
BKC	BLACK CRAPPIE	POMOXIS	NIGROMACULATUS
BKT	BROOK TROUT	SALVELINUS	FONTINALIS
BNT	BROWN TROUT	SALMO	TRUTTA
BTC	BONYTAIL CHUB	GILA	ELEGANS
CCF	CHANNEL CATFISH	ICTALURUS	PUNCTATUS
CRA	CRAYFISH	N/A	N/A
CRP	COMMON CARP	CYPRINUS	CARPIO
CSF	COLORADO SQUAWFISH	PTYCHOCHEILUS	LUCIUS
CUT	CUTTHROAT TROUT	ONCORHYNCHUS	CLARKI
FHM	FATHEAD MINNOW	PIMEPHALES	PROMELAS
FMS	FLANNELMOUTH SUCKER	CATOSTOMUS	LATIPINNIS
FRH	FLANNELMOUTH/RAZORBACK HYBRID		
GSF	GREEN SUNFISH	LEPOMIS	CYANELLUS
GSH	GOLDEN SHINER	NOTEMIGONUS	CRYSOLEUCAS
HBC	HUMPBACK CHUB	GILA	CYPHA
LMB	LARGEMOUTH BASS	MICROPTERUS	SALMOIDES
MOS	MOSQUITO FISH	GAMBUSIA	AFFINIS
NOP	NORTHERN PIKE		
PKF	PLAINS KILLIFISH	ZEBRINUS	FUNDULUS
RBS	RAZORBACK SUCKER	XYRAUCHEN	TEXANUS
RBT	RAINBOW TROUT	ONCORHYNCHUS	MYKISS
RCH	RAINBOW/CUTTHROAT HYBRID	ONCORHYNCHUS	MYKISS/CLARKI
RGK	RIO GRANDE KILLIFISH		
RSH	RED SHINER	CYPRINELLA	LUTRENSIS
RTC	ROUNDTAIL CHUB	GILA	ROBUSTA
SDS	SAND SHINER		
SHR	SHINER	CYPRINELLA	LUTRENSIS
SMB	SMALLMOUTH BASS	MICROPTERUS	DOLOMIEU
SPD	SPECKLED DACE	RHINICHTHYS	OSCULUS
STB	STRIPED BASS	MORONE	SAXATILIS
SUC	UNIDENTIFIED SUCKER	N/A	N/A
TAD	TADPOLE		
TFS	THREADFIN SHAD	DOROSOMA	PETENENSE
USU	UTAH SUCKER	CATOSTOMUS	ARDENS
UTC	UTAH CHUB		
VRC	VIRGIN RIVER CHUB	GILA	SEMINUDA
VSD	VIRGIN SPINEDACE	LEPIDOMEDA	MOLLISPINIS
WAL	WALLEYE		
WOU	WOUNDFIN	PLAGOPTERUS	ARGENTISSIMUS
WSU	WHITE SUCKER	CATOSTOMUS	COMMERSONII
YBH	YELLOW BULLHEAD	AMEIURUS	NATALIS
YPE	YELLOW PERCH	PERCA	FLAESCENS

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and northern leopard frog effects analysis was provided for both the site specific and broad-scale analysis within each complex analysis previously and will not be discussed in this section because there is no likelihood for their occurrence in the lower portion of the Little Colorado River.

Humpback Chub and Critical Habitat
The Little Colorado River between its confluence with the Colorado River and Atomizer Falls, 15.5 km (9.63 miles) upstream of the confluence, is critical habitat for the largest spawning aggregation of the endangered humpback chub in the Grand Canyon. Because of the importance of this reach, intensive fish sampling has occurred for over three decades in this reach. Humpback chub have been documented historically in the LCR below Atomizer and Chute falls. More recently, translocations of young chub and natural movement of marked chub have resulted in their occurrence above Chute Falls.

Critical habitat is designated in the Colorado River from Nautiloid Canyon to Granite Park in the Grand Canyon. Critical Habitat is designated in the Little Colorado River from river mile 8 (below Atomizer Falls) downstream to the confluence with the Colorado River. Known constituent elements include water, physical habitat, and biological environment as required for each particular life stage for each species. Biological environment is the only aspect of Critical Habitat with potential to be affected.

Potential impacts

The stocking of the proposed 12 non-native species within the Little Colorado River Basin has coincided with intensive sampling of the Lower Colorado River since 1977. Data from these efforts provide no evidence that stocked species have survived and been transported into humpback chub critical habitat. While possible, it is unlikely that these species survive the violent turbid floods and immense drop at Grand Falls. If humpback chub in the lower Little Colorado River or the Colorado River were exposed to fish stocked upstream in the Little

Colorado River watershed potential impacts could include predation of on small size classes of humpback chub and competition of all size classes of humpback chub with adult stocked fish and any progeny of stocked fish.

Although the proposed species have been stocked in the Little Colorado River Basin for over three decades during which the lower Little Colorado River has been intensely sampled, there is no evidence of movement of the 12 proposed stocked fish species from the 47 reservoirs and 4 streams to the Lower Little Colorado River downstream of Grand Falls. Of the 12 species proposed for stocking in the Little Colorado River watershed, only 6 species (channel catfish, largemouth bass, bluegill, redear sunfish, rainbow trout and brown trout) are stocked in the drainages where escapement is a likely possibility (Table 36).

Any stocked fish surviving the approximately 70–150 mile journey from stocked locations to the lower Little Colorado River would be subject to heavily sediment-laden floods and the drop over Grand Falls (191 ft. tall). It is unlikely that any salmonids, bluegill sunfish, redear sunfish, or largemouth bass could survive the journey, and it is likely that few if any channel catfish survive.

Table 36. Stocking complex summary information. Proposed fish species with biological life histories that may have a higher potential for transport, exposure, and potential impacts to humpback chub in the lower LCR are highlighted.

Stocking Complex	**Number of waters**	**Species Proposed for Stocking**	**Connectivity**	**Reservoirs with proposed species of concern**
West Fork LCR Complex	6 reservoirs + 2 stream reaches	ONAP, ONMY, THAR	Open	
LCR above Lyman Complex	6 reservoirs	ONAP, ONMY, THAR	Open	
Upper LCR Complex	2 reservoirs	ONMY, MISA, LEMA, ICPU	Closed system	
Schoen's Dam Complex (proposed stocking locations in Schoen's and White Mountain complexes both flow into Silver Creek)	6 reservoirs + 1 stream reach	ONMY, ONCL, SAFO, LEMA, ONAP, ICPU, MISA	Open	**Woodland:** ICPU, LEMA, ONMY **Rainbow:** ONMY, ICPU, LEMA, (MISA - protocol/catastrophic) **Show Low:** ONMY, SAFO, ONCL, ONAP, ICPU, (LEMA - protocol/catastrophic) **Fools Hollow:** ONMY, ONAP, ONCL, SAFO, ICPU Scott's Reservoir: ONMY, ICPU, LEMA Show Low Creek : ONMY Mountain Meadow : ONMY, LEMA
White Mountain Complex (proposed stocking locations in Schoen's and White Mountain complexes both flow into Silver Creek)	4 reservoirs + 1 stream	ONMY, ONAP, ICPU	3/5 closed (Only Little Mormon Lake & Silver Creek are open)	Little Mormon Lake: ICPU Silver Creek: ONAP, ONMY
Chevelon Creek Complex & Black Canyon Lake	5 reservoirs	ONMY, SAFO, THAR	Open	
Clear Creek Complex &	4 reservoirs	ONMY, THAR	Open	

Stocking Complex	Number of waters	Species Proposed for Stocking	Connectivity	Reservoirs with proposed species of concern
Clear Creek Reservoir				
Jacks Canyon Complex	4 reservoirs	ONMY, MISA, ICPU, LEMA, PEFL, SAVI, LEMI	Most likely a Closed system	
Canyon Diablo Complex	6 reservoirs	ONMY, ICPU, SATR, SAFO, THAR, ONCL, LEMA, LEMI, MISA	2/6 closed (only Ashurst / Coconino lakes are closed)	**Mud Lake:** ONMY, ICPU **Kinnikinick Lake:** ONMY, ICPU, SATR, SAFO, THAR, ONCL **Morton:** ONMY, ICPU **Frances Short:** ONMY, ICPU, LEMA, LEMI, MISA
Walnut Creek Complex (Walnut Creek is a closed system within the Canyon Diablo Complex)	5 reservoirs	ONMY, SAFO, THAR, ICPU, MISA, PEFL, LEMA, LEMI, SATR	Closed system	

Stone et al. (2007) describes the presence of red shiners, common carp, and black bullheads just downstream of Grand Falls and suggests that they originated from upstream. The interpretation of these data were based on the assumption that Atomizer and Chute falls were sufficient drops to act as upstream fish barriers. Since the time of that publication, five marked humpback chub have traveled upstream over these suspected fish barriers (Stone et al., 2009b). While some of the non-native species documented in the area above and below Chute Falls by Stone et al. (2007) may have originated from upstream and survived transport over the falls, it is also possible that they originated from downstream locations. Stone et al. (2007) did not find any of the 11 species proposed for stocking in the upstream watershed near Grand Falls when sampled in 2005. However, channel catfish and rainbow trout were known to occur above Chute Falls from prior surveys. It is possible that the catfish or rainbow trout moved downstream from stocked locations or remnant reproducing populations in the watershed, but equally possible that they came from known existing populations in the Little Colorado River by migrating over Chute Falls. Channel catfish might have migrated upstream over Chute Falls similar to the way the marked humpback were able. With respect to rainbow trout, it is possible they moved downstream over Chute Falls, but also possible that they have routinely migrated upstream over Chute Falls or come from rainbow trout lakes on the Navajo Reservation that join the LCR below Grand Falls where they would not have to traverse that 190 foot drop.

Stone et al. (2007) report on pools surveyed above and below Grand Falls in June and July of 2005 following flood flows during the previous winter. That report mentioned Clear Creek Reservoir (127 km upstream of Grand Falls) and Chevelon Creek (141 km above the falls) as presumably the closest sources of non-native fishes. Furthermore, of the 6 species stocked into open systems in this watershed, none were found by Stone et al. (2007) immediately above or below Grand Falls, and only 2, channel catfish and rainbow trout were found further downstream but above Chute Falls (presumably in the perennial reach between Blue Spring and Chute Falls). However, that report failed to identify other sources of non-native fishes downstream of Grand Falls such as those found in Moenkopi Wash watershed. On the Navajo Reservation, two lakes, White Mesa Lake and Cow Springs Lake are located approximately 88 km from the confluence of Moenkopi Wash and the Little Colorado River, entering the LCR downstream from Grand Falls. According to the Navajo Nation website, these lakes offered fishing opportunities for stocked rainbow trout and channel catfish as recently as 2009 and likely harbor other non-native fish species.

Only 3 of the 12 species proposed for stocking in this basin have been captured in the Lower Little Colorado River since 1977, these include rainbow trout, channel catfish, and brown trout. A self-sustaining population for each of these three species is found within the main channel of the Colorado River with easy access to occupied and critical habitat for humpback chub in the lower LCR up to and including Atomizer Falls. These self-sustaining populations are described below.

Rainbow trout

Rainbow trout have been stocked in the Grand Canyon since around 1930. Immediately after Lake Powell filled, rainbow trout were stocked below Glen Canyon Dam. Self-sustaining populations of rainbow trout persist throughout Glen, Marble, and Grand Canyons, and rainbow trout are most densely populated upstream of the confluence of the Colorado and Little Colorado Rivers (River Mile 61, Figure 45). Rainbow trout have been captured throughout the 15.5-km (9.63 mile) reach of the Lower Little Colorado River and were most frequently captured near its confluence with the Colorado River. Length histograms of rainbow trout provide no evidence of young rainbow trout in the Little Colorado River (Figure 46), suggesting there is no local recruitment or a self-sustaining population of rainbow trout in the Little Colorado River. It is most likely that all rainbow trout in the Little Colorado River originate from the self-sustaining population in the main channel of the Colorado River, which has both adult and young rainbow trout (Figure 47) because it is closer in proximity than locations proposed for trout stocking upstream in the Little Colorado River watershed, and has a constant connectivity to the Little Colorado River.

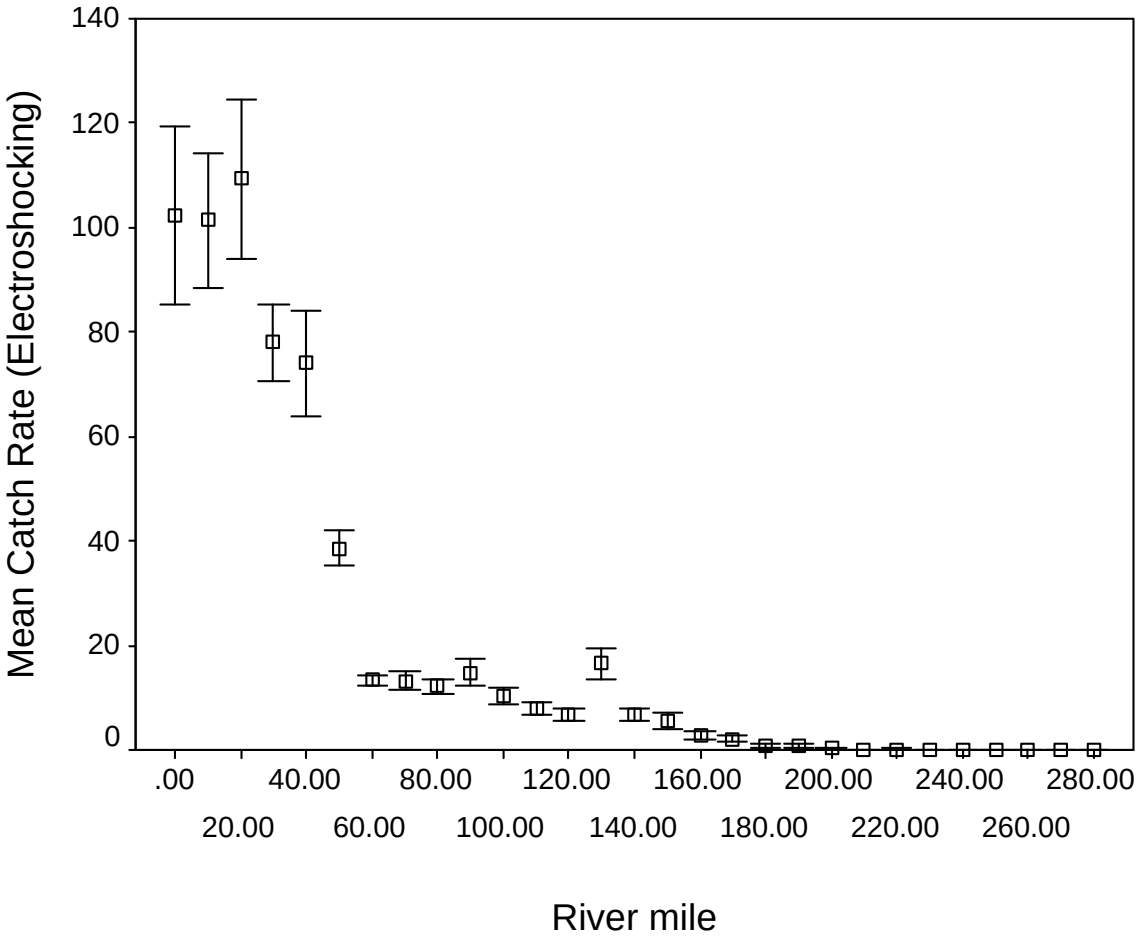

Figure 45. Rainbow trout mean catch per unit effort (electroshocking, fish/hour, 95% CI) by river mile in the Colorado River (Lees Ferry to Lake Mead 1991–2008). The Little Colorado River is located at river mile 61.

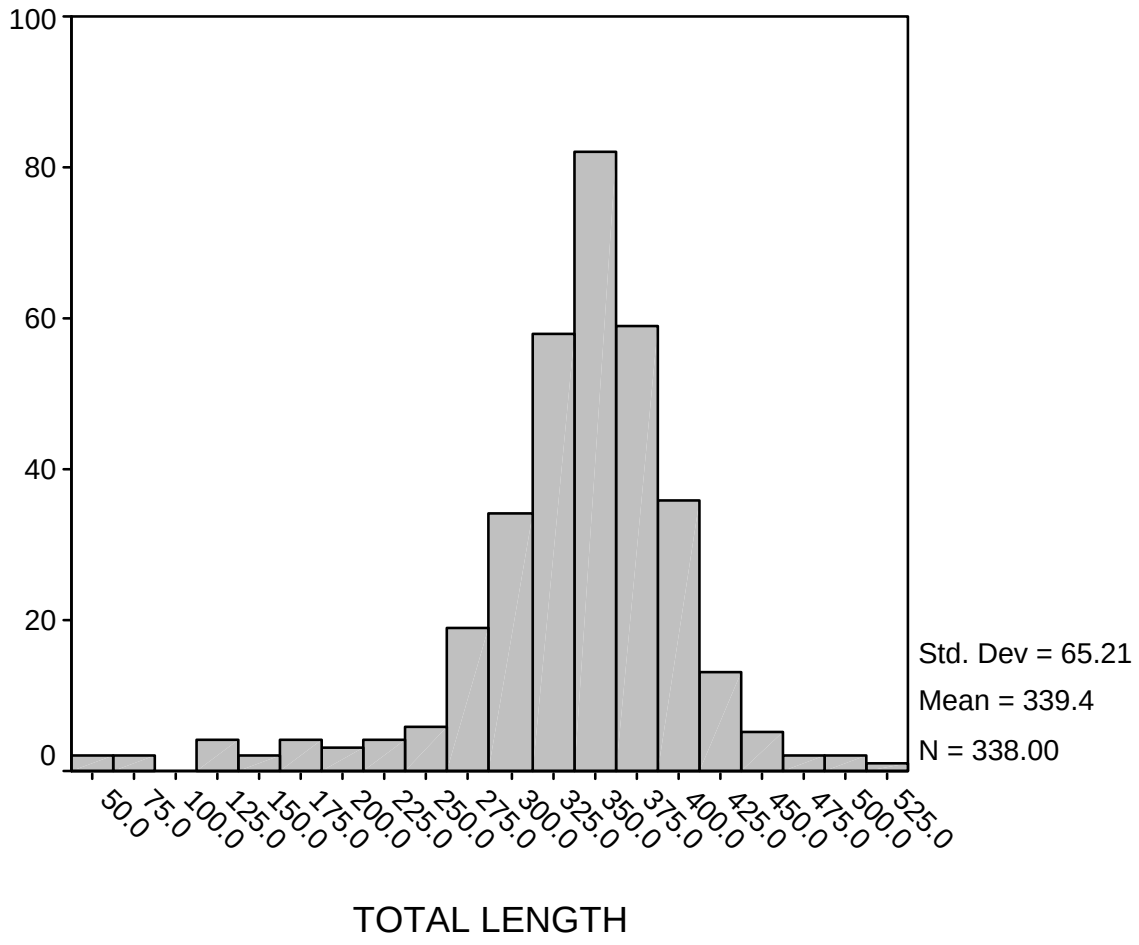

Figure 46. Length distribution of rainbow trout captured in the Lower Little Colorado River (1977–2008). The y-axis is the number of fish captured, and Total Length is measured in mm.

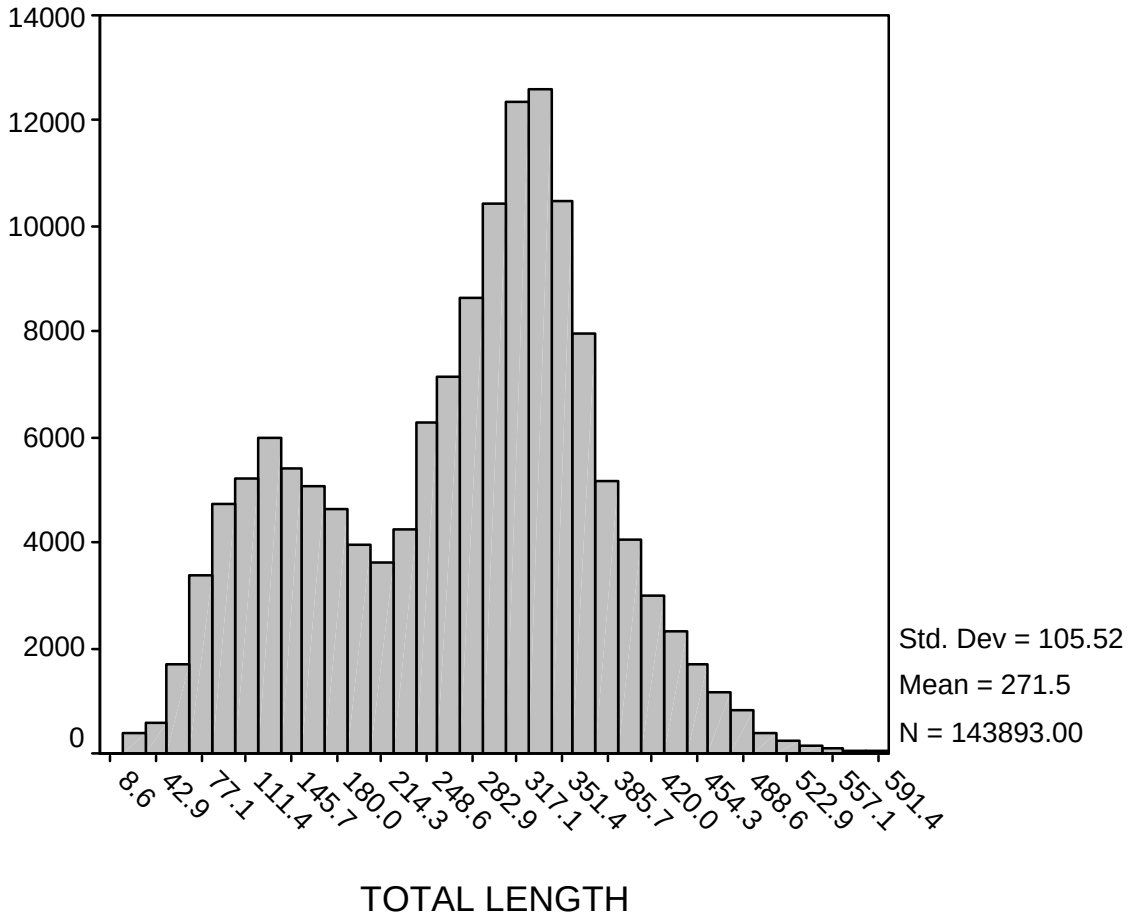

Figure 47. Length distribution of rainbow trout captured in the Colorado River (Lees Ferry to Lake Mead, 1991–2008). The y-axis is the number of fish captured, and Total Length is measured in mm.

Brown trout

Few brown trout have been captured in the Little Colorado River, and all but three of these were captured near the confluence of the Little Colorado and Colorado Rivers (Figure 48). Only one brown trout has been captured in the LCR since 1995. Brown trout were first stocked near Bright Angel Creek in 1923. Brown trout continue to be most densely populated in the Colorado River near Bright Angel Creek (River Mile 85, Figure 49). This area is located only 24 miles downstream of the confluence of the Colorado and Little Colorado Rivers, and it is likely that the few brown trout captured in the Little Colorado River originated in the main channel of the Colorado River or in Bright Angel Creek. Only one location not considered a closed system is proposed for stocking brown trout upstream in the little Colorado River watershed; Kinnikinick Lake in the Canyon Diablo drainage.

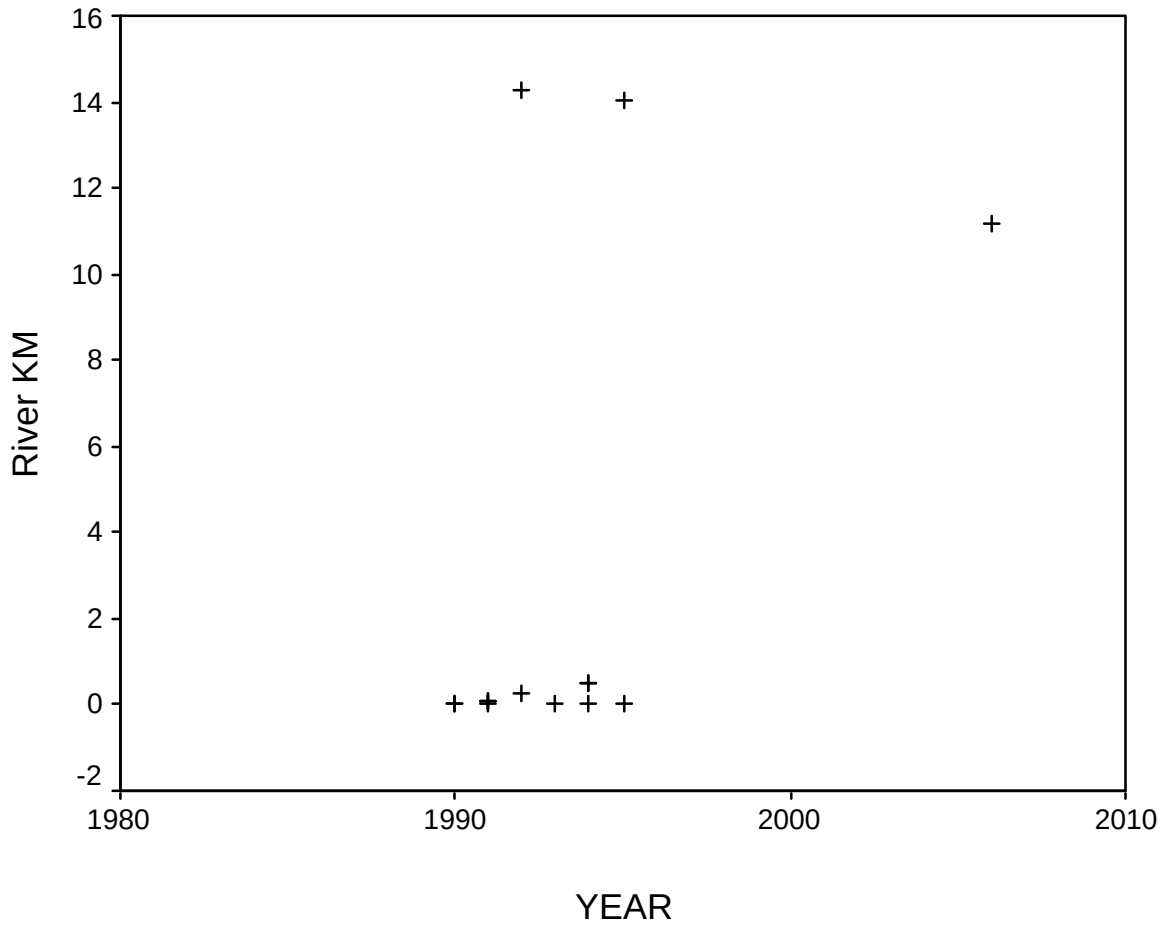

Figure 48. Distribution of brown trout captured in the Lower Little Colorado River. River KM 0 is the confluence of the Little Colorado and Colorado Rivers and River KM15.5 is at Atomizer Falls (1977-2008).

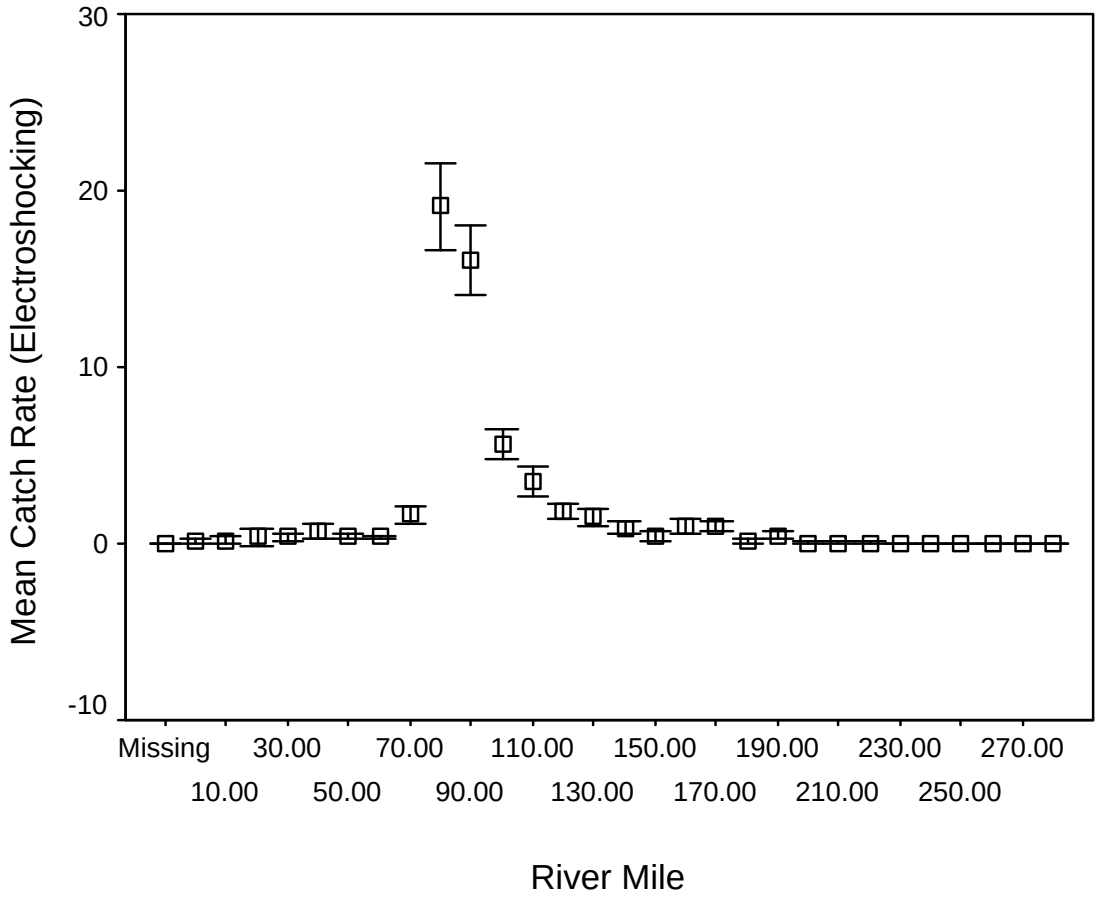

Figure 49. Brown trout mean catch per unit effort (electroshocking, fish/hour, 95% CI) by river mile in the Colorado River (Lees Ferry to Lake Mead, 1991-2008).

Bright Angel Creek is located near river mile 85 and the confluence of the Colorado and Little Colorado Rivers is located near river mile 61.

Channel Catfish

Channel catfish were likely one of the most abundant species in the Grand Canyon prior to the construction of Glen Canyon Dam. Over recent years, surveys suggest that channel catfish occur in relatively high abundances only in the Little Colorado River and downstream of river mile 170 in the Colorado River (Figure 50). Catfish have persisted in the Little Colorado River since at least the late 1970s and have been captured throughout the Little Colorado River from its confluence with the Colorado River to Atomizer Falls (Figure 51). Multiple cohorts have been witnessed over the years (Figure 52), suggesting that the Little Colorado River supports a self-sustaining population of channel catfish (Figure 53). It is likely that few if any channel catfish survive the floods and falls from the Upper and Middle Little Colorado River into the Lower

Little Colorado River. The self-sustaining population of channel catfish within the Lower Little Colorado River confounds any attempts to discern the presence or potential of downstream movement from our stocked location to the Lower Little Colorado River.

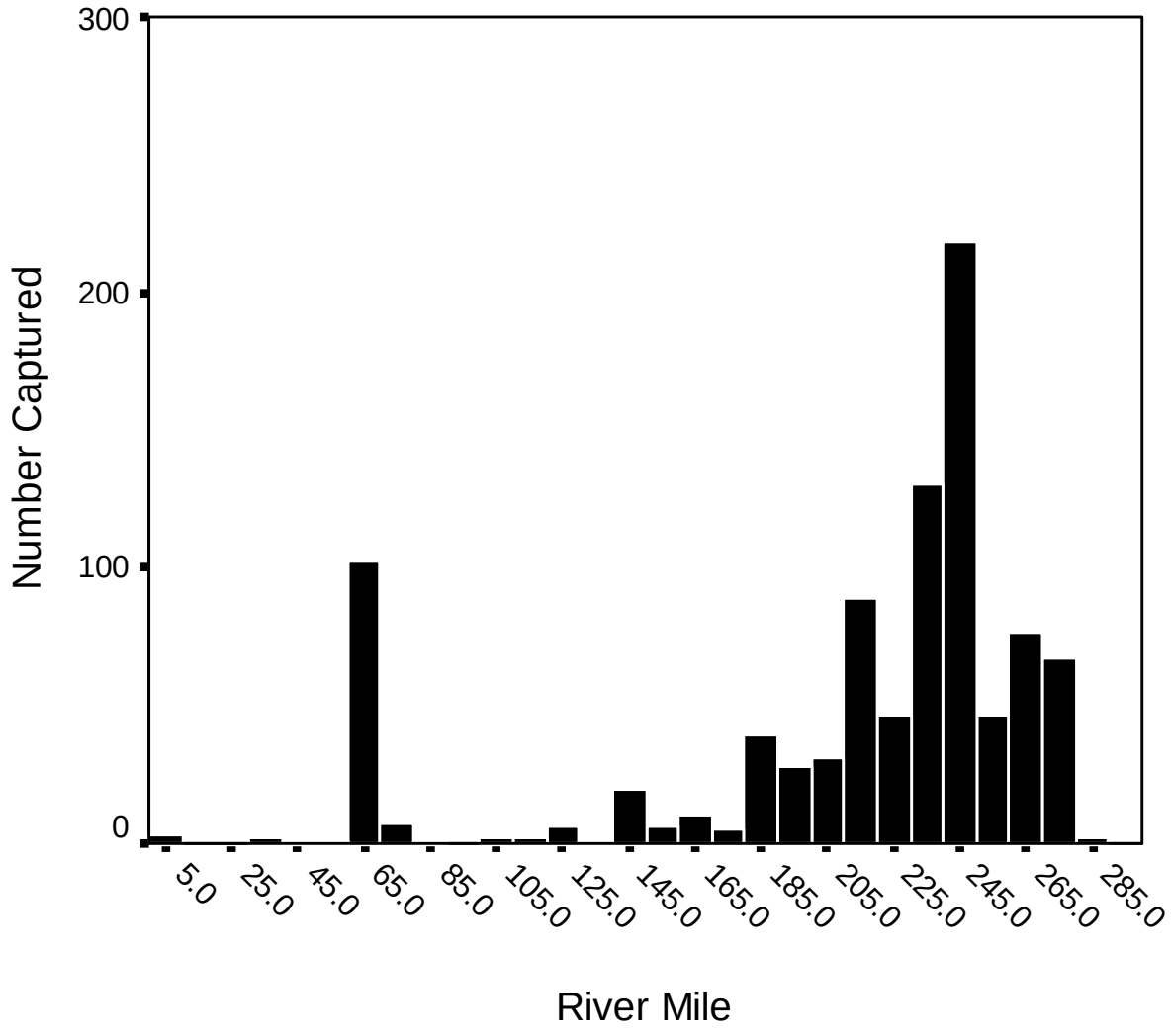

Figure 50. Total number of channel catfish captured in the Colorado River (Grand Canyon, 1998-2008)

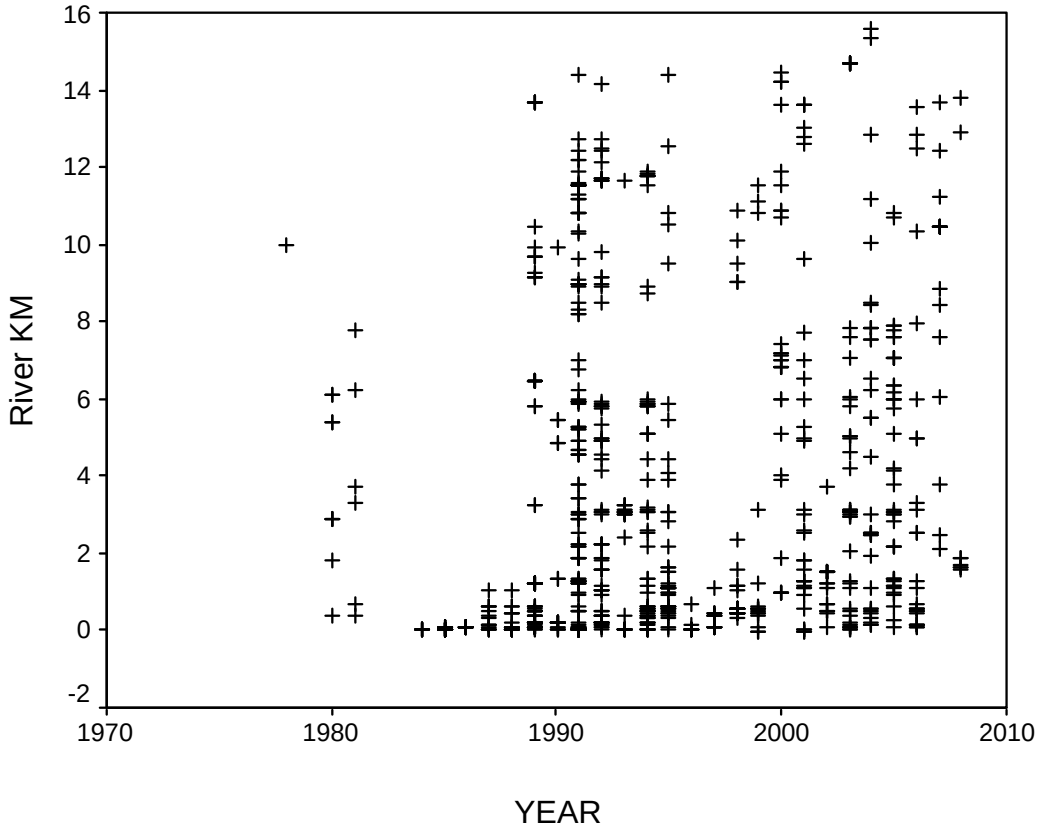

Figure 51. Distribution of channel catfish captured in the Lower Little Colorado River. River KM 0 is the confluence of the Little Colorado and Colorado Rivers and river KM 15.5 is at Atomizer Falls (1977-2008).

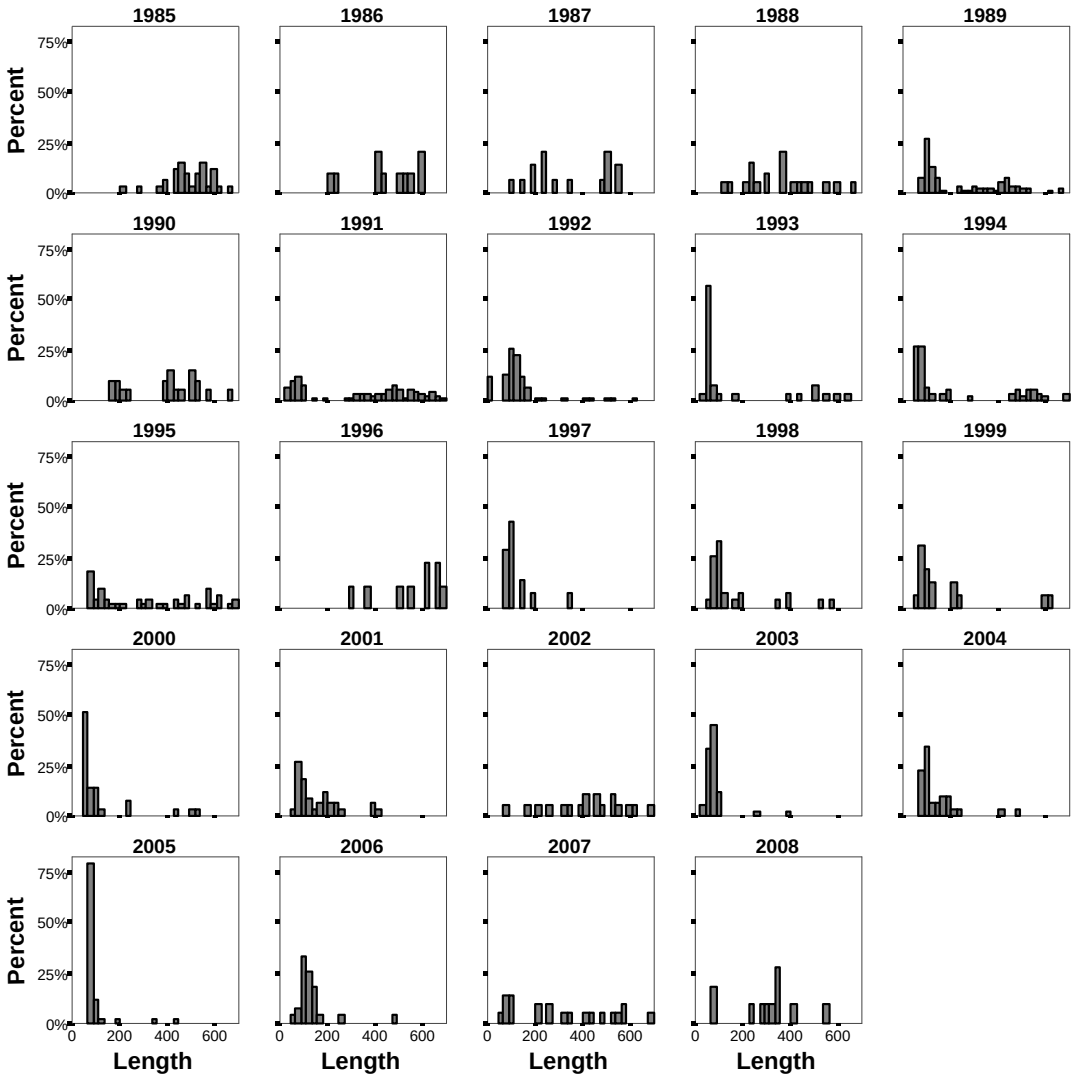

Figure 52. Length distribution of channel catfish captured in the Lower Little Colorado River by year (1985–2008).

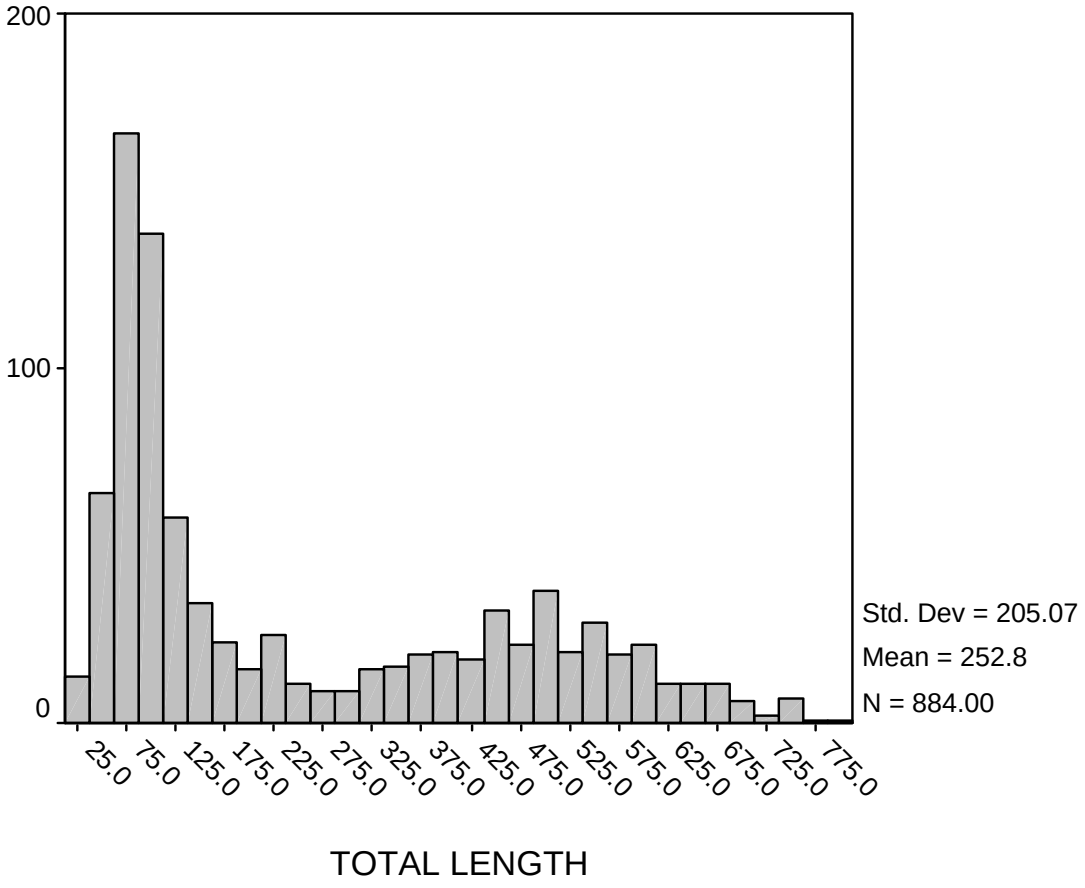

Figure 53. Length distribution of channel catfish captured in the Lower Little Colorado River (1977–2008).The y-axis is the number of fish captured, and Total Length is measured in mm.

Bluegill, Largemouth bass and Redear Sunfish

No bluegill, largemouth bass or redear sunfish have been captured in the lower Little Colorado River during intensive sampling over the past 32 years (Table 32). Nine sunfish have been captured in the lower Little Colorado River since 1977 and all have been identified as green sunfish. Green sunfish are not proposed for stocking by Arizona Game and Fish Department. It is unknown if green sunfish survive Grand Falls. No green sunfish have been captured immediately below Grand Falls (Stone et al., 2007). The green sunfish captured in the lower Little Colorado River may have originated from the main channel of the Colorado River. Green sunfish have been captured just downstream of Glen Canyon Dam over recent years (A. Makinster, pers. comm.) and have been documented in the Colorado River since 1978 (Table 34). Green sunfish may also have originated from watersheds within the Navajo Nation that spill into the Little Colorado River downstream of Grand Falls. Although green sunfish are numerous and

distributed throughout the Little Colorado River watershed, neither green sunfish nor the other centrarchid species have established populations in the lower Little Colorado River.

Critical Habitat

When Critical Habitat was designated for humpback chub, the Colorado River and lower Little Colorado River were already occupied by numerous species of non-native predatory and competitive fish species. The potential for transport of additional non-native fishes stocked in the upstream watershed might result in an immeasurable and incremental increase in the adverse effect to critical habitat that predation and competition impart. The potential for transport of parasites or pathogens that might affect humpback chub from the proposed stocking action in the watershed into critical habitat is similarly possible, but less likely to be measurable because the species proposed for stocking do not generally harbor the same or similar organisms as humpback chub because they are not cyprinids. Additionally, it would be impossible to determine if the occurrence of a new parasite or pathogen resulted from the existing baseline non-native or native fish assemblages or from the incremental and immeasurable effect of movement of stocked fish species. Potential increase in incidence or infestation rate of an existing parasite or pathogen is equally impossible to attribute to the stocking program as opposed to in situ increase from habitat or other environmental factors.

Chapter 7 GILA RIVER AND WILCOX PLAYA WATERSHED

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GILA RIVER WATERSHED

SAN FRANCISCO RIVER SUB-WATERSHED

Physical Geographic Description

Drainage Area

The headwaters of the San Francisco River are located on the Apache National Forest northwest of the town of Alpine in Apache County. The watershed is south of the Little Colorado River (LCR) headwaters and east of the Black (upper Salt) River watersheds. The San Francisco River flows eastward into New Mexico, then southward, then westward back into Arizona to the confluence with the Gila River near Morenci. The drainage area exceeds 2,766 square miles.

Range of Elevation

Elevations in the sub-watershed range from over 9,700 feet above sea level at the headwaters to about 3,330 feet at the confluence with the Gila River.

Tributaries

The San Francisco's major tributaries are the Blue River in Arizona and Whitewater Creek and the Tularosa River in New Mexico.

Luna Lake

Site Description

Luna Lake dam was constructed in 1893 on the mainstem of the San Francisco River near its headwaters (Figure 1 and Figure 2). The dam was rebuilt in 1927 and raised an additional 12 feet in 1951. The lake is 154 surface acres, with a maximum depth of 21 feet and an average depth of 8 feet. Luna Lake is located at an elevation of 7,882 feet on the Apache-Sitgreaves National Forest, about 4 miles east of Alpine. Within Arizona, the majority of the San Francisco River sub watershed is on the Apache-Sitgreaves National Forest. The watershed is also on the Gila National Forest in New Mexico. Private land in-holdings are present along the river on both National Forests. The southernmost downstream portion of the river near Morenci is on Bureau of Land Management, State Trust and private lands.

Management of Water Body

Luna Lake has been managed as a put-grow-and take cold water fishery with rainbow and cutthroat trout (Table 1). The lake is productive and the trout grow to catchable size quickly and some grow to larger sizes.

Figure 1. Luna Lake Dam

Table 1. Stocking history at Luna Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1943	1995	32	655,200
Brown trout	1935	1938	4	76,940
Bullfrog tadpoles	1968	1968	1	2,650
Coho salmon	1958	1964	2	156,100
Cutthroat trout	1952	2009	24	606,342
Native trout	1937	1938	4	154,064
Rainbow trout	1937	2009	334	10,243,154
Total			401	11,894,450

Because of the productivity, aquatic weeds also grow aggressively (Robinson et al. 2007) and the lake experiences strong blue-green algae blooms. The blooms have caused summer fish kills by depleting oxygen from the lake as the phytoplankton decays en masse. Table 2 shows the fish kill history at the lake.

Table 2. Fishkill history at Luna Lake.

Date	Magnitude	Cause
August 1982	Heavy	High pH from macrophytes
July 1984	Partial	Macrophytes
June 1988	Small	High pH, blue-green algae
June 1989	Small	High pH, blue-green algae

Date	Magnitude	Cause
July 1989	Moderate	Oxygen depletion
July 1999	Moderate	Oxygen depletion
July 2000	Moderate	Oxygen depletion
July 2002	Heavy	Oxygen depletion
July 2007	Small	Oxygen depletion

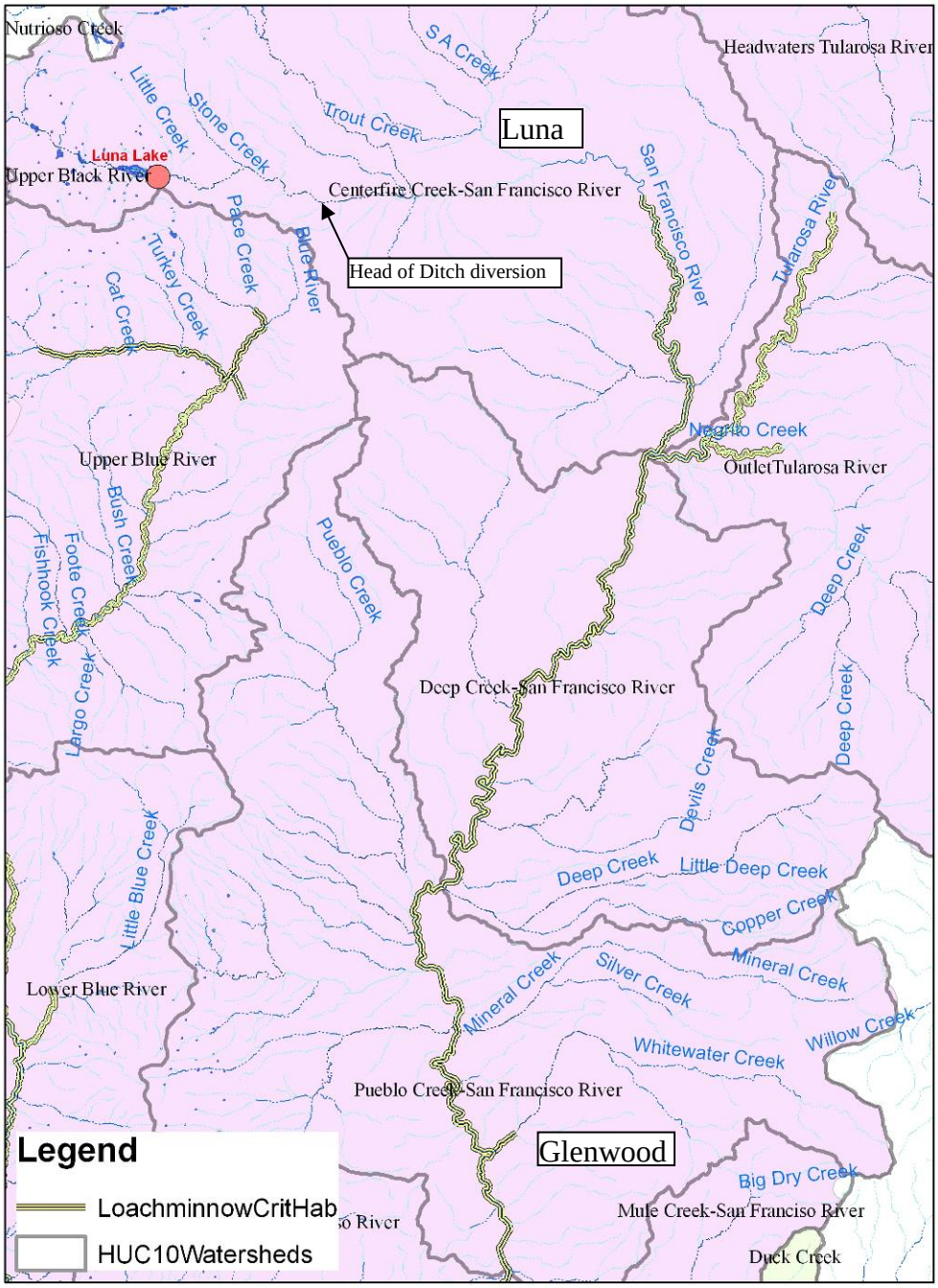

Figure 2. Overview of Luna Lake and downstream areas of San Francisco and Tularosa rivers.

The Department operates a weed harvester in the lake every summer to cut back the macrophyte density, to improve water quality and reduce the frequency of summer fish kills. Luna Lake is also an irrigation reservoir. Luna Irrigation Company in New Mexico owns most of the water rights. The Department owns a minimum pool water right in Luna Lake.

On the south shoreline, the Apache-Sitgreaves National Forest maintains the boat launch, picnic and campground facilities, and administers a special use permit for the concession, which sells tackle and rents boats (Figure 3). A fishing pier is also present on the south shoreline. The Luna Lake Wildlife Area at the upper end of the lake is closed to access from February 15 to July 31 each year to protect waterfowl. The picnic area and most of the lake is open year round, but the campground and concession are only open from May to September. The lake is used for ice fishing during the winter. Bank fishing is concentrated on the south shore and near the dam because of easy access. Boats have access to the entire lake except when the upper end is closed between April 1 and July 31.

Figure 3. Aerial picture of Luna Lake area.

Angler use has been determined by on-site creel surveys in 1981 (25,734 AUDs), 1983 (26,933 AUDs), and 1998 (20,285 AUDs), and by mail survey in 2001 (24,600 AUDs) (Pringle 2004).

The primary targeted opportunity is put-grow-and-take cold water trout fishery. The objective is to stock trout multiple times during spring and into autumn.

Proposed action

Rainbow trout and cutthroat trout are proposed for stocking into Luna Lake for the period covered by this consultation.

Fingerling, sub-catchable, and catchable rainbow trout will be stocked multiple times from April to November annually; numbers of rainbow trout stocked may be from 0 to 200,000 annually.

Fingerling, sub-catchable, and catchable cutthroat trout will be stocked multiple times from April to November annually; numbers of cutthroat trout stocked may be from 0 to 100,000 annually.

Water Distribution / Connectivity
Luna Lake is filled by seasonal flows coming down the upper San Francisco River directly into the lake. Most of the water coming into the lake enters during the spring snowmelt runoff, and the river above the lake dries frequently during the summer months.

Luna Lake spills nearly every year in the spring over the spillway (Figure 4 and Figure 6); however, during drought conditions the lake may not spill. Occasionally the lake will spill in the fall, but usually only when lake levels remain high during the irrigation season in conjunction with a heavy monsoon season. The lake has spilled during spring in 5 of the last 7 years, but has spilled only once during fall (Table 3).

Table 3. Spill history for Luna Lake 2003-2009

Year	**Spill months**
2009	February-mid April
2008	January-early May
2007	February-April
2006	October-November
2005	January-early May
2004	No spill
2003	March-early May

Figure 4. Luna Lake Spillway

The entire length of the San Francisco River from Luna Lake downstream to its confluence with the Gila River flows during heavy snowmelt runoff during the spring. However, that connectivity is broken during the summer months when Luna Lake is not spilling and the irrigation season begins (Figure 5). Water is also released from Luna Lake through a head gate in the dam to meet irrigation needs downstream during April 1 through November 1 during the irrigation season; during that period the river flow is continuous from the dam to an irrigation diversion known as the Head of Ditch about 7.5 miles downstream at Luna, New Mexico. The entire released flow during the irrigation season is diverted at the town of Luna, with the river below that diversion dry or intermittent for approximately another 5.5 miles until the river re-enters a canyon–bound reach. Below this point subsurface flow is forced back to the surface by the bedrock, and the river becomes perennial down to the confluence with the Gila River. Trout Creek is a tributary to the San Francisco River that joins it near the town of Luna. Trout Creek has permanent water in its headwaters, but is intermittent in the lower reaches near the San Francisco River.

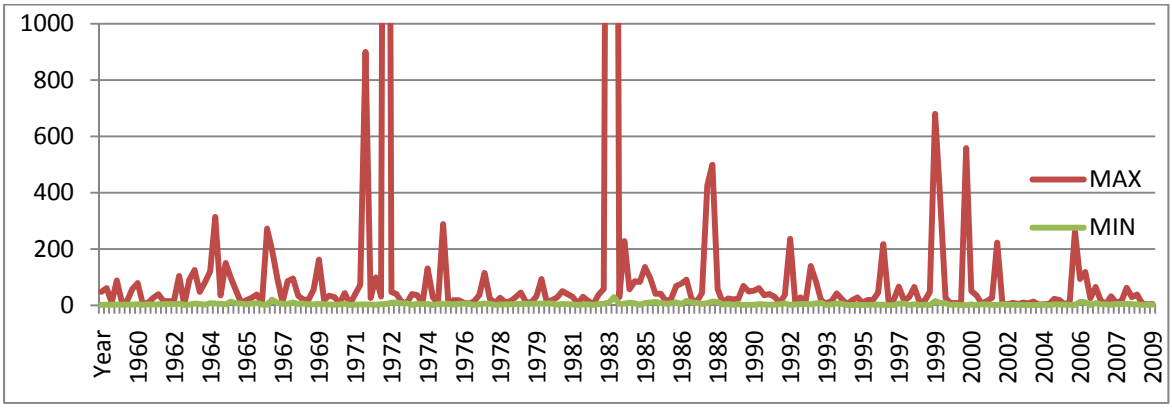

Figure 5. Minimum and maximum discharge in the San Francisco River during the months of July-October, 1959-2009 recorded from the USGS gage near Reserve, New Mexico.

Figure 6. Luna Lake irrigation release during summer irrigation season

From the beginning of perennial flow, downstream of Luna, the San Francisco River flows for about 9 miles to The Box and the beginning of designated Critical Habitat for loach minnow, which is about 21 miles downstream of Luna Lake; then another 5.7 miles to the beginning of loach minnow occupied habitat, which is 26 miles downstream of Luna Lake. Frisco Warm Spring is located 1.7 miles upstream of loach minnow critical habitat, which is significant in that it contributes to the warming of the stream. The San Francisco River continues for another 7.6 miles to the confluence with the Tularosa River, a major tributary. It then continues for another 37.7 miles to the Town of Glenwood and the confluence with Whitewater Creek, another major tributary. Another series of hot springs occur 5.9 miles downstream of Glenwood. The river continues perennial flow for 24.8 miles downstream of the hot springs, back into Arizona, and to the confluence with Harden Cienega Creek. The lower end of Harden Cienega is seasonally dry but likely flows continuously into the San Francisco River during the spring snowmelt runoff and summer flooding associated with monsoon events (McKell 2005c). The San Francisco River continues perennial for 2.6 miles to the confluence with Dix Creek, another 2.2 miles to the confluence with the Blue River, another 20.6 miles to the town of Clifton, then another 12.0 miles to its confluence with the Gila River.

Fish Movement

Trout may move upstream into the San Francisco River above Luna Lake; however, they would not likely persist very long as it regularly dries above the lake. Trout do persist in Luna Lake; however, occasional summer fish kills reduce those numbers in the lake but rarely result in a full fish kill. There is no evidence that trout spawn in Luna Lake or within the San Francisco River upstream.

Trout can and do escape downstream into the San Francisco River by going over the spillway when the lake spills in the spring. During this spring runoff, trout are able to move downstream into New Mexico, through the town of Luna when the river is running continuously, and down to loach minnow designated critical habitat and occupied habitat, 21.6 and 27.3 miles below Luna Lake, respectively. The trout are able to continue downstream and into major tributaries. At some point, the river becomes unsuitable for trout even during spring runoff, as no trout have been collected in the San Francisco River downstream of the Glenwood area, likely because water temperatures are above their thermal maximum which causes mortality. In addition, trout finding their way into perennial water immediately downstream of the town of Luna, likely would not persist, as the stream warms during the summer and becomes unsuitable. The hot springs along the San Francisco River and lower elevations contribute to the warming of the waters. The unsuitability of this portion of the San Francisco River for trout is supported by an analysis of designated uses for stream reaches within the Gila National Forest (Camarena 1997). This analysis cited recorded water temperatures of 78-80 degrees Fahrenheit June through August in the San Francisco River upstream of the town of Luna, and irrigation use from June through October in Luna Valley, which dries out the river from Head-of-the-Ditch to 1.5 miles

downstream of Luna. This analysis also described low water levels that result in shallow exposed water subject to high temperature and algal growth, and hot springs effect on water temperatures in the San Francisco River upstream of the town of Reserve, which is just above loach minnow occupied habitat. The analysis further describes the San Francisco River downstream of Reserve as a warm water fish designation.

When Luna Lake is not spilling, trout may still have an opportunity to escape through the headgate in the dam during irrigation releases during the summer months. Water released from the headgate flows through a rock strainer immediately below the dam (E. Nail, pers. comm.), which keeps larger trout from moving downstream during the irrigation releases; small trout have the potential to get through this rock strainer (Figure 7). During irrigation releases, fish can travel downstream nearly to the town of Luna if they get past the rock strainer. Trout may persist in deeper pools in this reach. During irrigation use, all flows are diverted at a diversion dam just upstream of Luna, New Mexico, which prevents fish from moving further down the streambed, because the streambed is dry through the Town of Luna during these periods. Fish could move into the irrigation ditches and into fields, but water does not flow back to the San Francisco River except as subsurface flow.

Figure 7.Luna Lake irrigation release water seeping through cobble bed between the spillway and culverts on Forest Road 570 on upper San Francisco River.

Community Description

Luna Lake contains cutthroat and rainbow trout, fathead minnows, crayfish, and tiger salamander (Table 4; M. Lopez, pers. comm.). The San Francisco River upstream of Luna Lake dries regularly and does not support fish populations. The San Francisco River downstream of Luna Lake to the Head-of-the-Ditch diversion just upstream of the town of Luna has been rarely surveyed; however, the species composition in this reach is considered to include reproducing populations of desert sucker, speckled dace, and fathead minnow. Occasionally, rainbow trout are also encountered (M. Lopez, pers. comm.). An August 11, 2009 fish survey, using a backpack electrofisher, of three sites in the San Francisco River between Luna Lake and the Arizona-New Mexico boundary, documented desert sucker, speckled dace, and fathead minnow at each site (Table 5). A fisheries survey in 1948 was conducted in the reach immediately downstream in New Mexico, approximately 4 miles west of the town of Luna (Kansas St. GAP data base), and documented desert sucker and speckled dace. No trout were found in either fish survey; however, the survey history in this reach is poor and rainbow trout are occasionally reported by anglers fishing the river in both Arizona and New Mexico (M. Lopez, pers. comm.).

Angler creel surveys conducted on the San Francisco River immediately downstream of Luna Lake in 1998 documented anglers catching rainbow trout that escaped from the reservoir. The creel survey documented the catch of 5 rainbow trout over 63 separate survey dates, and estimated a total catch of 166 rainbow trout. All the trout documented were caught in April, with no trout caught from May through November, indicating that they may not persist or, if they do persist, they do so in very low numbers.

Table 4. Five Year Survey History in Luna Lake using experimental gillnets. Effort is listed as gillnet nights (GN).

Date and Effort	**Species Collected**	**Num. Collected (TL range in mm)**
April 2008 Effort = 3 GN	Rainbow trout Cutthroat trout	7 (405-463) 4 (370-390)
April 2007 Effort = 3 GN	Rainbow trout	71 (192-434)
April 2006 Effort = 3 GN	Rainbow trout Cutthroat trout	135 (110-445) 1 (287)
April 2005 Effort = 4 GN	Rainbow trout cutthroat trout	8 (220-434) 26 (200-262)
April 2004 Effort = 3 GN	Rainbow trout	70 (109-330)

Table 5. Survey of San Francisco River between Luna Lake and AZ-NM border on August 11, 2009

Site	Species collected	Num. Collected
1	Desert sucker Speckled dace Fathead minnow	4 11 14
2	Desert sucker Speckled dace Fathead minnow	7 22 21
3	Desert sucker Speckled dace Fathead minnow	1 17 41
Total	Desert sucker Speckled dace Fathead minnow	12 50 76

The San Francisco River through the town of Luna does not support fish populations because it dries up during the irrigation season when all flows and irrigation releases are diverted into irrigation ditches. No known surveys exist in this reach.

Trout Creek, a tributary of the San Francisco River that enters in the town of Luna, has a currently unknown fish composition; however, it did contain rainbow trout at one time. The New Mexico Department of Game and Fish (NMDGF) stocked trout into Trout Creek until 1970 (Camarena 1997), plus the book “Fishing in New Mexico” by Titus Piper (1989) identified good rainbow trout fishing in Trout Creek.

The San Francisco River from the start of permanent flow downstream to The Box contains native fishes, including desert sucker, Sonora sucker, longfin dace, and speckled dace. This reach has a historical record of rainbow trout, caught approximately 6 miles north of Reserve in 1953, which could have come from Luna Lake, but also could have come from Trout Creek. Three other surveys conducted in this reach from 1948 to 1976, did not detect trout (Kansas GAP database 2009), indicating that although trout do show up in this area from unknown sources, they are infrequent and do not persist.

The San Francisco River from The Box downstream to just above Glenwood contains mostly native species; loach minnow, longfin dace, speckled dace, Sonora sucker, and desert sucker, and non-native fathead minnow and mosquitofish. Headwater chub were documented once in 1948. This reach is within designated loach minnow critical habitat. Twenty-two surveys were conducted in this reach from 1948 to 1991, finding the above-mentioned species, but finding no

trout (Kansas GAP database 2009), although deeper pools in the area of the box likely hold trout temporarily.

The Tularosa River is a perennial tributary entering the San Francisco River just downstream of the town of Reserve. Since 1988, the NMDGF has conducted fish surveys in the Tularosa River at Eagle Peak Road, also within loach minnow critical habitat. One rainbow trout was found in the Tularosa sampling site in 1997 (Propst et al. 2009 and Table 6). This trout could have come from a number of sources, from Luna Lake over 35 miles upstream of the Tularosa River, from Trout Creek, or from Negrito Creek, a tributary of the Tularosa River that holds a wild population of rainbow trout. According to Piper (1989) "Negrito Creek is a little spring-fed tributary to the San Francisco just east of Reserve. Negrito holds some of the best small-stream trout fishing in the entire Gila Watershed, especially in its mid-section".

Table 6. Occurrence of fishes at Tularosa River Eagle Peak Road site, Catron County, New Mexico, 1988-2008 (Propst et al. 2009).

Species	**Year**																				
	88	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**
Longfin dace	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Speckled dace	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Loach minnow	x	x	x	x	x	x	x	x	x	x	x	x		x	x						x
Desert sucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sonoran sucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fathead minnow					x				x	x			x		x					x	
Rainbow trout									x												
Western mosquitofish		x		x	x		x							x	x	x	x			x	
Largemouth bass															x						

The San Francisco River around Glenwood contains the same species as the previous reach, but includes a higher occurrence of rainbow trout. Since 1988, the NMDGF has conducted fish surveys in the San Francisco River at the Glenwood Ranger Station site, also within loach minnow critical habitat. Rainbow trout were collected in 1990, 1991, 1992, 1994, 1998, 1999, and 2001 (Propst et al. 2009 and Table 7). Although the NMDGF has not stocked rainbow trout in the San Francisco River for over 30 years, according to Stan Long, hatchery manager at the Glenwood Hatchery, there is a potential that rainbow trout collected at this site might have

escaped from the Glenwood State Fish Hatchery, which is located on tributary Whitewater Creek less than 2 miles from the Glenwood Ranger Station sampling site. He also confirmed there are reproducing wild populations of brown and rainbow trout persisting in Whitewater Creek, a tributary to the San Francisco River at Glenwood that could also be providing fish to this reach of the river.

Table 7. Occurrence of fishes at San Francisco River Glenwood Ranger Station site, Catron County, New Mexico 1988-2007 (no surveys in 2000).

Species	**Year**																			
	88	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**
Longfin dace	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x		x	x
Speckled dace	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Loach minnow	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Desert sucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sonoran sucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fathead minnow	x	x						x											x	
Rainbow trout			x	x	x		x				x	x	x							
Western mosquitofish	x		x				x					x			x					
Largemouth bass				x																

Downstream of Glenwood, the San Francisco River contains the same native species, but includes many more warm water fishes, including channel catfish, bullheads, green sunfish, red shiner, carp, and largemouth bass. Over 30 surveys have been conducted below Glenwood to the AZ-NM state line from 1948 through 1980, without detecting trout in this reach (Kansas GAP database 2009). In Arizona, no trout have been documented in the lower San Francisco River during surveys from 1983 through 1995.

Two tributaries to the San Francisco River, Harden Cienega and Dix Creek, contain native fishes, including Gila chub. These creeks are within designated critical habitat for Gila chub.

Surveys in these streams in 1983, 1988 1995, 1996, and 2005 have documented Gila chub, longfin dace, speckled dace, Sonora sucker, and desert sucker, but no trout (Papoulias et al. 1989; McKell 2005c; AGFD native fish database).

Although the San Francisco River and Luna Lake are within the historical range of narrow-headed gartersnakes, the species is likely extirpated from the Luna Lake stocking site (see analysis below).

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Mexican spotted owl designated critical habitat is analyzed below.

Chiricahua leopard frog
Local Analysis: Although Luna Lake is within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish within the buffered stocking complex is low because there are no historical records for Chiricahua leopard frogs at Luna Lake. However, there are historical records for Chiricahua leopard frogs from 3 sites in the buffered stocking complex; San Francisco River (=Little Creek Confluence) (1971), San Francisco River (= Hwy 666) (1974), Unnamed Tributary (S of Luna Lake at Jackson Creek) (1979). There have been 22 surveys and site records at 10 sites within the buffered stocking complex between 1935 and 2009 with most surveys conducted between 1991-1995 (Figure 8; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were not observed during subsequent surveys at San Francisco River (=Little Creek Confluence)

(1979 and 1995), San Francisco River (= Hwy 666) (1987 and 1995) or Unnamed Tributary (S of Luna Lake at Jackson Creek) (1994 and 1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that Chiricahua leopard frogs no longer occupy areas within the Luna Lake buffered complex because frogs have not been detected during recent surveys. In addition, the presence of crayfish and non-native fish in Luna Lake and non-native fish in major tributaries flowing into the San Francisco River make the habitat within the buffered stocking complex less suitable for Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish is low, because it is unlikely that fish could reach occupied Chiricahua leopard frog sites. There are current records for Chiricahua leopard frogs at 2 sites in Dix Creek; a tributary of the San Francisco River; Dix Creek (=Right Prong) (2003, 2005, 2008) and Dix Creek (=Left Prong) (2003, 2005). As mentioned above in the *Fish Movement* section, trout stocked in previous years have not persisted downstream of the Glenwood area due to unsuitable habitat; water temperatures are above their thermal maxima. It is unlikely that stocked fish will disperse downstream of the Glenwood area and reach the San Francisco River and Dix Creek confluence where Chiricahua leopard frogs occur.

Northern Leopard Frog

Local Analysis: Although Luna Lake is within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish within the buffered stocking complex is low because there are no historical records for northern leopard frogs at the Luna. However, there are historical records for northern leopard frogs from 3 sites in the buffered stocking complex: San Francisco River (=Little Creek Confluence) (1971), San Francisco River (= Hwy 666) (1974), Unnamed Tributary (S of Luna Lake at Jackson Creek) (1979). There have been 22 surveys at 10 sites within the buffered stocking complex between 1935 and 2009 with most surveys conducted between 1991 and 1995 (Figure 8; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at San Francisco River (=Little Creek Confluence) (1979 and 1995), San Francisco River (= Hwy 666) (1987 and 1995) or Unnamed Tributary (S of Luna Lake at Jackson Creek) (1994 and 1995) (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although there are available habitats that have not been surveyed, it is likely that northern leopard frogs no longer occupy sites within the Luna Lake buffered complex because they have not been detected during recent surveys and the presence of crayfish and non-native fish in Luna Lake and non-native fish in major tributaries flowing into the San Francisco River

make the habitat within the buffered stocking complex less suitable for northern leopard frogs.

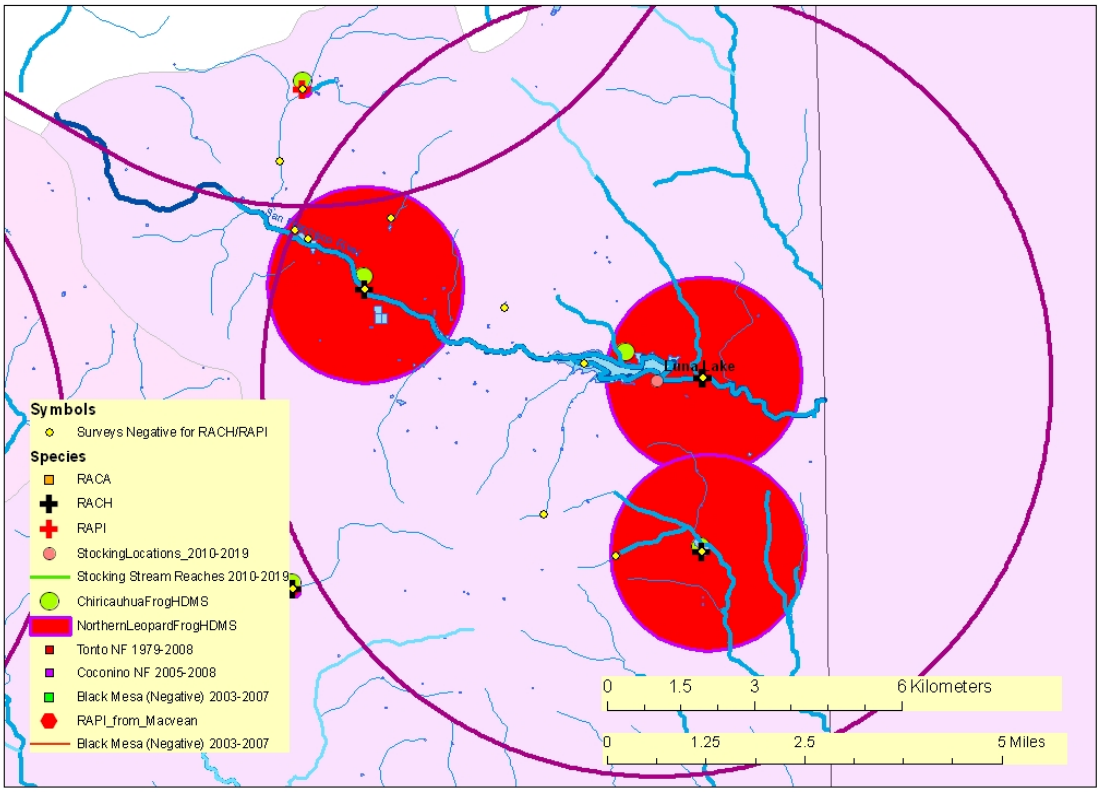

Figure 8. Map of Luna Lake buffered stocking site:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked at Luna Lake that disperse outside the buffered stocking complex is low, because previous surveys suggest that northern leopard frogs no longer occupy sites where fish could disperse. In addition, the habitat in these drainages is less suitable for northern leopard frogs due to the presence of crayfish and non-native fish.

Gila Chub and Critical Habitat

Gila chub occupied and critical habitat is found in small tributaries of the lower San Francisco River. The nearest occupied and critical habitats are located in Dix Creek and Harden Cienega Creek, which are 103.4 and 106.0 miles, respectively, downstream from Luna Lake. There have

been no records of trout collected in these tributaries or in the San Francisco River anywhere in the vicinity of these tributaries. The nearest record of rainbow trout in the San Francisco River was at the Glenwood Ranger Station New Mexico monitoring site, where rainbow trout were collected in 1990, 1991, 1992, 1994, 1998, 1999, and 2001. However, these collections were over 30 miles upstream and most likely were either escapees from the Glenwood State Fish Hatchery, located on tributary Whitewater Creek less than 2 miles from the monitoring site, or came from a robust wild population of rainbow trout in Whitewater Creek itself. The lower San Francisco River is unsuitable for trout, because water temperatures are too high, and is inhabited by predators such as flathead catfish that could easily prey upon unsuspecting dispersing trout. It is also unlikely for a Gila chub to disperse upstream to an area where it might encounter an escaped trout from Luna Lake, because numerous nonnative predatory fish in the San Francisco River near the tributaries inhabited by Gila chub likely limit the distribution of the chub to the tributaries.

Potential impacts

The proposed stocking activity would not be anticipated to have adverse impacts on the Gila chub or its critical habitat. Gila chub occupied habitat and critical habitat are over 100 miles from the stocking site. The distance and the presence of warm water, not suitable for trout, would likely preclude an escaped trout from Luna Lake from ever reaching and persisting in occupied or critical habitat for the Gila chub. The confluence area of Harden Cienega and Dix creeks with the San Francisco River has also been occupied by many species of non-native warm water fish: red shiner, mosquitofish, channel catfish, largemouth bass, fathead minnow, and flathead catfish.

Loach Minnow and Critical Habitat

Loach minnow occupied and critical habitat is found in the San Francisco River below The Box, near the town of Reserve, downstream to the confluence with the Gila River. Loach minnow have been documented 27.3 miles downstream of Luna Lake at Tularosa River (Paroz and Propst 2007) and critical habitat starts 21.6 miles downstream of the lake.

Potential impacts

The stocking location is 27.3 miles upstream of the upper range of loach minnow, approximately 4 miles upstream of the town of Reserve, and 21.6 miles upstream of Critical Habitat. The connectivity of the stocking location at Luna Lake allows the transport of stocked trout downstream into occupied and critical habitat in the San Francisco River when the lake spills during spring snowmelt runoff, between January and May, and rarely during an intense and long-duration summer thunderstorm. Trout are able to escape the reservoir through the headgate during irrigation releases in the summer through fall, but they have to get through a rock strainer just below the dam, which is a filter and not a complete barrier, and hence will reduce the number and size of trout escaping downstream. Creels surveys indicate that anglers caught trout

below the lake only in April, but caught no trout from May through November. This indicates that they catch most of the escaped trout immediately below the reservoir. Additionally, a recent fish survey just below the dam failed to collect any trout (Table 5). The stream also warms to temperatures unsuitable for trout during the summer months. All water released from Luna Lake during the irrigation season is diverted into irrigation ditches in Luna, New Mexico, resulting in a stretch of dry streambed downstream of the diversion through the town of Luna. Pools in the reach between Luna Lake and the town of Luna likely support rainbow trout that have escaped from the lake during the spring runoff, for short periods; however, summer temperatures likely preclude long term persistence and reproduction. The stream through Luna dries in the summer. Permanent flows don't exist until further downstream in The Box. However, in this reach, summer water temperatures, exacerbated by hot springs between the towns of Luna and Reserve, create an environment too warm for trout. The warm water from the hot springs would be masked by cold spring runoff flows, which may allow an escaped trout to persist for a short period. Once spring run-off ceases or is diverted at Luna, the water temperatures warm up. Trout likely do not persist long or reproduce in the San Francisco River.

The proposed stocking activity would be anticipated to have potential direct impacts on the loach minnow and its critical habitat as there is a potential for the stocked species to move into occupied and designated critical habitat during spring snowmelt runoff. However, impacts are likely infrequent and of short durations, because few trout likely would be able to make it that far during the spring runoff, and if they did, they would only persist for the short duration that water temperatures are suitable; these assertions are supported by the very low occurrence of trout in the survey record in the San Francisco River upstream and outside of the Glenwood hatchery area. Furthermore, the period when rainbow trout were collected in the Glenwood area (Table 7, above) coincided with the period when stocking of brook trout (through 1995) and cutthroat trout (through 2009) was also occurring in Luna Lake. Yet, these two species were not collected in the Glenwood area. Many explanations of this are possible, including that trout from Luna do not get to this area. Anglers also catch many of the escaped trout just below the lake before they have a chance to travel far downstream.

Some of the trout in the San Francisco River could be from other sources besides Luna Lake, These sources include wild trout populations in Trout Creek, which is a tributary to the San Francisco at Luna, Negrito Creek, a tributary of Tularosa Creek, which is, in turn, a tributary to San Francisco near Reserve, and Whitewater Creek, which is a tributary at Glenwood. Another possible source is the Glenwood State Fish Hatchery, located right on Whitewater Creek less than a mile from the San Francisco River, and less than 2 miles from collections of rainbow trout. Glenwood State Fish Hatchery currently raises only triploid female rainbow trout (Williams unpublished report).

Although few trout that escape from Luna Lake likely reach occupied and critical habitat, if they did they would potentially contribute to predation and competition.

Escaped trout from Luna Lake likely would not impact dispersal of loach minnow on a large scale, primarily because the numbers of escaped trout would be expected to be very low and of short duration. Loach minnow occupy nearly all of suitable habitat in the San Francisco River, from The Box downstream to the confluence with the Gila River. Poor water quality and water diversions are likely the greatest limitation to upstream dispersal of loach minnow, and downstream distribution is likely limited by naturally reproducing nonnative warm water fishes in the lower San Francisco River. Escaped trout from Luna Lake could potentially impact dispersal on a small short-term scale, between one riffle habitat and another within occupied range, if the trout occupies a pool between the riffles. However, any impact is expected to be very limited because of the very low numbers of escaped trout that might make it into occupied habitat, and the short time that water temperatures are suitable for trout in this reach of river.

Survey data indicate that rainbow trout and cutthroat trout do not reproduce in Luna Lake; no larval or early-stage juvenile fish have ever been captured (Table 4). It is possible that escaped trout could spawn in the San Francisco River, since both species are spring-time spawners (Behnke 1992), but larvae or juveniles would not persist because summer-time water temperatures are unsuitable for trout (M. Lopez, pers. comm.). According to New Mexico Department of Game and Fish (NMDGF) biologists, the stocking of trout are not issues of concern (D. Propst, pers. comm.), even to the point that they implemented a translocation of spikedace into the stream reach occupied by loach minnow as a recovery action for that species in 2009, knowing about the trout management ongoing at Luna Lake for the last 70+ years.

Indirect effects on loach minnow by anglers pursuing escaped trout are expected to be extremely limited, because of the very low occurrence of escaped trout in occupied habitat, and their short persistence. Anglers pursuing escaped trout in the portion of the river in Arizona are concentrated in the stream immediately below the lake, and rarely venture more than a mile downstream from the lake. An occasional angler may fish some of the perennial water in New Mexico for escaped trout, but this is probably pretty rare because of the low occurrence of escaped trout in this area (Propst et al. 2009).

The primary constituent elements identified for loach minnow critical habitat that could be affected are: abundant aquatic insect food base, habitat devoid of nonnative aquatic species detrimental to loach minor, or habitat in which detrimental nonnative species are at levels which allow persistence of loach minnow. Impacts on PCEs for critical habitat are expected to be low because of the very low occurrence of any trout and their short time of occupation within critical habitat.

Narrow-headed Gartersnake

Site-specific analysis: Although Luna Lake lies within the historical range of narrow-headed gartersnakes and suitable habitat may be present nearby, it is unlikely that narrow-headed gartersnakes will be exposed to stocked sportfish. There is one historical (1953) narrow-headed gartersnake record from the San Francisco River above Luna Lake, but no snakes have been observed since then (HDMS). Holycross et al. (2006) surveyed Alma Bridge in 2005 and San Francisco Hot Springs in 2004 and did not observe any snakes.

Downstream analysis: It is unlikely that narrow-headed gartersnakes downstream of Luna Lake would be exposed to dispersing rainbow and cutthroat trout in the San Francisco River downstream of the Glenwood area because water temperatures are above their critical thermal maxima for trout.

Mexican Spotted Owl and Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Spikedace

On October 21, 2009, 112 spikedace from the Gila Bird Area were relocated to the San Francisco River upstream of the US 180 Bridge in Catron County, nearly 50 miles downstream of Luna Lake. Most were age 1+ spikedace averaging >70mm TL. This was the second stocking of spikedace into the San Francisco River, the first is unknown (unpublished report).

Potential impacts

The potential impacts that may result from the co-occurrence of stocked trout with the conservation population of spikedace would be very similar to those described for loach minnow,

and are elaborated in greater detail in Chapter 4. The potential for escapement, transport and occurrence of stocked trout in the areas stocked with spikedace was also previously described in the Fish Movement Section above.

According to New Mexico Department of Game and Fish (NMDGF) biologists, the stocking of trout are not issues of concern because there is little to no habitat in the San Francisco River from Luna, New Mexico downstream that is suitable for salmonids (D. Propst, pers. comm.) and because multiple years of survey data have only found one rainbow trout. Since 1988, the NMDGF has conducted fish surveys in the Tularosa River at Eagle Peak Road, also within loach minnow critical habitat. One rainbow trout was found in the Tularosa sampling site in 1996 (Propst et al. 2009 and Table 6). It is unlikely that this trout could have come from Luna Lake over 35 miles upstream of the Tularosa River. It is more likely that this trout came from Trout Creek, or from Negrito Creek, a tributary of the Tularosa River that holds a wild population of rainbow trout.

NMDGF implemented this translocation of spikedace into the stream reach also occupied by loach minnow as a recovery action for this species. NMDGF was aware of the trout management ongoing at Luna Lake in Arizona for the last 70+ years and did not expect this to be a threat to the translocated spikedace or their recovery in this reach for the reasons discussed in the previous paragraph.

UPPER GILA RIVER SUB-WATERSHED

UPPER GILA COMPLEX

Physical geographic description

Site Description

The Upper Gila River Complex is located in southeastern Arizona above Coolidge Dam near the Arizona-New Mexico border (Figure 9). The area covers about 7,430 square miles, and consists of rugged mountain ranges, broad intermountain plains, and flat, gentle valleys. The climate above 7,000 feet ranges from cool to sub-humid and annual precipitation approaches 20 inches. Vegetation is dominated by Ponderosa pine and pinon/juniper. In contrast, the valleys are arid with annual precipitation of only 9.5 inches. Dominant vegetation is desert scrub or desert grassland. Most rain falls during summer thunderstorms resulting in intense, localized runoff. Winter rains are generally mild, but can result in heavy runoff once the soil becomes saturated. Although the Upper Gila River and some of its tributaries are perennial, many tributaries are ephemeral. The ephemeral streams can be fast and free flowing during the rainy season, yet carry no water during the dry period. The majority of the surface water comes from precipitation, predominantly snow pack from the many mountain ranges. The volatility of the region is occasionally seen in flash flooding and torrential rains.

The main tributaries of the Upper Gila Complex are the San Francisco River, Blue River, San Simon River, Eagle Creek, Bonita Creek, and the San Carlos River.

The elevation at Coolidge Dam is roughly 2540 feet in elevation. The watershed above this point rises to a maximum elevation of 10,758 feet on Escudilla Mountain.

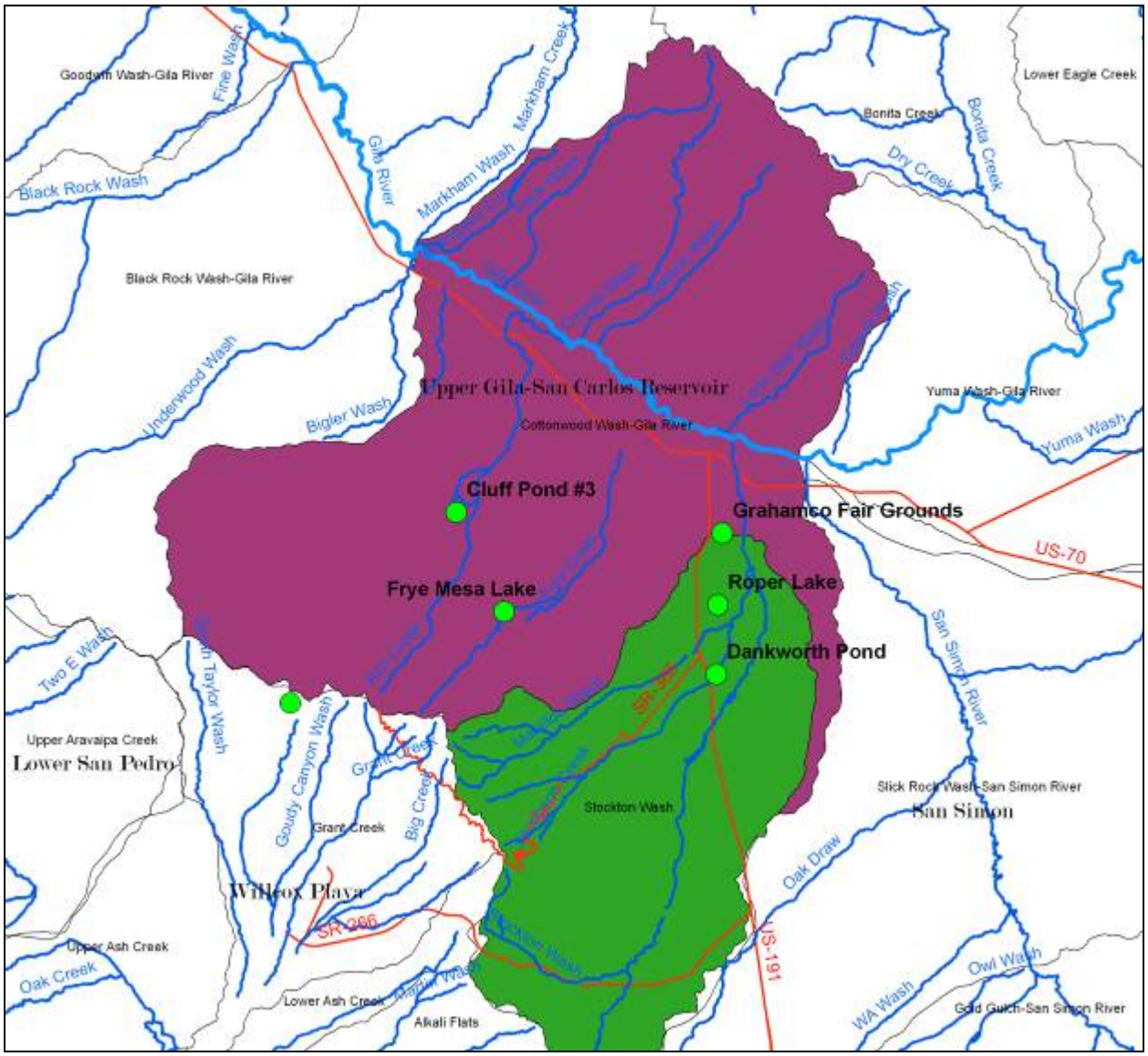

Figure 9. Upper Gila stocking sites overview map.

Graham County Fairgrounds

Site Description

The Department's involvement in this location is fairly new. Due to Arizona State Parks budget constraints and U.S. National Forest fire closures during 2002, a majority of the fishing

opportunities in the Safford area were closed to access. The City of Safford approached the Department about the possibility of re-starting a fish stocking program at this location in an effort to increase angler opportunity.

Graham County Fairgrounds pond is a 2-acre impoundment with an average depth of 6 feet; it is managed by Graham County as a public park located within the Graham County fairgrounds near the town of Safford at an elevation of 3,043 feet. This pond was constructed by building an above-grade berm in a horseshoe shaped configuration (Figure 10). A second smaller pond also in the shape of a horseshoe was constructed at the same time; however, this location is not proposed for stocking due to the small nature of the site. The landscape around the location is composed of county-maintained athletic fields, asphalt parking lots, and desert scrub.

Figure 10. Aerial photo of Graham County Fairgrounds Ponds

Management of Water Body

This location is managed primarily as a put-and-take rainbow trout fishery during the winter months. Catchable sized rainbow trout are stocked multiple times, between the months of November through March, annually. Along with the winter fishery, the Department also manages a secondary opportunity as a put-and-take channel catfish fishery during the summer months. Catchable sized channel catfish are stocked multiple times, between the months of May through September, annually, to provide additional opportunity to local anglers. The stocking

history by the Department at this pond consists of only rainbow trout and channel catfish (Table 1).

Although no official angler survey has been completed at this location, the Department, through observation by local wildlife managers during fishing license compliance checks, believes that this location receives most of its fishing pressure during the winter months of November through March, when catchable rainbow trout are stocked.

Table 8. Historic Department fish stocking at Graham County Fairground Pond.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
rainbow trout	2002	2007	5	12,500
channel catfish	1985	2007	22	2,200
Total			27	14,700

Proposed Action

The Department proposes to stock rainbow trout and channel catfish for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times annually with numbers of trout stocked ranging from 0 to 10,000 fish annually.

Catchable channel catfish stockings would occur multiple times annually during the summer months (typically May through September) with numbers of channel catfish stocked ranging from 0 to 5,000 fish annually.

Water Distribution / Connectivity

This small lake was constructed by building an 8 to 10 foot high earthen berm, which encircles the entire lake creating the basin in which the pond is located (Figure 9). This berm was built above grade, and the urban developed nature of the grounds surrounding the location does not allow for any natural drainage to flow into this lake. On the southeast end of the lake is a small outlet structure directing water escaping from the lake in the event of high water levels into a small canal connected to a small pond located approximately 150 yards to the south of the lake. This small pond is part of the public park maintained by Graham County. The pond is of a similar design to the lake and was constructed by building an earthen berm 6 to 8 feet above grade. The pond has no spillway structure associated with it. The shoreline of both the lake and the pond are lined with concrete and rock walls, which have been sealed to prevent water

infiltration in an effort to reduce water loss. If water did fill the pond to the point it would spill, water would leave in the form of sheet runoff and flow out across the park grounds or into active agricultural fields located east of the action area. Once reaching the active agricultural fields, water would then have to travel an additional 3 miles through more agricultural fields and urban development before reaching the Gila River.

The county pumps ground water to maintain the water levels in the lake and pond. County employees turn the pumps on as needed to fill the lake, and if overfilled, water will then travel down a man-made canal to the small pond. Once the level in the small pond has reached an acceptable level, county employees shut off the ground water pump and the canal begins to dry out. The location is not hydrologically connected to any drainages that connect with the Gila River, thus, this location is considered a closed system.

Fish Movement

There are only two opportunities for fish to leave the proposed stocking location. The first is by escaping through the small outlet directing water into the canal that delivers water to the small pond. Fish escaping in this manner would then become trapped in the small pond with no outlet structure to allow their escape, or become trapped in the man-made canal, only to perish once conditions begin to dry. In the unlikely event of a torrential rain event causing an overflow, fish may also be transported out over the top of the berm in sheet flow from either location and could then be transported across the landscape either into the developed grounds of the county park or the active agricultural fields. This type of flow event lends to very shallow water, minimizing potential movement of fish across this landscape.

Community Description

The fishery at this location is maintained by regular and repeated stockings of catchable sized fish; therefore, the Department has not conducted fish population surveys at this lake. Summer time water temperatures reach lethal limits for rainbow trout by mid April, and trout cannot spawn in the pond due to a lack of appropriate spawning habitat. Channel catfish likely persist year round in low numbers within the small pond, if they are not caught out by anglers. Catfish could potentially reproduce in the small pond; however, there is no evidence to support or refute this assumption. No other aquatic species are known to occur in this location.

Consultation Species or Critical Habitat

There are no aquatic consultation species, or critical habitats associated with this action area. Consultation species such as the southwestern willow flycatcher are discussed within the complex analysis.

Roper Lake

Site Description

Roper Lake is a 30 acre man-made lake located on US Highway 191, 5 miles south of Safford (Figure 11). Facilities at the lake include a boat ramp, natural stone hot tub, a swimming beach, a day use island with picnic tables and grills, camping cabins, and campgrounds. Located about 7 miles south of the Gila River, the lake was constructed by building a crescent shaped 8 to 10 foot high earthen berm, which stores water behind it to an average depth of 20 feet.

Originally constructed as a private recreational facility in the early 1960's, the Department purchased the lake and the land surrounding it in the late 1960's. After purchasing the lake, the Department entered in to a cooperative agreement with Arizona State Parks for the management of the land and parks facilities. The Department maintains management over the fishery at the lake. The Park itself was officially opened to the public in 1975 as Roper Lake State Park.

Figure 11. Roper Lake and Dankworth Pond Watershed

Management of Water Body

The primary fishery is a naturally reproducing year-round warm water fishery, consisting of largemouth bass, bluegill sunfish, redear sunfish, green sunfish, black crappie, and channel catfish. The Department also manages a secondary fishery, which consists of a winter put-and-

take rainbow trout fishery, with trout being stocked multiple times each year between the months of November through March.

The lake continues to be extremely popular with local citizens throughout the year. Angler surveys conducted in 2001 estimate that anglers expended 5,909 angler use days at the lake (Pringle 2004).

The stocking history shows that both flathead catfish and tilapia were stocked in the system in the early 1970's; however, neither of these species persisted in the lake and are no longer found there (Table 9).

Table 9. Historic Department fish stocking at Roper Lake

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1981	1981	1	147
Bluegill	1981	1981	1	85
channel catfish	1969	2006	18	60,750
Flathead catfish	1970	1970	1	5,000
Largemouth bass	1970	1981	7	1,627
Rainbow trout	1987	2007	127	192,227
Redear sunfish	1979	1979	1	5,000
Tilapia species	1971	1971	1	880
Total			157	265,716

Proposed Action

The Department proposes to stock rainbow trout, largemouth bass, channel catfish, redear sunfish, bluegill sunfish, black crappie, and white amur for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times each year; the numbers of trout annually stocked would range from 0 to 30,000 fish annually.

White amur ranging in size up to 15 inches in length would be stocked as needed to control aquatic vegetation, to allow for improved angler access. The number stocked would range from 0 to 1,000 annually.

Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), black crappie (sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), and redear sunfish (fry/fingerling, sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation, to augment the existing fishery or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Water from artesian wells sited near the lake and rain runoff are the sources of water for this man-made lake. This lake is not located directly within any natural drainage in the Gila River watershed, and as such there is no opportunity for flood water to enter the lake. Water that does enter the lake is delivered through a concrete lined irrigation ditch owned and operated by the Lebanon Ditch Company. This irrigation ditch collects rain runoff from Rincon Canyon in the Pinaleno Mountains west of the lake. The water is stored in two reservoirs west of the lake known as Lebanon reservoir #1 and Lebanon reservoir #2. When water is released from these reservoirs, it travels approximately 3 miles down the concrete irrigation ditch to the point where it enters Roper Lake at the southwest corner. Artesian well water that is used to augment the lake level during times of drought is carried through the same concrete irrigation ditch for delivery to the lake.

The spillway at this lake is located in the southeast corner of the lake near the boat ramp. The spillway is concrete lined as it crosses the road in the park, but is poorly defined once it leaves the park property. Water passing over this spillway will eventually encounter Stockton Road east of the lake, which forces the water to change direction and begin flowing north along the outer edge of the earthen berm of the lake. Eventually the water will cross Stockton road just before reaching Roper Lake Road, at which point the water makes another turn to the east and then back to the north after crossing Roper Lake Road. The water then enters both active and retired agricultural fields where it will likely spread out in sheet flow and travel for approximately 1.5 miles through the fields before emptying into Stockton Wash. Once the water is in Stockton Wash it travels ½ mile, finally reaching a flood control dike constructed by Graham County to protect active agricultural fields and urban development's located along Stockton Wash. This flood control dike is located approximately 3 miles south of the Gila River (Figure 12).

The flood control dike prevents water from reaching the Gila River, and there are no naturally occurring drainages connecting the upstream of this lake to natural habitats. This location is therefore considered a closed system.

Figure 12. Aerial photo of flood control dike preventing flow from Roper and Dankworth to the Gila River drainage.

Fish Movement

The only opportunity for fish to leave this lake in an upstream direction is by way of the concrete irrigation canal. While the opportunity exists for fish to escape upstream, there is no opportunity for them to escape from the canal, and once water delivery has ceased and the canal dries up, any fish left in the canal will perish.

Fish moving downstream may do so during events which produce flow through the spillway. Such events can be expected to occur during the summer monsoon season or in the spring during the snow melt events in the higher elevations of the Pinaleno Mountains. Typically, such events would have to fill the two storage reservoirs of the Lebanon Ditch Company first before water would be released down the irrigation ditch to Roper Lake. Fish escaping during such events would travel the same path described in the water connectivity section above, until reaching the flood retention dike. Once there, fish would persist for a period of time until water either infiltrates in to the surface or evaporates, leaving fish to perish.

Community Description

Currently, the fish population at this lake consists of largemouth bass, bluegill sunfish, redear sunfish, green sunfish, black crappie, channel catfish, and yellow bullhead catfish. All of these species can and do reproduce in the system. Rainbow trout are stocked at this location during the

winter months of November through March; however, they do not carry over due to high water temperatures in the summer months (D. Mitchell pers. comm.). Rainbow trout also do not reproduce in this location due to the lack of appropriate habitat. There is no knowledge of how or when the green sunfish and yellow bullhead got into the lake. It is likely that these populations were present prior to the Department taking over ownership of the property, but no records are known to exist of the conditions at that time. The only other aquatic species recorded at this location are bullfrogs and crayfish.

The Department conducts annual fish surveys in the spring, using 150-foot experimental gill nets set over a 12 hour period at randomly selected sites around the lake. Results consistently show a healthy and stable populations of all of the above mentioned warm water fish species (Table 8Table 10).

Table 10. Spring survey at Roper Lake 2008

Species	**Number Sampled**	**Percent of Total**
Black crappie	17	28
Bluegill	4	7
channel catfish	4	7
Flathead catfish	0	0
Largemouth bass	24	40
Rainbow trout	0	0
Redear sunfish	5	8
Green sunfish	6	10
Total	60	100

Although completely separate from the proposed stocking location, a refugia population of Gila topminnow was established at Roper Lake headquarters pond in July 1989, and follow up surveys consisting of visual surveys and dip net sweeps reported that the fish persisted until 1996. The headquarters pond was reported to be dry in 2001 by Arizona State Parks staff. The Department assisted by Arizona State Parks conducted a sampling effort consisting of visual surveys, dip net sweeps, and cast net tosses in 2004 did not capture any Gila topminnows (Foster 2004). The population is considered as failed at this time. No other listed or non-listed native aquatic species have been documented at this location.

Consultation Species or Critical Habitat

There are no aquatic consultation species or critical habitats associated with this action area. Consultation species such as the southwestern willow flycatcher are discussed within the complex analysis.

Dankworth Pond

Site Description

Dankworth Pond is located on US Highway 191 approximately 7 ½ miles south of Safford, in Graham County. Located about 7 miles south of the Gila River near the Jacobson Creek drainage flowing off the east side of the Pinaleno Mountains, the lake was originally constructed as a private aquaculture facility in the early 1960's. Dankworth Pond was constructed by building an earthen berm 6 to 8 feet high using dirt that was removed from the bottom of the future pond. Today the property including the pond along with several non-functioning ponds is now owned by Arizona State Parks and is managed as a sister park to Roper Lake State Parks, about 2 miles north of the site. Dankworth Pond is approximately 7 acres in size with an average depth of approximately 15 feet.

Dankworth Pond is managed as a day-use only park, and visitors are not allowed at the park after sunset. While boats are allowed at the lake there are no launching facilities available and boats must be small enough to be carried to the water from the parking lot.

Management of Water Body

The primary fishery is a naturally reproducing warm water fishery consisting of largemouth bass, redear sunfish, bluegill sunfish, channel catfish, and black crappie. The Department also manages for a secondary seasonal opportunity fishery consisting of a winter put-and-take rainbow trout. The stocking history shows that two species of tilapia were stocked in the pond; however, there is no data to suggest either of these populations have persisted (Table 11).

Table 11. Historic Department fish stockings at Dankworth Pond

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Blue Tilapia	1975	1976	1	100
Channel catfish	1977	1987	7	6,950
Largemouth bass	1975	1975	1	145
Rainbow trout	1989	2007	70	47,224
Redear sunfish	1976	1976	1	86
Mozambique tilapia	1976	1976	1	300
Total			81	54,805

An angler survey conducted in 1998 showed the small pond receives some light use, but less than that of other lakes and ponds in the area; however, because the data were combined with that from other lakes in the area during analysis, it is not possible to determine exact numbers for angler use at Dankworth alone (Porath and Blasius 1999).

Proposed action

The Department proposes to stock rainbow trout, largemouth bass, channel catfish, redear sunfish, bluegill sunfish, black crappie, and white amur for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times each year. The numbers of trout stocked would range from 0 to 20,000 fish annually.

White amurs ranging in size up to 15 in length would be stocked as needed any time during the period covered by this consultation, to control aquatic vegetation to allow for improved angler access; the number stocked would range from 0 to 1,000 fish annually.

Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), black crappie (sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), and redear sunfish (fry/fingerling, sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation, to augment the existing fishery or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

This man-made pond is not located directly within any natural drainage in the Gila River watershed, and as such there is no opportunity for flood water to enter the pond. Water levels at the pond are maintained only by ground water pumping from artesian wells associated with the property on which the pond is located. Although there are no water inlets associated with the small pond, there is a spillway that allows excess water to leave the pond, where it enters Jacobson Creek approximately 200 yards away. Jacobson Creek is an ephemeral creek that drains approximately 10,000 acres off the east slope of the Pinaleno Mountains just south of the Swift Trail Road. Once water reaches Jacobson Creek, water then flows north for approximately 2 miles, where it confluences with Marijilda Creek. Water then would travel approximately 1.5 miles down Marijilda Creek where it confluences with Stockton Wash. Water then travels 1.5 miles down Stockton Wash where it would then encounter the same county owned and maintained flood control dike that prevents water escaping from Roper Lake from reaching the Gila River, which is approximately 3 miles further south (Please see Roper Lake Water Distribution/Connectivity discussion). There are no naturally occurring upstream drainages that connect with this lake; therefore, this location is considered a closed system.

Fish Movement

There are no drainages providing water into Dankworth Pond, thus, there are no opportunities for fish to escape in an upstream direction; however, fish could escape downstream during events which produce flow through the spillway. The water level is maintained through groundwater pumping, and the only opportunity for such events would be caused by human failure to shut off

pumps. If this happened the water would travel through the spillway. Fish escaping during such an event would then travel the same path described in the water connectivity section, above, until reaching the flood retention dike on Stockton Wash, approximately 5.5 miles north of Dankworth Pond. Once there, fish would likely persist for a period of time until water either infiltrates into the surface or evaporates, leaving fish to perish.

Community Description

Due to the small size and the difficulties of launching a boat large enough to conduct fish surveys, the Department has never completed one at this location. Based on angler catch reports, it has been determined the current fish population at this pond consists of largemouth bass, bluegill sunfish, redear sunfish, green sunfish, black crappie, and channel catfish. All of these populations are considered self-sustaining through natural reproduction. Rainbow trout are stocked at this location during the winter months of November through March; however, they do not carry over due to high water temperatures in the summer months and cannot reproduce due to the lack of suitable habitat. Although green sunfish are part of the fish community at this location, there are no records of how this fish population was established.

Beyond the fish community, bullfrogs and crayfish also occupy this location. There has not been listed or non-listed native aquatic species documented in this location.

Consultation Specie or Critical Habitat

There are no aquatic consultation species or critical habitats associated with this action area. Consultation species such as the southwestern willow flycatcher are discussed within the complex analysis.

Frye Mesa Lake

Site Description

Frye Mesa Lake is located on Frye Creek on the north facing slope of the Pinaleno Mountains, approximately 5 miles southeast of the town of Thatcher, at an elevation of 5,000 feet. The land around the lake is desert scrub and is owned and managed by the United States Forest Service.

The small lake was originally constructed by the town of Thatcher for the purpose of supplying domestic water to the town. It is about 5 acres in size, and has an average depth of 40 feet. There are no facilities at the lake and watercrafts are prohibited.

Management of Water Body

The lake is managed as an intensive put-and-take rainbow trout fishery, as well as a put-grow-and-take brown trout and brook trout fishery, with multiple stockings of each species annually. The stocking history at this lake shows only trout species have been stocked by the Department (Table 12).

Table 12. Historic Department fish stockings at Frye Mesa Lake

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1988	1988	1	5,000
Brown trout	1998	2001	2	8,083
Rainbow trout	1939	2007	124	232,989
Total			127	246,072

The Department has never conducted an angler-use survey at this location; however, the location is a very popular fishing location for the residents of the area.

Proposed Action

The Department proposes to stock rainbow trout, brown trout, and brook trout for the period covered by this consultation.

Rainbow trout would be stocked multiple times annually during the summer months, from April through late September, with catchable size rainbow trout; the number of catchable size rainbow trout stocked range from 0 to 30,000 annually.

Gila trout may be stocked multiple times annually depending on availability, with catchable size Gila trout; the number of catchable size Gila trout stocked range from 0 to 10,000 annually.

Brown trout are stocked one time per year as fingerling or sub-catchables in late September each year; the number of fingerling or sub-catchable brown trout stocked ranges from 0 to 10,000 annually. Periodically as available this population may be augmented with catchable size trout; the number of catchable size brown trout stocked would range from 0 to 10,000.

Fingerling or sub-catchables brook trout may be stocked annually dependant on the availability of this species; the number of brook trout would range from 0 to 10,000. Periodically, as available, this population may be augmented with catchable sized trout; the number of catchable sized Brook trout stocked would range from 0 to 10,000.

Water Distribution / Connectivity

Water levels at Frye Mesa Lake are typically within 2 or 3 feet of full throughout the year. However, during drought conditions this level may fluctuate, since rain and snow runoff from Frye Creek are the only sources of water for this reservoir. The Frye Creek drainage encompasses approximately 15,600 acres. Frye Creek above Frye Mesa Lake is perennial and ephemeral below the lake. Events that would cause water to flow over the spillway at this small reservoir are summer monsoon events and spring snow melt runoff from the higher elevations. Water leaving Frye Mesa Lake travels down the ephemeral section of Frye Creek approximately 5 miles, before entering a subdivision and golf course built directly in the drainage bottom.

Water entering the golf course would likely inundate and spread out, becoming sheet flow rather than a channelized flow. Once water leaves the golf course and developed urban areas, it flows approximately 1.5 miles where all flow is stopped and contained by a 15 to 20 foot tall flood control dike built and maintained by Graham County (Figure 13). This flood control dike is approximately 1 mile in length and is about 2 miles southwest of the Gila River. The dike was constructed to protect active agricultural fields, the High Line Canal System, and urban development in the town of Thatcher.

The flood control dike prevents water from reaching the Gila River, and there are no naturally occurring drainages connecting the upstream of this lake to natural habitats; therefore this location is considered a closed system.

Figure 13. Aerial photo of flood retention dike in Frye Creek

Fish Movement

Upstream movement of fish into the perennial sections of Frye Creek above the lake are impossible due to the presence of natural barriers present at the upstream end of the lake, where Frye Creek enters the Lake (Figure 14). The initial barrier that would be encountered by fish trying to leave upstream is a sheer vertical rise approximately 40 to 50 feet tall.

Fish leaving downstream could possibly do so during the flow events following summer monsoon and spring runoff. Fish leaving the reservoir would follow the same path as the water described above in the water distribution and connectivity section. Once the fish reached the flood control dike downstream of the lake their progress would be stopped; once there, fish

would likely persist for a period of time until water either infiltrates into the surface or evaporates, leaving fish to perish.

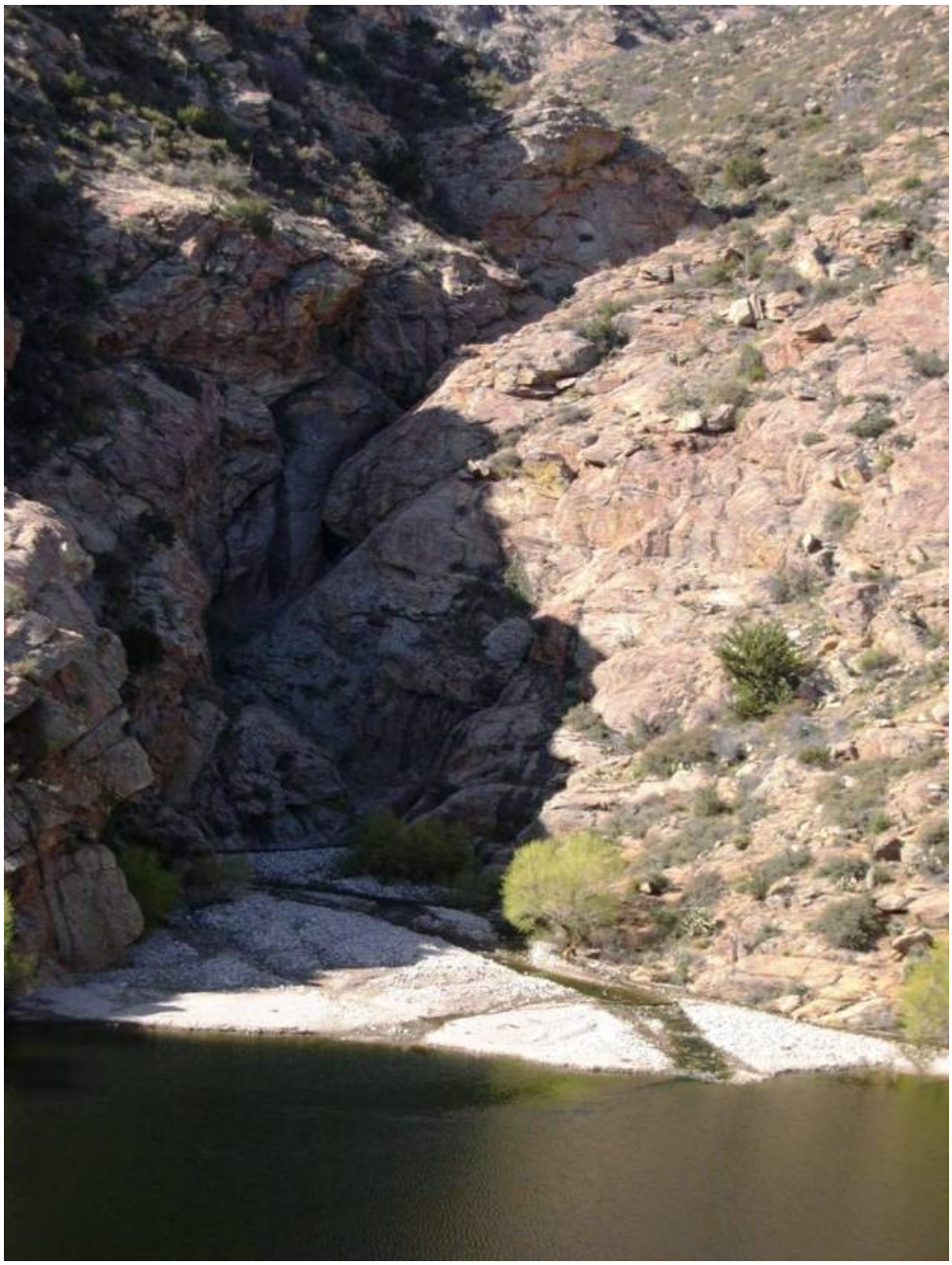

Figure 14. Upstream barrier to fish movement at Frye Mesa Reservoir

Community Description

Both brown and rainbow trout are known to still occur in this reservoir and are reported on a regular basis by anglers. It is not known for certain if brook trout are present. Anglers report catching brook trout; however, these reports have not been verified by the Department. Although

trout could carry over at this lake, there is no natural reproduction occurring due to the lack of appropriate habitat for successful spawning by trout species. The Department must maintain the fish population through stocking; therefore, fish surveys have never been conducted at this lake. Crayfish are also known to be present in the lake. Gila trout were stocked into Frye Mesa Creek upstream of the reservoir as a recovery action on Nov. 4, 2009.

Consultation Species or Critical Habitat
Consultation species such as the southwestern willow flycatcher are discussed within the complex analysis. Gila trout are discussed below.

Gila Trout
Gila trout were stocked into Frye Mesa Creek upstream of the reservoir as a recovery action on Nov. 4, 2009. It is too early to determine survival of the stocked fish or establishment of a recovery population but it is expected to occur into the future. The Gila trout were stocked by AGFD in cooperation with the Coronado National Forest. As part of the introduction process, the Forest prepared a Biological Assessment (Hayes 2009).

Potential Impacts

Gila trout washed down into Frye Mesa Reservoir may be subject to competition with and/or possible predation by stocked brown, brook, Gila or rainbow trout and may also hybridize with rainbow trout (although trout reproduction has never been documented in the lake). Additionally, Gila trout in Frye Mesa Lake will also be subject to harvest by angling as allowed under Section 4(d) of the ESA. Gila trout that migrate into the lake will be lost from the recovery population in the stream above because they will not be able to migrate back upstream due to existing natural waterfalls, which also prevent non-native trout stocked into the lake from accessing the recovery area.

Cluff Ranch Pond #3
Site Description
Cluff Ranch Pond #3 is a man-made pond about 10 acres in size, with an average depth of 12 feet. It is located about 5 miles south of Pima on the Cluff Ranch Wildlife Area (Figure 15). The Cluff Ranch Wildlife Area is located on Ash Creek at the foot of the Pinaleno Mountains. The Department acquired the property from the Federal Government in 1949. Cluff Ranch Pond # 3 is located in desert scrub at an elevation of 3,000 feet.

Facilities at the location include a concrete boat ramp, fishing pier, and restroom. Boats are restricted to a single electric motor, and camping overnight is prohibited.

Figure 15. Cluff Ranch Drainage

Management of Water Body

The Department manages the entire wildlife area today to optimize the potential of the area as wildlife habitat, to promote use of the area for present and future generations for public hunting, fishing, wildlife viewing, education and other wildlife oriented recreation. The primary management emphasis is on fishing for warm and cold water species.

As a primary fishery, the Department maintains naturally reproducing warm water species consisting of largemouth bass, bluegill sunfish, redear sunfish, green sunfish, channel catfish, and black crappie. Additionally the Department manages a secondary fishery consisting of a winter put-and-take rainbow trout fishery, with catchable rainbow trout stocked in the months of November through March. Historically, the lake has been stocked with a number of warm water species (Table 13).

Table 13. Historic Department fish stocking at Cluff Ranch Pond #3.

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Black crappie	1965	1965	1	1,000

Bluegill sunfish	1937	1953	2	8,375
Channel catfish	1964	1993	9	36,436
Largemouth bass	1937	1972	5	3,335
Rainbow trout	1972	2010	203	357,936
Threadfin shad	1957	1957	1	3,000
White Amur			1	100
Total			191	365,082

Cluff Ranch Pond #3 is a very popular fishing destination with the local citizens, with data collected in 2001 estimating that anglers expended 3,688 angler use days at the pond (Pringle 2004).

Proposed Action

The Department proposes to stock of rainbow trout, largemouth bass, channel catfish, redear sunfish, bluegill sunfish, black crappie, and white amur for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times each year; the numbers of trout annually stocked would range from 0 to 20,000 fish annually.

White amurs ranging in size up to 15 in length would be stocked as needed any time during the period covered by this consultation, to control aquatic vegetation to allow for improved angler access; the number stocked would range from 0 to 1,000 fish annually.

Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), black crappie (sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), and redear sunfish (fry/fingerling, sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation, to augment the existing fishery or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Cluff Ranch Pond #3 is maintained by rain runoff during the monsoon season and snow melt runoff in the early spring. Runoff is diverted from Ash Creek, approximately 3 miles upstream from the pond. The Department currently holds a water right for 1,223.48 acre-feet of water per year from Ash Creek. Ash Creek drains the north slopes of the Pinaleno Mountains, and

encompasses approximately 5250 acres, according to the Forest Service, with an 8.2 mile trail along the creek. Ash Creek is perennial from its headwaters near the top of the Pinaleno Mountains down to the Departments diversion; once past the diversion, the creek is ephemeral for the rest of its length. Water delivery from Ash Creek to the pond occurs through a 6-inch pipe operated and maintained by the Department. To direct the flow of water, there is a valve on this pipe allowing the ranch manager to either divert water into the pipe for delivery to the pond or directly down Ash Creek. In addition to the pipe delivering water to the pond, there is also a small unnamed drainage approximately 1 mile in length, entering the pond from the south. This small drainage would provide some rain runoff into the pond during the summer monsoon season, but the overall amount provided by this small drainage is unknown and thought to be minimal.

The spillway at this pond is poorly defined and the pond rarely, if ever, spills due to the management of the water level by the ranch manager. When the pond is full, the ranch manager closes the inlet to the pipe, allowing water to flow down Ash Creek instead of into the pipe for delivery into the pond. In the unlikely event that water were to spill over the spillway, it would leave the pond and flow into Shingle Mill Canyon via a now defunct irrigation ditch. Once the water enters Shingle Mill Canyon it would flow 2.5 miles to its confluence with Ash Creek. Once water enters Ash Creek it travels another 3 miles where the creek channel becomes bisected by the High Line Canal system (Figure 16). This canal consists of a 5 to 6 foot high berm, effectively acting as a dam and stopping all flowing water, preventing it from flowing further downstream. Depending on the size of the precipitation event and the amount of water pooled up behind the canal berm, water could spill over into the canal. In extreme events, water could fill the canal and spill over the other side of the canal berm, where it would simply be captured in active agricultural fields north of the canal. Water captured in the active agricultural fields at this point remains approximately 3 miles from the Gila River, separated by extensive agricultural and urban development.

The canal infrastructure built in Ash Creek channel diverts and stops all water flowing down Ash Creek, making it is impossible for water to reach the Gila River; therefore this system is considered closed.

Figure 16. Termination point of Ash Creek below Cluff #3

Fish Movement

The water pipe supplying water from Ash Creek is screened on both ends, and it is therefore impossible for fish to enter this pipe. Fish escaping from Cluff Ranch Pond # 3 in an upstream direction could only do so by entering the small unnamed drainage located on the south of the pond during summer monsoon rainfall runoff events. This small unnamed drainage is ephemeral and only has habitat appropriate to support aquatic wildlife during these rainfall runoff events. Any fish that were to escape in the upstream direction could potentially persist until conditions dry out, at which point the fish would perish.

Fish moving downstream could do so through the spillway, and would follow the same path as the water described above in the water distribution and connectivity section. As with the water, any fish that were to reach the berm of the canal system would find further progress blocked by the canal berm. All drainages associated with the downstream portion of this drainage, below the pond, are ephemeral and only contain aquatic habitat during these runoff events; once there, fish would likely persist for a period of time until water either infiltrates into the surface or evaporates, leaving fish to perish.

Community Description

Warmwater fish have persisted in the lake since before the Department purchased the property. The current warm water fish are self-sustaining and consists of largemouth bass, bluegill sunfish, green sunfish and black crappie (Table 14 and Table 15). There is no knowledge of how or when

green sunfish, and bullhead catfish got into the lake. It is likely these populations were present prior to the Department taking over ownership of the property, but no records are known to exist of the conditions at the time of purchase.

Table 14. Cluff Pond 2007 electrofishing survey for spring

Species	**Number Sampled**	**Percent of Total**
Black crappie	8	11
Bluegill sunfish	23	31
Largemouth bass	29	38
Green Sunfish	15	20
Total	75	100

Table 15. Cluff Pond 2007 electrofishing survey for fall

Species	**Number Sampled**	**Percent of Total**
Black crappie	14	6
Bluegill sunfish	85	36
Largemouth bass	103	44
Green Sunfish	34	14
Total 236 100	236	100

Rainbow trout are stocked during the winter months of November through March; they do not reproduce in the system, due to a lack of habitat. They do not persist in this system during the summer months, because water temperatures reach lethal limits during mid-summer.

Threadfin shad, although stocked in 1957, were not considered to be persisting in the small pond, and were thought to be eliminated until they were sampled again in the early 2000's. Repeated sampling over the years found no evidence that this species still persisted in the pond, suggesting they were illegally re-introduced to the system at some point. In addition there are also self-sustaining populations of bullfrogs and crayfish in Cluff Ranch Pond #3. There are no listed or non listed native species known from this drainage.

Consultation Specie or Critical Habitat
There are no aquatic consultation species, or critical habitats associated with this action area. Consultation species such as the southwestern willow flycatcher are discussed within the complex analysis.

UPPER GILA RIVER COMPLEX ANALYSIS
All of the proposed stocking locations within this complex have been determined to be closed systems with no connection to the Gila River drainage.

Water Distribution / Connectivity
The sites discussed in this analysis are all closed systems. Only two, Roper Lake and Dankworth Pond, have the potential for water spilled from the lakes to combine in Stockton Wash. However, a dike in Stockton Wash prevents water from entering the Gila River (See Roper Lake Water Distribution above).

Fish Movement
Fish cannot move between or from the proposed stocking locations as they are closed systems.

Community Description
The aquatic community at these locations may contain rainbow trout, largemouth bass, channel catfish, redear sunfish, bluegill sunfish, black crappie, and white amur. Frye Mesa Lake would be the exception, containing mainly rainbow, brown, and possibly brook trout.

Consultation Species or Critical Habitat
There are no anticipated effects to listed aquatic species residing in the Gila River drainage because the complex is a closed system.

Southwestern Willow Flycatcher
There are documented occurrences of the southwestern willow flycatcher along the Gila River proper. There is no suitable habitat for flycatchers at or adjacent to any of the proposed locations within the complex. There is no riparian vegetation necessary for the flycatcher at any of the stocking sites. Cluff Pond #3 is the closest location to the Gila River (approximately 1.5 miles).

Potential Impacts
No impacts are anticipated to southwestern willow flycatcher, as they occur only at the Gila River proper. There are no documented occurrences at the proposed stocking sites, which lack suitable habitat.

MIDDLE GILA SUB-WATERSHED
Physical Geographic Description

The Gila River originates in southwest New Mexico in the Mogollon Mountains in the Gila National Forest. The waters flow west through southeastern Arizona, to the south of Phoenix and eventually joins the Colorado River near Yuma. The Middle Gila River covers approximately 5,425 mi^2 from the confluence with the Salt River to San Carlos Reservoir (Figure 17).

Drainage Area and Elevations

The Middle Gila flows west from the San Carlos Reservoir to the confluence of the Salt River west of Phoenix and ends at the Ashurst-Hayden Diversion Dam. The Middle Gila consists of rugged mountain ranges, broad intermountain plains and flat, gentle valleys. Most rain falls during summer thunderstorms resulting in intense, localized runoff. Winter rains are generally gentle, but can result in heavy runoff once the soil becomes saturated (ADWR 2003). The Middle Gila River sub-watershed, for the purposes of this analysis, does not include the Santa Cruz sub basin, which is addressed in a separate chapter. The San Pedro River is the only major tributary between the San Carlos Reservoir and the Ashurst -Hayden Diversion Dam. According to the USGS Hydrologic Unit Codes, the Middle Gila watershed includes Wilcox Playa sub-watershed. The Ashurt-Hayden Diversion dam, a smaller earthen structure, located 50 miles downstream of Coolidge Dam diverts water into canals for delivery to water users. Significant tributaries include the San Pedro River and Salt River.

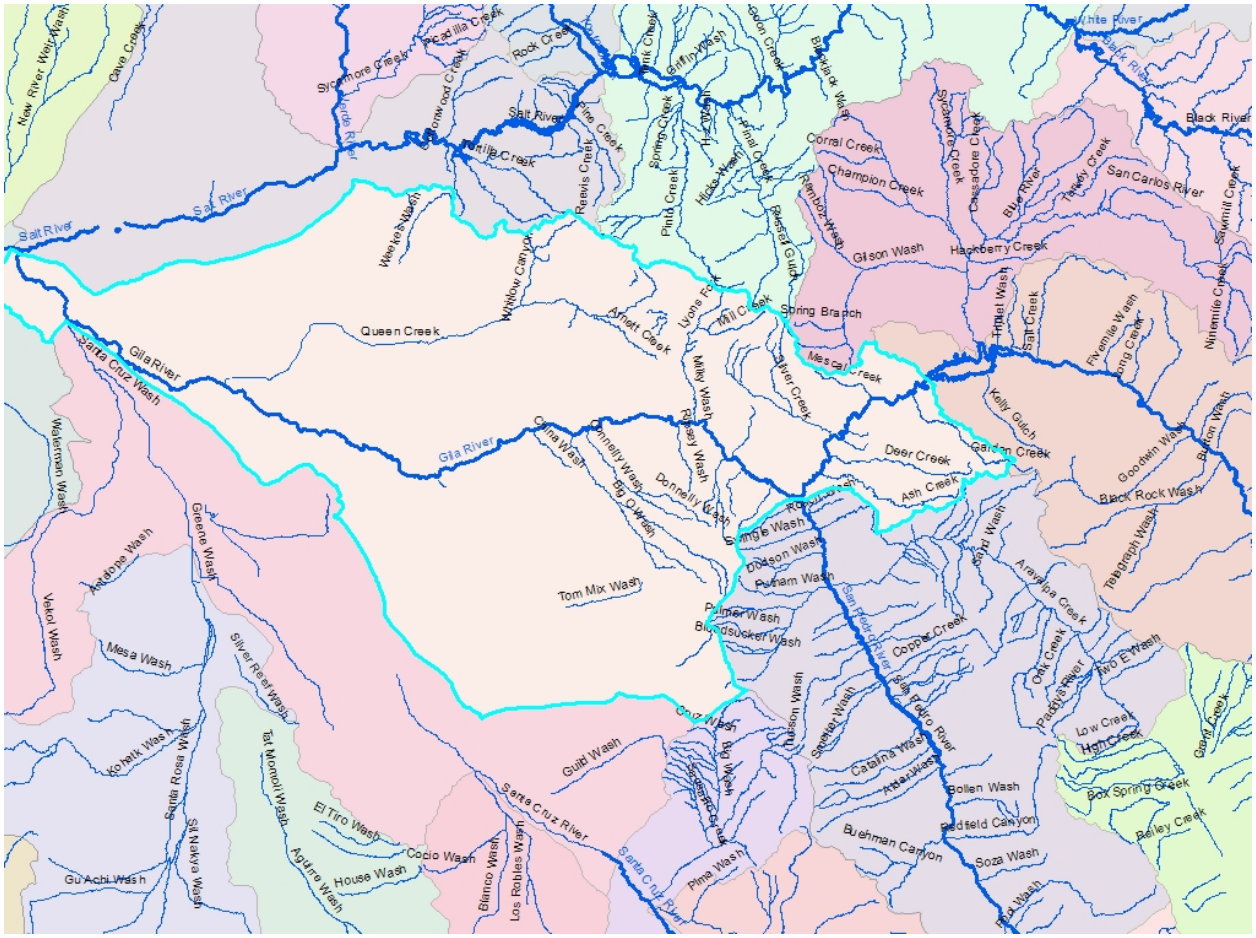

Figure 17. Middle Gila Sub-Watershed

Kearny Lake

Site Description

Kearny Lake is located in the town of Kearny at an elevation of 1860 feet, in Pinal County (Figure 18 and Figure 3). The lake is 5 acres in size and was constructed by the town to replace the previous lake when it was lost due to flooding in 1993. The lake was constructed above grade with a lined PVC geothermal membrane and a concrete lined shoreline. The lake is located within a city park that provides a campground facility, restrooms, and an improved concrete boat ramp.

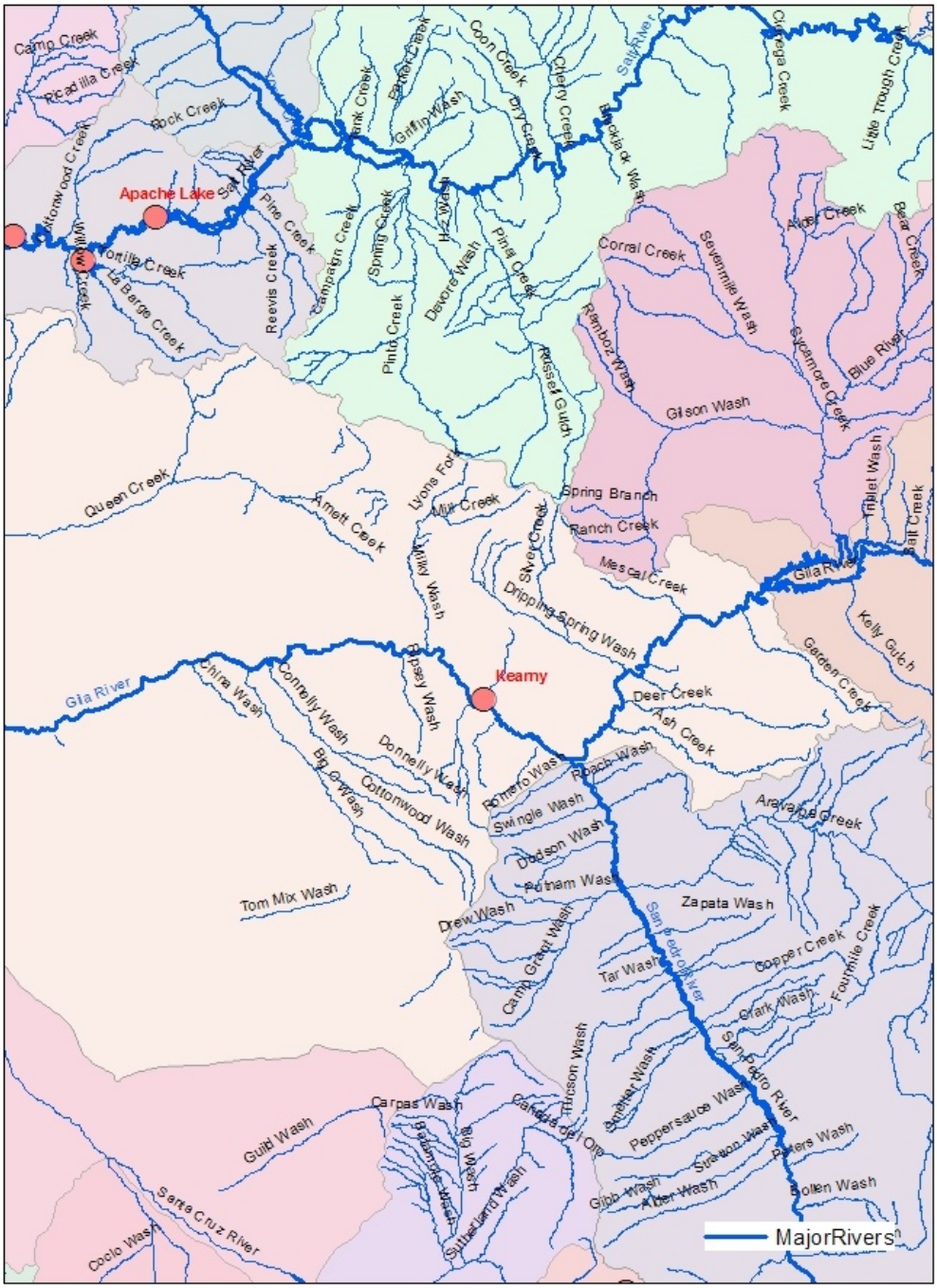

Figure 18. Kearny Lake.

Figure 19. Kearny Lake

Prior to 2002, the lake was managed as a self-sustaining warm water fishery and a winter put-and-take rainbow trout fishery. Angler surveys in 2001 estimated that Kearny provided approximately 3,000 angler use days (Pringle 2004). However, in 2002, golden alga (GA) was discovered. Blooms continue to occur each winter and kill all gill breathing animals. Prior to this discovery, the lake had experienced a series of severe fish kills resulting in a complete loss of aquatic life at the lake. Once GA had been positively identified the Department believed blooms would be ongoing because the alga is present and frequently reoccurs; there is no way of predicting if and when blooms will occur in the future. Because GA blooms prevent maintenance of self sustaining populations at Kearny Lake, private consultants hired by the town of Kearny have asked us to reconsider the stocking of fish following GA blooms to maintain a put and take fishery.

Since then, the lake has been managed as a put-and-take rainbow trout fishery as the Department determined that GA would prevent it from ever becoming a self-sustaining fishery. The

Department plans to expand it into a summer put-and-take warmwater fishery. Historic stocking at this location can be found in Table 16.

Table 16. Historic stocking at Kearny Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Rainbow trout	2000	2002	9	14,248
Largemouth bass	2000	2000	1	1,900
Total				16,148

Proposed Action

The Department proposes to stock rainbow trout, largemouth bass, channel catfish, redear sunfish, and bluegill sunfish, for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times annually with numbers of trout stocked ranging from 0 to 20,000 fish annually.

Catchable channel catfish stockings would be stocked multiple times from April through October. Numbers of catfish stocked would range from 0 to 40,000 fish annually.

Largemouth bass (catchables), bluegill sunfish (catchables), and redear sunfish (catchables) may be stocked at any time to augment the put-and-take channel catfish fishery in an effort to increase angler interest and participation. Number for each of the three species would range from 0 to 10,000 per species.

Water Distribution / Connectivity

Groundwater pumping and rainfall are the only sources of water for this lake. There is no spillway at this lake. If water reaches a high level, it would automatically be siphoned from the lake through a screened pipe (Figure 20 and Figure 21). Excess water would then be delivered 500 m to the Gila River through this screened pipe; however, due to monetary constraints, the Town of Kearny maintains the lake at a level well below the siphon.

Figure 20. Screened pipe

Figure 21. Close up of screened pipe

Fish Movement

There is no possibility of upstream movement out of this location, because the lake was built above the natural grade with no contributing watershed or channel. Fish movement downstream could only occur through the screened pipe off the siphon. This is highly unlikely due to the fact

the water level is maintained below the siphon and the catchable size of fish stocked cannot pass through the screened pipe although sub-catchables might do so if present. Reproduction, while possible, has never been documented since GA was positively identified at the location. Again, it is not possible to predict when GA would bloom, but past history has shown fish do not survive for extended periods of time due to the blooms.

Community Description

The Department has no data for this location. After construction was completed and the lake stocked, there was a GA fish kill before surveys could be completed. Currently, this site is believed to be fishless due to GA. For the same reason, no invertebrates or amphibians are present at the lake.

Consultation Species or Critical Habitat

Kearny Lake is approximately .3 miles from the mainstem of the Gila River. Southwestern willow flycatcher and designated critical habitat occur along the Gila River potentially adjacent to the lake.

Southwestern Willow Flycatcher

The stocking site occurs adjacent to designated critical habitat along the Gila River. Southwestern willow flycatchers were last documented in 2002 approximately .6 miles from the lake, on the other side of the airport near the Gila River. It is unlikely that anglers would walk from this stocking location to the Gila River because they would have to cross two roads and an irrigation ditch, airport runway and because the Gila River at this location is not stocked with sport fish. No suitable habitat exists for the flycatcher at or in the vicinity of the lake. There is no riparian vegetation at the lake for the flycatcher to utilize.

Potential Impacts

No potential impacts are anticipated to individual flycatchers or critical habitat. The stocking site occurs adjacent to designated critical habitat along the Gila River. Suitable habitat is not present at the lake.

AGUA FRIA RIVER SUB-WATERSHED

Physical geographic description

Drainage area

The Agua Fria River sub-watershed occupies about 1,200 mi^2 in central Arizona (Figure 22). The northern half of the basin is in the Central highlands physiographic province, and the southern half is in the Basin and Range province. The basin's main drainage is the Agua Fria River, which flows north to south through the basin and empties into Lake Pleasant. The Agua Fria and its tributaries are generally intermittent streams, except for some perennial stretches where impermeable bedrock forces groundwater into the streambed. The basin is bounded on the north

by Hickey Mountain, on the west by the Bradshaw and Buckhorn Mountains, on the south by Lake Pleasant, and on the east by the Black Hills and New River Mountains. The Agua Fria sub-watershed has a mixture stewardship of Federal, State, and private lands. Specifically, 46.7% National Forest and Wilderness, 16.7% U.S. Bureau of Land Management, 14.6% State Trust Land, 12.1% National Parks, Monuments, and Recreational Areas, 7.1% Private and 2.6% Other (AGFD, County, and Bureau of Reclamation Lands) (ADWR 2007).

Range of elevations
Land-surface elevations in the Agua Fria basin vary from 1,570 feet above sea level at Lake Pleasant to 7,800 feet in the Bradshaw Mountains.

Tributaries
The Agua Fria and its major tributaries are a combination of intermittent and ephemeral streams, except for some perennial stretches. Connected tributaries to the Agua Fria river upstream of Lake Pleasant include, Black Canyon, Slate, Boulder, Squaw, Little Squaw, Tule, Big Bug, Silver, Sycamore, Larry, Lousy, Tank, Bishop, Badger Springs, Indian, Lynx, Yarber Wash, Chaparral-Gulch Arroyo, Coyote Wash, Clipper Wash, and Yellow Jacket Creeks.

Three stocking locations, Lynx Lake, Fain Lake, and Horsethief Basin Lake, are proposed. Proposed stocking actions in the watershed will be evaluated as two reaches, the Lynx Creek Complex (consists of the two stocking sites of Lynx Lake and Fain Lake) and the Black Canyon Complex (consists of one stocking site of Horsethief Basin Lake).

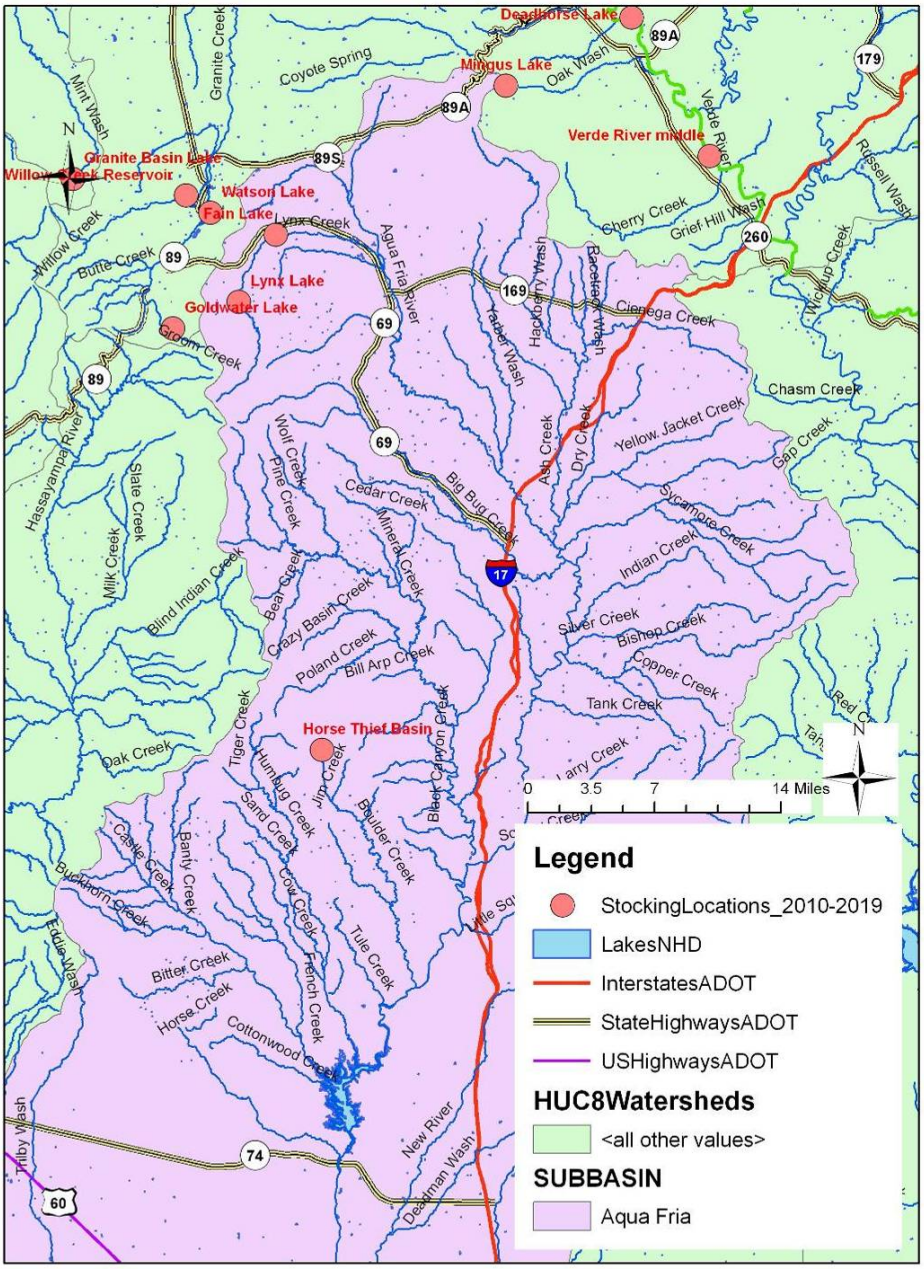

Figure 22. Overview map of the Agua Fria River Watershed and stocking sites.

LYNX CREEK COMPLEX

Physical Geographic Description

Drainage area and elevations

Lynx Creek begins off the northwest slopes of Mt. Davis in the Bradshaw Mountains, at roughly 6,500 feet of elevation, falling to 4,600 feet of elevation at its mouth. The stream bed courses

roughly 6-miles in a northerly path until in hits Lynx Lake. From the base of Lynx Lake Dam, the creek continues north to northeast 4.5 miles to Fain Lake. From the base of Fain Dam the creek continues east another 7.5 miles to its confluence with the Agua Fria River.

Tributaries
A number of small tributaries feed into Lynx Creek, including Smith Ravine, Benjamin Gulch, and Clipper Wash. All of these tributaries are ephemeral drainages.

Lynx Lake
Site Description
Lynx Lake is within the Prescott National Forest (PNF), but the lake itself is owned and operated by the Department (Figure 23). The 55-acre impoundment was created in 1963 and sits about 4-miles south of urban Prescott.

The area around the lake is a Forest Service recreation area with restrooms, campgrounds, picnic areas, a fishing pier, and a launch ramp for boats. Facilities are open all year. A general store and restaurant operated by a concessionaire is located on the north shore of the lake. The Prescott National Forest completed renovations and site improvements in 2002 in response to the ever-increasing popularity of Lynx Lake. Angling access is good because of a trail that contours the entire lakeshore. This trail has been closed on the east-side of the lake a minimum of December 1st to June 30th each year to prevent disturbance around a Bald Eagle nest.

Figure 23. Angler at Lynx Lake, July 2008.

Management of Water Body

Lynx Lake is managed primarily as an intensive use, put-and-take trout fishery using catchable sized rainbow, brown, brook, and cutthroat trout cultured at state hatcheries. Prior to stocking by the Department, other warm-water fish species such as common carp, and goldfish were illegally introduced. These species now maintain modest populations but are under-utilized by anglers at Lynx Lake. In April 2003, the Department modified its recent management approach and proposed to add brown trout, brook trout, cutthroat trout, channel catfish, largemouth bass, and crappie to the list of species approved for stocking, to improve the fishery. The crappie species currently present in Lynx is the black crappie. However, conditions at Lynx Lake are better suited for white crappie (Edwards et al. 1982). White crappie are currently present in the Agua Fria Watershed downstream at Lake Pleasant. Newer approved warm water species stockings did not start until 2004, and involve largemouth bass and channel catfish (Table 17 and Table 18).

Surplus trout in smaller age classes may be utilized to provide opportunity for a put-grow-take trout fishery. Trout stockings generally occur twice monthly with catchable fish throughout the year (with breaks in July and August due to water quality constraints). Smaller age classes would be stocked in autumn months to maximize the amount of growth time before water quality conditions become marginal. A secondary fishery is managed for warm water species, including largemouth bass, bluegill, crappie, and channel catfish. The warm water component is managed toward self-sustaining populations, with supplemental stockings of bluegill and channel catfish in spring, summer, and autumn for angler recruitment and retention special events. Summer supplemental stockings of largemouth bass and white crappie may be needed in the future, due to angler pressure or shifts in food webs and prey base. A lake management plan has been developed and contains strategies to achieve management goals (Clark 2004a). This plan will be updated every 2-years in conjunction with the Department's Operational Planning efforts.

Table 17. Stocking history of Lynx Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1992	1992	3	18,000
Bluegill	1992	2006	32	331,954
Brook trout	1964	2009	17	141,633
Brown trout	1971	2005	63	160,002
Cutthroat trout	1972	1972	3	30,000
Largemouth bass	2006	2006	4	4,268
Rainbow trout	1963	2009	1,921	4,874,704
Tadpole	1978	1978	3	6,000
Channel catfish	2004	2008	5	1,831

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Total			2,040	5,533,466

Table 18. Total numbers of fish stocked into Lynx Lake by species and year for the previous ten years.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Rainbow trout	35,768	29,217	30,416	22,100	21,469	41,595	20,424	18,951	18,873	17,500
Brown trout					8,186	25,433	14,029			
Brook trout									22,498	20,984
Largemouth Bass								1,217		
Bluegill						200		4,727		
Channel catfish						370	325	350	250	536

Lynx Lake was originally stocked in 1963 with catchable sized rainbow trout; however, in subsequent years it was found that due to poor benthos and zooplankton production, the size of the trout caught depended on the size of the trout stocked. The lake until 2003 was managed as a put-and-take cold water fishery supported by stocking as many as 51,000 rainbow trout annually. In 1964, largemouth bass and bluegill were discovered, and these species remained a secondary angler attraction until 2005. Other species such as Yellow bullhead, channel catfish, common carp, goldfish, green sunfish, and golden shiner were illegally introduced prior to subsequent stocking by AGFD (as listed in Table 17) and round out the warm water component of Lynx Lake as of 2008. Crayfish are also present locally in high numbers. Black crappie and golden shiner were plentiful in netting and electrofishing surveys until 2000. Origin and means of golden shiners accessing the lake are unknown. Golden shiner and black crappie have not been collected during survey efforts since that year. The lake was drawn down in 2002 for a complete a re-surfacing of the dam. Subsequently, in 2003 the lake was estimated at 18 feet below the spillway (this was its lowest level in some 25 years).

Past surveys and studies have suggested low levels of nitrogen and phosphorus as well as high levels of copper and zinc limits the primary productivity (Ziebell and Tash 1981). These factors have discouraged past fisheries managers from developing Lynx Lake into anything beyond a put-and-take trout fishery. During summer months, due in part to low primary productivity, dissolved oxygen levels fall to less than zero below a depth of 15-feet. Anoxic conditions deep in the lake combine with warm temperatures at the surface to force the suspension of trout stockings from July through late September. A hypolimnetic aerator was installed at the lake in 1999. This aerator was to pull cold anoxic water from the hypolimnon of the lake, saturate it with

oxygen and return it to the bottom, thereby avoiding mixing. Other aerators mix the layers in a lake thereby getting atmospheric oxygen in contact with water from the bottom. To date, the hypolimnetic aerator has not ameliorated the anoxic conditions during the summer months at Lynx Lake. The system was severely undersized at the onset of the project, and efforts to upgrade it have met with short-term successes only. Over the last 5-years the system has not been used due to mechanical or structural limitations.

Department fisheries personnel with the assistance of Department wildlife managers conducted a 13 month roving creel survey from June 1st 2008 to June 30th, 2009. This study was designed to determine the utilization of stocked fish and angler demographics for Lynx Lake. Outlined below are the key findings from that investigation.

- Rainbow trout were the most highly targeted species at 55%. If anglers listed more than one species, they were categorized as targeting anything. This accounted for 35% of the anglers. Catfish was the next highest at 6%.
- An estimated 13,529 fish were caught and 8,223 harvested. Catch rate overall was 0.17 fish/hr with a harvest rate of 0.10 fish /hr. 33,109 fish (cold and warm water species) were stocked into Lynx during the sampling period. This yields a 25% harvest return, a 41% catch return, and an angler success of 16%.
- 1,579 people were interviewed with a total of 71,281 angler hours or 35,318 angler use days. An angler use day is defined as any portion of a day that an angler is in the act of fishing.
- The Statewide survey of 2001 Arizona Anglers (Pringle 2004) estimated the annual angler use days to be 28,234 and the annual economic value (direct and indirect) of $3,924,526. This effort estimated the total number of angler use days to be 35,318 over the 13 month period. If we take into account the difference in the number of months, there remains a 15% increase in angler use days and an increase of $588,679 annual economic value.
- Average angler satisfaction with their fishing experience was 4.2 on a scale of 1-5.
- Ninety-six percent of anglers were residents of Arizona. 93% of anglers came from Yavapai County (51%) or Maricopa County (42%).

Angler's specifically targeting warm water species only account for about 10% of the anglers. This is likely a little lower than reality. Sampling is not done at night, when some anglers come out to catch catfish. While the number of anglers who do this is not high, they were not surveyed in this effort at all. The effort documented that both rainbow and brook trout were getting caught

during the summer months when they are not stocked. It was previously thought that rainbow trout would not over summer due to the anoxic conditions below the thermocline and the warm surface temperature. Based on these data rainbow trout did over summer in low numbers. During the survey period there were small areas where water quality was sufficient to sustain trout year-round. It is unclear if this occurs every year.

Some of the stocked fish are lost to avian predation, with double-crested cormorants taking the largest number of fish. Data are being collected to quantify the extent of the cormorant predation. Currently Lynx Lake is stocked once a month. While the harvest and catch numbers are not the lowest in the state, the angler success is only 16%. Only one in six anglers catches a fish. An angler has to fish nearly 6 hours to catch one fish. For a put-and-take trout fishery this is very low.

Angler use days were estimated to be 35,318 over the 13 month period. If we take into account the difference in the number of months, and use the same multipliers as the 2001 survey, a 15% increase in angler use days remains, and an increase of $588,679 annual economic value from just under $4 million to over $4.5 million annually. This is likely a low number, since the multiplier likely has increased from 2001 values. A complete summary of this creel survey is available in the appendices.

Proposed Action

The Department proposes to stock largemouth bass, bluegill sunfish, white crappie, rainbow trout, brook trout, brown trout, cutthroat trout and channel catfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked twice monthly except during July and August; numbers of trout stocked may be from 0 to 30,000 fish annually.

When available catchable and sub-catchable brook trout, brown trout and/or cutthroat trout would be stocked multiple times year round; total numbers of trout stocked may be from 0 to 50,000 fish annually.

Catchable bluegill sunfish would be stocked in support of angler recruitment/clinics; numbers of bluegill sunfish stocked may be from 0 to 3,000 fish annually.

Catchable channel catfish would be stocked in support of angler recruitment/clinics; numbers of catfish stocked may be from 0 to 3,000 fish annually.

Largemouth bass (fry/fingerling, sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), and white crappie (sub-catchables, catchables) may be stocked as needed basis at any time during the year to augment the fishery or recover the fishery from catastrophic events. Numbers of fish stocked for this

purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol. White crappie would be a new species established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity

The lake's main tributary, Lynx Creek, begins off the northwest slopes of Mt. Davis in the Bradshaw Mountains at roughly 6,500 feet of elevation. The stream bed courses roughly 6-miles in a northerly path until in hits Lynx Lake. The portion of Lynx Creek upstream of the lake is ephemeral in nature, typically flowing in response to snow run-off or local thunderstorm events. Two sediment "check-dams" are situated on Lynx Creek immediately upstream from the lake (Figure 24). The two structures are designed to control sedimentation of the lake from the surrounding shallow watershed. The upper dam failed in August of 2001, and excess sediment from behind both dams washed into Lynx Lake. The PNF and the Department dredged and repaired both structures and they are currently functioning properly.

Figure 24. Lower most sediment dam on Lynx Creek just upstream of Lynx Lake, March 2009.

Downstream of Lynx Lake Dam, Lynx Creek continues 4.5-miles until it reaches Fain Lake. Several diversions exist in this stretch; the largest diverts water to meet the 250-acre feet water right of Asphalt Paving Company (APS) in Prescott Valley. This diversion begins roughly one-half mile above Fain Lake and is carried by a canal around Fain Lake to an upper pond on APS property. The water in this pond and two others on the property are used for sand and gravel processing operations. All water is diverted during normal summertime releases from Lynx Lake. The nature and amount of water diverted by other diversions is unknown. Lynx Creek in

this stretch is ephemeral. Run-off from local thunderstorms may reach Fain Lake and downstream up to several times per year, depending on stochastic precipitation events. During normal and above normal snowfall years, some water spills over Lynx Dam and reaches Fain Lake; however, the frequency is highly variable and unknown.

A downstream water right minimum of 250 acre-feet is typically pumped out of Lynx Lake annually. The water is transported through two 8-inch pipes that sit on the spillway and deliver water to a normally dry streambed below the dam. This water is delivered regardless of the amount of spill in a given year. The Department is not required to deliver the 250 acre-feet if the lake level is lower than 15-feet below the spillway. The water delivery must happen between the months of May and August each year.

Lynx Lake spilled in 1999, 2005, 2007, and 2009 as a result of spring runoff. The spillway drops for 60 feet and ends in a small plunge pool. Water flows through Lynx Creek until it reaches a diversion dam (Figure 25) where a portion (depending on flows) is taken from the creek and then flows around Fain Lake into a series of ponds at the Asphalt Paving and Supply (APS) sand and gravel operation. Water that spills from the lake may also be diverted; however, some or all of the water may move downstream in Lynx Creek past Fain Lake and the APS property.

Below Fain Lake, water is diverted from Lynx Creek into a 5-acre pond that is secondarily used to maintain the upper pond that receives Lynx Lake water. These ponds are all used primarily for sand and gravel recovery and processing. Water in Lynx Creek does make it past the diversions on occasion. APS employees stated that “several times catfish have been seen in the streambed dying from desiccation”. Downstream of the lower pond, yet another pond exists to capture as much water as is allowed. Once below the APS operation, water in Lynx Creek released during high flows may reach the confluence of the creek and the Agua Fria River. Department field staff reports that this happens rarely because of the wide sandy highly impacted streambed and the rarity of a precipitation event that could cause such a flow. Once below the APS operation, Lynx Creek flows through ephemeral reaches (Figure 27) and rarely makes it to its confluence with the Agua Fria River.

Figure 25. Diversion dam on Lynx Creek between Lynx Lake and Fain Lake, July 2009.

Fish Movement

Both Lynx Creek and the Agua Fria River are ephemeral/intermittent streams flowing seasonally and during high precipitation events (Corkhill 2002). During periods of deliberate release from the lake, small stocked sport fish could be transported with the water diversion through the set of 8 inch pipes. These pipes provide water through a gas powered water pump when they are delivered outside of normal spilling of the reservoir. The action of passing water through the impellers likely greatly reduces the potential for transport of live adult fish through the pipes. All sizes of stocked sport fish could be washed over the spillway when the lake spills due to high inflows (Figure 26).

Figure 26. Drop from the spillway at Lynx Lake to Lynx Creek, March 2009.

Figure 27. Lynx Creek downstream of the APS lower pond, March 2009.

Community Description

No official surveys have been conducted on Lynx Creek above or below Lynx Lake. This is due to the ephemeral nature of the creek. Visual surveys performed by local Department wildlife managers and Department fisheries personnel have not recorded any fish persisting in the creek for more than a few months.

Department summer interns working out of the Regional Fisheries Program walked the entire stretch of Lynx Creek between Lynx Lake and Fain Lake in July 2009. Only small pools of shallow, fishless water were reported. Regional electrofishing efforts commenced in 2005 at the lake (Table 19). Channel catfish appear to be reproducing because young have been observed at the lake (A. Clark, pers. comm.), although they have not been collected during these recent sampling efforts.

Table 19. Number, relative abundance, relative biomass and catch per unit effort of sampling at Lynx Lake.

June 2005 (electrofishing)						
N= 39	Total Weight= 29,576			Total effort units = 45		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Yellow Bullhead	9.00	9.00	23.08%	0.20	565	1.91%
Common Carp	8.00	8.00	20.51%	0.18	25761	87.10%
Channel Catfish	2.00	2.00	5.13%	0.04	2118	7.16%
Bluegill	5.00	5.00	12.82%	0.11	283	0.96%
Largemouth Bass	14.00	14.00	35.90%	0.31	774	2.62%
Rainbow Trout	1.00	1.00	2.56%	0.02	75	0.25%
May 2007 (electrofishing)						
N= 65	Total Weight= 41,262			Total effort units = 45		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Yellow Bullhead	13.00	13.00	20.00%	0.29	6%	0.00%
Goldfish	2.00	2.00	3.08%	0.04	846	2.05%
Common Carp	25.00	25.00	38.46%	0.56	36952	89.55%
Channel Catfish	2.00	2.00	3.08%	0.04	2316	5.61%
Bluegill	15.00	15.00	23.08%	0.33	720	1.74%
Largemouth Bass	6.00	6.00	9.23%	0.13	234	0.57%
Brook Trout	2.00	2.00	3.08%	0.04	194	0.47%
	65.00			1.44		
September 2009 (electrofishing)- fish under 100mm total length were not weighed or measured.						
N= 173.00	Total Weight= 15,553.8			Total effort units = 45		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Yellow Bullhead	7.00	7.00	4.05%	0.16	6	0.04%
Goldfish	0.00	0.00	0.00%	0.00	0	0.00%
Common Carp	2.00	2.00	1.16%	0.04	3068	19.73%
Channel Catfish	4.00	4.00	2.31%	0.09	6130	39.41%
Bluegill	107.00	65.00	61.85%	2.38	2464	15.84%
Largemouth Bass	31.00	23.00	17.92%	0.69	3134	20.15%
Brook Trout	22.00	6.00	12.72%	0.49	752	4.83%

Total	173.00			3.84		

Non-natives have been recorded at the confluence of Lynx Creek with the Agua Fria River. Non-native fish captured during 1979 – 1995 surveys at this location were green sunfish and fathead minnows. Speckled dace is the only native fish sampled at this location (A. Clark pers. comm.).

Consultation Species or Critical Habitat
There are no aquatic consultation species in the immediate vicinity of Lynx Lake. Breeding bald eagles occur at the lake and are discussed below. Additional consultation species, including Gila Chub and spikedace, known from downstream in the Agua Fria River, Gila topminnow and desert pupfish in isolated tributaries along with Northern Mexican gartersnakes will be discussed in the Agua Fria River Complex Analysis section.

Bald Eagle
Lynx Breeding Area is located approximately 0.5 miles from Lynx Lake on private property and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2001 and were last observed in 2010 with young eaglets present. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2006 birds accounted for 17.1%, fish 14.3%, mammals 14.3%, carrion 5.7%, and unknown 48.6%. No prey items could further be identified. Lynx Breeding Area productivity data shows that the nest has been successful in 2007, 2008, and 2009 (Jacobson et al. 2006, 2007; McCarty and Jacobson 2008, 2009).

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Lynx Lake does have monofilament bins present.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Fain Lake
Site Description
Fain Lake is a 2-acre impoundment is owned by the Town of Prescott Valley (Town) and managed as a city park (Figure 28). In 1996 the Fain family donated the lake to the Town but retained the upstream water rights. These water rights are now owned by the Asphalt Supply

Company. A fishing pier was installed in 1998 using State Lake Improvement Funds to improve angler access. No boats are allowed at Fain Lake.

Figure 28. Fain Park, July 2002.

Management of water body

The Department currently operates the lake's fishery under a Cooperative Agreement with the Town. Fain Lake is located approximately 5-miles downstream of Lynx Lake. In 2003, Fain Lake was approved for stocking of rainbow trout, brown trout, cutthroat trout, brook trout, largemouth bass, channel catfish, bluegill, and white crappie. However, not all of these species were stocked into the lake (Table 20 and Table 21). Rainbow trout are stocked annually with about 16,000 catchable sized fish. State hatcheries stock Fain Lake every month, except July and August. Fain Lake's water quality conditions are similar to Lynx Lake, making white crappie a logical choice for that fishery as well.

Data from the latest Department mail-out angler survey estimates that 12,589 angler use days were expended at Fain Lake in 2001, and most (8,497) were seeking trout. The remaining 4,092 angler use days were attributed to anglers seeking warm water species, such as largemouth bass or channel catfish. A fountain type aerator was installed at Fain Lake in 1998, and during most

years, the aerator is able to maintain adequate oxygen levels to sustain trout stockings throughout the summer.

As with Lynx Lake, many of the stocked fish are lost to avian predation, with double-crested cormorants taking the largest number of fish. Fain is small enough that anglers or general visitors can visually observe double-crested cormorant predation. Numerous anglers complain of the lack of trout several days after a stocking and claim they have witnessed cormorants eating multiple trout. Data are being collected to quantify the extent of the cormorant predation.

Table 20. Stocking history of Fain Lake

Species	**First Year**	**Last Year**	**Num. of Stockings**	**Num. Stocked**
Rainbow trout	1997	2008	183	140,242
Channel catfish	1997	2008	7	3,060
Brook trout	2007	2008	2	13,492
Bluegill	2007	2007	1	1,000
Total			193	157,794

Table 21. Total numbers of fish stocked into Fain Lake by species and year.

Species	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Rainbow trout	9,355	10,800	11,500	9,851	14,327	23,842	14,001	15,851	19,882	13,630
Brown trout										
Brook trout									3,000	10,492
Largemouth Bass										
Bluegill									1,000	
Channel catfish						260	150	250	250	150

Similar to Lynx Lake, Fain Lake is managed primarily as an intensive use, put-and-take trout fishery using catchable sized rainbow, brown, brook, and cutthroat trout cultured at state hatcheries. Surplus trout in smaller age classes may be utilized to provide a small opportunity for a put-and-grow type concept. Trout stockings occur twice monthly annually with breaks in July and August due to water quality constraints. Smaller age classes would be stocked in autumn months to maximize the amount of growth time before water quality conditions become marginal. A secondary fishery is managed for warm water species, including largemouth bass, bluegill, white crappie, and channel catfish. The warm water component is managed to develop a self-sustaining populations with supplemental stockings of bluegill and channel catfish in spring,

summer, and autumn for angler recruitment and retention special events. Summer month supplemental stockings of largemouth bass and white crappie may be needed due to angler pressure or shifts in food webs and prey base.

Proposed Action

The Department proposes to stock largemouth bass, bluegill sunfish, white crappie, rainbow trout, brook trout, brown trout, cutthroat trout and channel catfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked twice monthly year round except during July to August; numbers of trout stocked may be from 0 to 30,000 fish annually.

When available catchable and sub-catchable brook trout, brown trout and/or cutthroat trout would be stocked multiple times year round; total numbers of trout stocked may be from 0 to 25,000 fish annually.

Catchable bluegill sunfish would be stocked in support of angler recruitment/clinics; numbers of bluegill sunfish stocked may be from 0 to 3,000 fish annually.

Catchable channel catfish would be stocked in support of angler recruitment/clinics; numbers of catfish stocked may be from 0 to 3,000 fish annually.

Largemouth bass (fry/fingerling, sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), and white crappie (sub-catchables, catchables) may be stocked as needed basis at any time during the year to augment the fishery or recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity

Flash flood events, typically in late summer, can transport and deposit large amounts of sediment into the lake. The lake has been dredged several times by the Town in the inflow areas, but extensive sedimentation remains in the main basin of the lake. The slopes of the surrounding hills as well as a narrowing canyon leading into Fain Lake make it vulnerable to flooding. Prior to the Fain family donation of the lake to the Town in the early 1990s, the lake was dredged every 6-8 years.

Historically, water from Lynx Lake was released bi-annually to meet a downstream water right and to maintain Fain Lake. Water is still released bi-annually from Lynx Lake, but due to the creation of a ditch to transport this water around Fain Lake, it no longer reaches Fain Lake under normal conditions. Water does spill over the dam at Lynx Lake periodically, and as a result fish

have most likely been transported downstream to Fain Lake. Trout were documented by anglers in 1997 before the Department started stocking Fain Lake.

Fish Movement

Overflow occurs by water topping the dam and dropping an estimated 60-foot onto bedrock and boulders (Figure 29). The water, once through this narrow bedrock canyon, opens to wide sandy alluvium and enters the APS property. Water is diverted from Lynx Creek into a 5-acre pond that is secondarily used to maintain the upper pond that receives Lynx Lake water (Figure 30). These ponds are all used primarily for sand and gravel recovery and processing. Water in Lynx Creek does make it past the diversions on occasion. Conversations with employees at APS revealed claims that “several times catfish have been seen in the streambed dying from desiccation”. Downstream of the lower pond, yet another pond exists to capture as much water as is allowed. Once below APS’s operation, water in Lynx Creek rarely makes it to its confluence with the Agua Fria River (Figure 31). From this point, the first viable habitat that could hold fishes occurs roughly 13-miles downstream.

Figure 29. Dam at Fain Lake.

Figure 30. Middle Pond on APS property.

Figure 31. Confluence of Clipper Wash, Lynx Creek and Agua Fria river looking west from road crossing to the sub-division of Quail Run, Prescott Valley, March 2009.

Community Description

No surveys have been implemented at Fain Lake due to its use as an intensively stocked and put-and-take trout fishery. Common species caught by anglers are rainbow trout, largemouth bass, bluegill, and channel catfish. Yellow bullhead and green sunfish have been found historically. Because of Fain Lake's connection to Lynx Lake (downstream from it), it has been assumed species that are found at Lynx Lake can also be found in Fain Lake. Native species of fish are not known from anywhere in the Lynx Creek area upstream from the Agua Fria confluence. Longfin dace are known from the Agua Fria River downstream of the mouth of Lynx Creek and are addressed in the Agua Fria Complex analysis.

Consultation Species or Critical Habitat

There are no aquatic consultation species in the immediate vicinity of Lynx Lake. Potential impacts to bald eagle are discussed below. Additional consultation species, including Gila Chub and spikedace, found downstream in the Agua Fria River, Gila topminnow and desert pupfish in isolated tributaries along with Northern Mexican gartersnakes would be discussed in the Agua Fria River Complex Analysis section.

Bald Eagle

Lynx Breeding Area is located approximately 4.2 miles from Fain Lake and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2001 and were last observed in May 2010. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2006 birds accounted for 17.1%, fish 14.3%, mammals 14.3%, carrion 5.7%, and unknown 48.6%. No prey items could further be identified. Lynx Breeding Area productivity data shows that the nest has been successful in 2007, 2008, and 2009 (Jacobson et al. 2006, 2007; McCarty and Jacobson 2008, 2009).

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Fain Lake does have monofilament bins present.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

BLACK CANYON CREEK COMPLEX

Physical Geographic Description

Drainage area and elevations

Black Canyon Creek and its tributaries drain a surface area of 244 square miles (refer back to Figure 22). Elevations range from a high over 6600 feet near Horsethief Basin, down to lower than 2000 feet at the confluence with the Agua Fria River.

Tributaries

The larger tributary drainages of Black Canyon Creek are Poland Creek, Crazy Basin Creek, Soap Creek, Rock Creek, Sycamore Creek, Poison Creek, Castle Creek, Bill Arp Creek, Arrastre Creek, Bumble Creek and its tributaries, and Turkey Creek and its tributaries. The only known documented perennial waters within these drainages occur within Castle Creek, as well as a few known localized springs within Black Canyon Creek and a tributary to Turkey Creek. There are no surface water or precipitation gauges on Black Canyon Creek or its tributaries. The Black Canyon Complex contains one stocking location (Horsethief Basin Lake).

Horsethief Basin Lake

Site Description

Horsethief Basin Lake was constructed in 1936 by the City of Phoenix to provide water resources to then-proposed Horsethief Basin Recreation Area. The lake is approximately a 5-acre impoundment with a storage capacity of 64 acre-feet of water and a maximum depth of 20 feet (Figure 32). It is located in the Bradshaw Mountains approximately 65 miles northwest of the Phoenix Metropolitan area and 3.5 miles southeast of the community of Crown King. It sits at an elevation of 6080 feet atop a small watershed connected to a tributary named Poland Creek. The watershed area for Horsethief Basin Lake is 0.76 square miles. Land ownership of Horsethief Basin Lake is comprised of 100% PNF lands. Poland Creek is intermittent/ephemeral for about 9 miles where it reaches Turkey Creek to form Black Canyon Creek, a 16-mile long tributary to the Agua Fria River. It is unknown if the lake ever spills, but the small watershed area relative to the size of the lake would suggest spill to be extremely unlikely.

Management of Water Body

Fisheries management practices for the lake were relatively passive from 1960 to 1988, mostly involving water quality examinations and intermittent sport fish stockings. Fish management strategies for Horsethief Basin Lake were more active from 1988 to 1998. The lake was modestly stocked with channel catfish six times over the ten-year period and two additional species, redear sunfish and fathead minnows were stocked in 1988 (Table 22). Water quality measurements were taken in 1988, 1991, 1993, and 1996-98 to determine oxygen/temperature profiles. The surveys from 1988 to 1993 revealed extreme levels of temperature stratification and less than

adequate dissolved oxygen levels (< 4.0 ppm) for fish; survival below two meters in depth were observed. In 1994, the Forest Service purchased a lake aeration system to remedy the poor water quality. A put-and-take catfish program ran, post aeration system from 1994-1998.

Figure 32. Horsethief Basin Lake

Fisheries management since 1999 has consisted of managing for largemouth bass and redear sunfish, in addition to the put-and-take stocking management for channel catfish of 300 catchables per year (during the summer to augment the non-reproducing population). The aeration system has not been operational for since at least 2005 and poor water quality has since returned to the lake. No stockings have occurred in this lake since 2003. In 2006 and 2009, water quality surveys were again conducted with dissolved oxygen levels varied from a marginal 4-5 ppm at the surface, to unacceptable levels for fish below two meters with readings of less than 2 ppm.

Table 22. Fish Species stocking summary for Horsethief Basin Lake, 1954-2003.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1954	1954	1	17,000
Channel catfish	1965	2003	18	10,228

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Fathead minnow	1998	1998	1	1,500
Largemouth bass	1954	1960	2	7,000
Redear sunfish	1988	1988	1	300
Total			22	36,028

In addition to the fish surveys, voluntary angler surveys have been conducted. A volunteer angler survey box was placed at the lake during the months of June - August in 1992, 1997, and 1998 to determine angler pressure and success rates. The creel form was designed to determine and establish baseline data for angler effort, success, harvest, demographics, and preferences. The results from these surveys indicated that catch and harvest rates improved from 1992 to 1998. Unfortunately, only ten survey cards were collected in 1997, rendering that data somewhat suspect. However, comparisons of the 1992 and 1998 angler survey data show a significant increase in angler harvest rates of 167%, from .05 to .35. Angler catch rates did improve somewhat for channel catfish between 1992 and 1998; however, only six catfish were reported caught during the angler survey in 1997, and 15 in 1998 survey. There were no reports of catfish caught during the 1992 angler survey. It is possible that most of the channel catfish had been harvested before or after the voluntary angler surveys, or during the surveys and not reported; regardless, these data suggests a less than anticipated return for the stocking investment. The Department also initiated two statewide angler use surveys in 2001 and 2006. The results from these surveys indicate an increase in angler use days on Horsethief Basin Lake from 163 in 2001 to 2220 in 2006.

Proposed Action

The primary objective is to stock largemouth bass, channel catfish, and bluegill sunfish for the period covered by this consultation. Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), and bluegill sunfish (sub-catchables, catchables) may be stocked as needed basis at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity

The Horsethief Basin Lake inflow sits on top of a small watershed that connects to the Poland Creek drainage, and is confined to inflow of only a 0.76 square mile watershed. The lake has not been documented to spill. During water quality surveys the lake has never been documented to rise over 7.2 meters in depth. For these reasons the Department determined the action is confined to only the lake.

The outflow of the lake, if it were to occur, drains into Horsethief Canyon. Horsethief Canyon travels north 8 miles where it connects with Poland Creek. Poland Creek drains approximately 11 miles where it connects to Black Canyon Creek. Other tributary drainages connected to Poland Creek include Crazy Basin Creek and its tributary. These creeks and canyons are ephemeral in nature.

Black Canyon Creek traverses 19 miles where it connects to Agua Fria River approximately 15 miles upstream from the northern arm of Lake Pleasant within the town of Black Canyon City. Other tributary drainages of Black Canyon Creek are Soap Creek, Rock Creek, Sycamore Creek, Poison Creek, Castle Creek, Bill Arp Creek, Arrastre Creek, Bumble Creek and its tributaries, and Turkey creek and its tributaries. The only known documented perennial waters within these drainages occur within Castle Creek, as well as a few known localized springs within Black Canyon Creek and a tributary to Turkey Creek.

Fish Movement

Black Canyon Creek and its tributaries are known to be intermittent and ephemeral in nature (ADWR 2007). The ephemeral and intermittent streams within the Agua Fria and its tributaries are the biggest inhibitor to fish movement within the drainage. It is undocumented if fish barriers exist within this drainage. If fish were to leave Horsethief Basin Lake they would have the ability to move down Horsethief Canyon to Poland Creek, then to Black Canyon Creek, and to the Aqua Fria River, which empties into Lake Pleasant. All of the species recommended for stocking have been collected in Lake Pleasant. However, these species have not been collected in Black Canyon Creek or its tributaries (LCRB Aquatic GAP database). This suggests stocked fish are not washing out of Horsethief Basin Lake and if they are that the ephemeral nature of the drainages downstream of the lake do not have the proper habitat to support long-term survival of these species.

Community Description

Fish population surveys were conducted in the summers of 1988, 91-93, 1996, 2006, and 2009 to document fish species presence and relative abundance. Table 23 compares the surveys conducted in a comparable fashion over time. The most recent survey at Horsethief Basin Lake once again documented the presence of largemouth bass, redear sunfish, and channel catfish. In addition, this survey indicated a healthy and abundant reproducing population of redear sunfish. The Largemouth population was in poor condition, seemingly due to lack of prey base. The channel catfish population in the lake was the lowest, most likely due to the poor water quality in the deeper portion of the lake, seriously inhibiting the habitat preference of a bottom dweller.

Table 23. Horsethief Basin Lake Gillnet/Electrofishing survey results by species..

Year	Species	Number	Rel. Abun. (%)	CPUE total effort (EFU)	CPUE total effort (NNU)

2009	Largemouth Bass	17	20.7	8.5	3.2
	Redear Sunfish	64	78	53.9	2.8
	Channel Catfish	1	1.2	0.9	0.0
	TOTAL	82	100	63.3	6.0
2006	Largemouth Bass	35	39	33.9	0
	Redear Sunfish	55	60	51.4	0.8
	Channel Catfish	1	1	1.0	0
	TOTAL	91	100	86.4	0.8
1996	Largemouth Bass	23	82		7.4
	Redear Sunfish	4	14		1.3
	Channel Catfish	1	4		.4
	TOTAL	28	100		9.1
1992	Largemouth Bass	34	67	9.5	3.3
	Redear Sunfish	15	29	5.7	.7
	Channel Catfish	2	4	.5	.2
	TOTAL	51	100	15.7	4.2

Below Horsethief Basin Lake, within the Black Canyon watershed, the presence of the following aquatic species has been documented: Gila topminnow, lowland leopard frog, longfin dace, red shiner, fathead minnow, and green sunfish (Kansas GAP 2009; HDMS 2009). Lowland leopard frogs are documented in most of the riparian sections throughout the Black Canyon watershed and its tributaries, with the closest know location is within 12 miles of the stocking location (HDMS 2009).

Gila topminnows were known to historically to occupy Castle Creek in 1987 and 1989. These topminnows were hypothesized to have washed out of Bench Well, a stocked site in 1983 (Kansas GAP 2009). Gila topminnows were also documented post-stocking in an unnamed spring near Cedar Creek in 1985 (Kansas GAP 2009). However, in the late 1980s and early 1990s, massive flooding scoured the Bradshaw Mountains. Since these floods, all of the Gila topminnows have disappeared from this drainage. Gila topminnows are currently considered extirpated from all waters within the Black Canyon Creek drainage.

Longfin dace are documented to occupy Castle Creek and Black Canyon Creek near the confluence with Castle Creek (Kansas GAP 2009), more than 15 miles downstream from Horsethief Basin Lake.

Red shiner, fathead minnow, and green sunfish, all non-native, are documented in Black Canyon Creek near the confluence with Castle Creek (Kansas GAP 2009). None of these fish are present in Horsethief Basin Lake, which is more than 15 miles upstream from the collection site. These fish are hypothesized to be invading Black Canyon Creek from the Agua Fria River during times of higher flows.

Consultation Species or Critical Habitat

The consultation species include Gila chub, spikedace, Gila topminnow, desert pupfish, and Northern Mexican gartersnakes. These species will be discussed in the Agua Fria River Complex Analysis section.

AGUA FRIA RIVER SUB-WATERSHED ANALYSIS

Water Distribution and Connectivity, fish movement, and aquatic community descriptions have been discussed for Lynx Lake and Fain Lake, down to the confluence of Lynx Creek and the Agua Fria River, and for Horsethief Basin Lake down to the Confluence of Black Canyon Creek and the Agua Fria River. Downstream connectivity the Agua Fria River and its connected tributaries would be discussed in this analysis along with the potential impacts to consultation species in the Agua Fria Complex.

Water Distribution/Connectivity

The Agua Fria River flows north to south and empties into Lake Pleasant and drains approximately 2,300 square miles into the central part of Arizona. The northern half of the basin is in the Central Highlands physiographic province, and the southern half is in the Basin and Range province. Connected tributaries to the Agua Fria river upstream of Lake Pleasant include, Black Canyon Creek, Slate Creek, Boulder Creek, Squaw Creek, Little Squaw Creek, Tule Creek, Big Bug Creek, Silver Creek, Sycamore Creek, Larry Canyon, Lousy Canyon, Tank Creek, Bishop Creek, Badger Springs Wash, Indian Creek, Lynx Creek, Yarber Wash, Chaparral-Gulch Arroyo, Coyote Wash, Clipper Wash, and Yellow Jacket Creek. Perennial streams in this basin include the Agua Fria River, Ash Creek, Sycamore Creek, Indian Creek, Silver Creek, a small stretch of Humbug Creek, Yellow Jacket Creek, and Grapevine Creek; all of these perennial streams have intermittent reaches (ADWR 2007). The rest of the streams are considered ephemeral.

Fish Movement

The ephemeral streams within the Agua Fria and its tributaries are the biggest inhibitor to fish movement within the drainage. The United States Geological Survey have constructed and maintains three surface water gauges on the Aqua Fria River; one near Humbolt (Figure 33), one near Mayer (Figure 34), and one near Rock Springs (Figure 35). The Rock Springs gauge provides solid data supporting the ephemeral nature of the drainage with monthly mean discharges of 0.00 cubic feet per second (cfs) annually since 2000 (Table 24). The other two

gauges also provide data supporting annual dry spells with monthly means of less than 1 cfs. Big Bug, Indian and Little Sycamore creeks are intermittent and often consist of isolated pools during dry times of year; there are no documented barriers to offer protection from nonnative fish species in these systems. However, no known invasion of non-native fish have occurred in these drainages, indicating some type of geologic characteristic is preventing their upstream movement in to occupied habitats (Kansas GAP 2009). Grapevine Creek, a tributary to Big Bug creek has perennial flows for over 1 mile of stream. Flows become intermittent beyond this point for approximately 0.6 miles and then the stream is dry for over three miles to the confluence of Big Bug creek. Lousy Canyon and Larry Creek are unique systems, in that they are at the top of relatively small basins. They are very well isolated from the mainstem Agua Fria River as evidenced by the fact they were fishless before being stocked with endangered fishes and there are documented barriers to fish movement. Other higher order tributaries within the drainage are ephemeral in nature and thought to be isolated from the mainstem Agua Fria River through distance of ephemeral channel and connection to one of these dry creeks listed above.

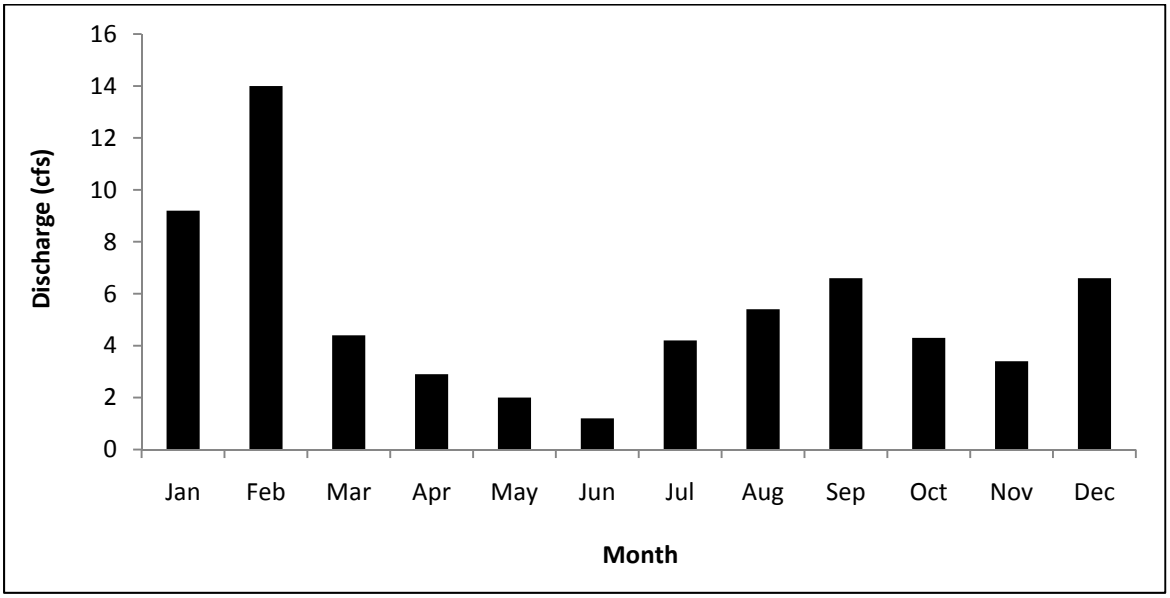

Figure 33. Mean monthly discharge for the USGS site at Humbolt, AZ for the period Jan 1, 2000 to September 30, 2009.

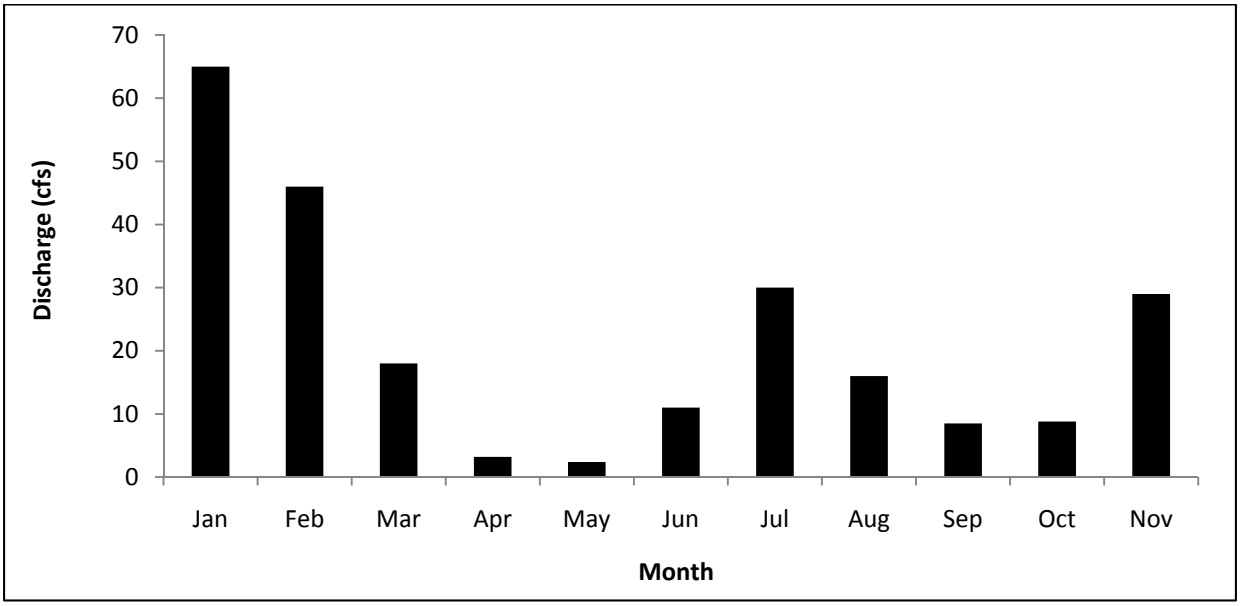

Figure 34. Mean monthly discharge for the USGS site at Mayer, AZ for the period Jan 1, 1940 to September 30, 2008.

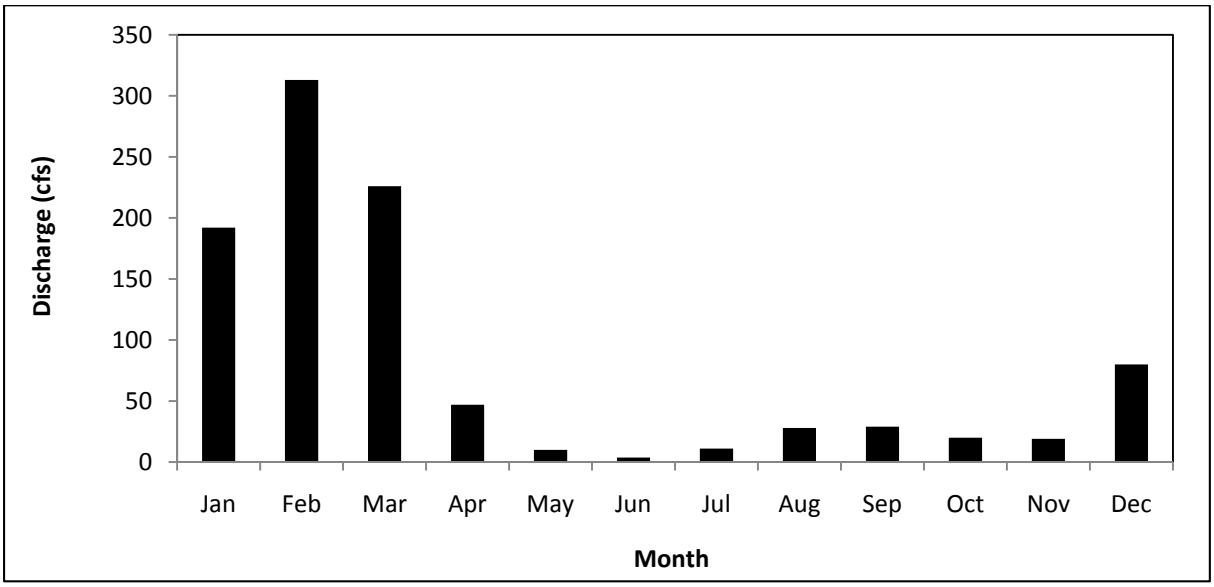

Figure 35. Mean monthly discharge for the USGS site at Rock Springs, AZ for the period February 1, 1970 to September 30, 2008.

Table 24. Mean monthly discharge for the USGS gage at Rock Springs, AZ for the period from January 1, 2000 to September 30, 2008.

YEAR	Month											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2000	1.0	0.8	13.6	2.7	0.3	11.5	0.8	6.5	2.5	136.5	18.2	2.2
2001	15.7	59.8	144.5	11.4	1.3	0.1	0.2	5.8	0.0	0.0	0.0	0.0
2002	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	99.9	0.3	0.1	0.0
2003	0.0	135.3	145.6	4.5	0.3	0.0	0.0	38.1	4.3	0.7	0.0	0.2
2004	0.2	0.2	2.9	4.7	0.0	0.0	8.2	5.3	10.4	4.8	73.8	546.8
2005	842.8	1650.0	180.1	47.6	16.8	2.1	20.4	76.8	6.3	9.7	8.4	2.1
2006	3.0	3.7	7.1	4.2	2.1	0.4	22.1	50.8	21.0	0.7	0.5	0.8
2007	0.9	1.0	0.7	0.2	0.0	0.0	27.6	12.2	0.3	0.0	0.5	157.0
2008	498.6	225.8	27.6	2.8	3.6	0.8	11.2	5.2	3.6			
Mean	151.4	230.7	58.0	8.7	2.7	1.7	10.1	22.3	16.5	19.1	12.7	88.6

In addition to the ephemeral nature of the Agua Fria watershed, Arizona's diverse topography and geology created canyon-bound reaches where natural barrier falls developed along stream courses or man-made structures were built (Table 25). Natural barriers are known to be present on Silver Creek and Sycamore Creek. There is also a man-made fish barrier in Tule Creek above Lake Pleasant that was developed to secure populations of Gila topminnow from invasion by nonnative fish. Upstream of these barriers are nonnative free (Kansas GAP), with the exception of Sycamore Creek, which contains a natural, reproducing population of rainbow trout in its headwaters (Gill 2006b) that is a remnant population established in 1942 from a single stocking of 2000 rainbow trout. These barriers inhibit the movement of fish upstream. Below these barriers, or the lower most barriers on these streams, nonnative fish populations exist (Kansas GAP).

Table 25. Known barrier locations in the Agua Fria Drainage.

Stream	Barrier Type	Location	Comments
Silver Creek	Natural	Narrow Gorge	1-2 meter drop
Agua Fria River	Natural	Below Badger Springs	Only during low flow
Sycamore Creek	Natural	Double T water fall near Double T ranch	3-4 meter drop
Sycamore Creek	Natural	Middle Box	1-2 meter drop
Sycamore Creek	Natural	Rock Bottom Box	2-3 meter drop
Tule Creek	Man Made	¼ mile upstream from the confluence	None

Community Description

The presence of the following species has been documented from the Agua Fria River watershed including its tributaries upstream of Lake Pleasant: northern Mexican gartersnakes, lowland leopard frog, longfin dace, yellow bullhead, desert sucker, common carp, red shiner, desert pupfish, mosquitofish, Gila chub, channel catfish, green sunfish, spikedace, rainbow trout, fathead minnow, sailfin molly, Gila topminnow, and speckled dace (Kansas GAP 2009; Holycross et al. 2006; HDMS). These records excluded accounts from the Black Canyon Creek Drainage and the Agua Fria and its tributaries upstream of the Ash Creek Confluence, which have already been addressed previously in the stocking site information.

Holycross et al (2006) surveyed the Agua Fria for northern Mexican and narrow-headed gartersnakes and found green sunfish, fathead minnow, common carp, red shiner, brown bullhead, and mosquitofish in the main river channel, and fathead minnow and green sunfish in Sycamore Creek near the Forest Service cabin, but did not document any stocked species. Likewise, the Department surveyed Sycamore Creek in the early nineties, and in 2001, 2005, 2008, and 2009, and did not find any of the stocked species, although rainbow trout from that 1942 stocking event have been found in Sycamore Creek and in the Agua Fria River at the mouth of Sycamore Creek in the past.

Northern Mexican gartersnakes were historically observed from the Agua Fria Watershed at Table Mesa Road, Bloody Basin Road, and at the confluence with Big Bug creek (Holycross et al. 2006). Based on surveys as reported in Holycross et al. (2006), and from additional surveys and requests for information, it appears this species may be extirpated from the Agua Fria drainage (see analysis below).

Lowland leopard frogs are found in most of the riparian sections throughout the Agua Fria River and its tributaries (HDMS 2009).

Longfin dace and desert sucker have similar distribution in the Agua Fria drainage and have been documented in most of the riparian sections throughout the Agua Fria River, Tule creek, Badger Springs Wash, Indian Creek, Silver Creek, Big Bug Creek, Ash creek, Sycamore creek, Little Ash creek, Little Sycamore Creek, Dry creek, Yellow Jacket Creek, and Cienega Creek (Kansas GAP 2009).

Yellow bullhead, channel catfish, red shiner, mosquitofish, and common carp have only been documented in a few localities between Rock Springs to Lake Pleasant in the Agua Fria mainstem. Mosquitofish were also known to occupy Mud Springs Tank, which is located above Larry Creek (Kansas GAP 2009).

Grapevine Creek was historically fishless up until November 2009 when Gila trout were stocked into the upper perennial section. Big Bug creek is also historically fishless presumably because it is intermittent during summer months and temperatures become too hot to support trout (J. Carter, Pers. Com.).

Desert pupfish occupy three streams in the drainage, Tule Creek, Larry Creek, and Lousy Canyon (Kansas GAP 2009).

Gila chub occupy six tributaries of the Agua Fria Drainage. These are Larry Creek, Lousy Creek, Silver Creek, Indian Creek, Sycamore Creek, and Little Sycamore Creek. All six of these streams have critical habitat associated with the occupied sites (Kansas GAP 2009).

Green sunfish and fathead minnow are also widely distributed throughout the Agua Fria Drainage. They have been documented in the mainstem Agua Fria from Lake Pleasant to Rock Springs, near Badger Springs Wash, in Silver Creek, Sycamore Creek, Little Ash creek, Dry creek, and Yellow Jacket Creek. Fathead minnows also occupy Cienega Creek (Kansas GAP 2009).

Rainbow trout are located only in the upper sections of Sycamore Creek (Kansas GAP 2009).

Sailfin molly has only been documented around Rock Springs in the Agua Fria mainstem (Kansas GAP).

Gila topminnows were stocked throughout the 1980s and early 1990s in many locations throughout this drainage. Many of these stockings failed due to numerous variables, including lack of sustainable water, grazing, and flooding events. Gila topminnow currently occupy Larry Creek, Lousy Creek, and Tule creek (Kansas GAP 2009). All other stocked sites within this drainage are considered extirpated.

Speckled dace occupy Ash Creek, Sycamore Creek, Little Ash Creek, Little Sycamore Creek, and Dry Creek (Kansas GAP 2009).

Consultation Species and/or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in

Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican gartersnakes are analyzed in this complex and downstream discussion, rather at the individual stocking sites due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Gila Chub

Suitable and occupied habitat for the Gila chub occurs in six tributaries of the Agua Fria River. These are Silver Creek, Sycamore Creek, Little Sycamore Creek, Indian Creek, Lousy Canyon, and Larry Canyon. All six of these streams have critical habitat associated with the occupied sites. The closest occupied habitat to Horsethief Basin Lake occurs at Larry Canyon approximately 35 stream miles from the stocking site and the next closest being Indian Creek, which is 45 miles from the stocking site. Lousy and Larry Canyons and Indian Creek are also designated critical habitat. Suitable habitat does not exist at Horsethief Basin Lake.

Potential Impacts

Due to the ephemeral and intermittent nature of the watershed and natural fish barriers, it is not anticipated that stocked species of fish would likely come into contact with individuals of Gila chub, but if so only on a rare basis following large scale flooding events. Populations of green sunfish, bullfrog, crayfish, and mosquitofish occur in downstream reaches of the Agua Fria River and may affect the ability of Gila chub displaced from habitats above the fish barriers in Sycamore and Silver creeks to persist in the stream and river below these barriers. The addition of piscivorous sport fish species, particularly channel catfish, even briefly, may result in additional predation that could affect the short-term persistence of these Gila chub populations. It is unclear if this potential effect is meaningful or reasonably certain to occur.

Gila trout

Gila trout were stocked into fishless Grapevine creek in November, 2009. Grapevine creek provides over 1 mile of habitat, and the Gila trout population counts towards recovery of the species in the San Francisco-Gila River recovery unit. Subsequent stocking may occur over the course of the next five to ten years. Because Gila trout are a federal threatened species, AGFD has the ability under the 4(d) rule of the Endangered Species Act to regulate take by allowing limited utilization of reestablished populations as a sport fisheries. Grapevine Creek is currently closed to angling while the population becomes established; however, the potential of the Gila trout population in Grapevine Creek to open to angling, once established may be considered in the future if the population is large enough to sustain limited catch-and-release angling pressure.

Potential Impacts

It is unlikely that Gila trout in Grapevine creek would move downstream into Big Bug creek or further into the Agua Fria since there is a three mile "dry barrier" upstream from the confluence with Big Bug Creek. If a trout did move downstream in an extreme precipitation and flow event, it would not persist in either Big Bug Creek or the Agua Fria due to temperatures above critical tolerance levels and lack of habitat (J. Carter, Pers. Com.). Prior to the stocking in November 2009, Grapevine creek was fishless, and Big Bug Creek is currently fishless indicating that fishes present in the Aqua Fria have not been successful at moving into and occupying Big Bug Creek. Consequently, if sport fish stocked in either Lynx or Fain lakes escape and move downstream into the Agua Fria, it is not expected that they would move upstream into Big Bug Creek or Grapevine Creek.

Desert Pupfish

Desert pupfish occupy three streams in the Agua Fria Watershed above Lake Pleasant; Tule Creek, Larry Creek, and Lousy Canyon; no critical habitat was designated for desert pupfish in the Agua Fria Watershed. Desert pupfish were stocked into Tule creek on September 19, 2007 and augmented again on October 15, 2009. To date this population has not established itself. Desert pupfish were stocked into Larry Creek and Lousy Canyon on March 31, 2006. Subsequent monitoring of the populations has determined both populations still occupy the creeks. Lousy Canyon and Larry Creek are unique systems in that they are at the top of relatively small basins. They appear to be very well isolated from the mainstem Agua Fria River although there are no obvious barriers to fish movement. They were fishless before being stocked with endangered fishes. The Biological Opinion (BO) (2-21-99-F-031) for the reintroduction of Gila topminnow and Desert Pupfish into Silver Creek, Larry Creek, and Lousy Canyon states, "The Agua Fria River downstream of all three stocking sites is occupied by green sunfish and mosquitofish. These two non-native fishes represent a biological barrier that would preclude both topminnow and pupfish from becoming established outside the maximum dispersal area." In addition to this statement, the BO further supports this by stating, "Any movement of these two fishes into the Agua Fria River would be considered temporary and subject to 100% incidental take from existing non-stocked non-native fishes, and other activities."

Potential Impacts

Because of the ephemeral and intermittent nature of the watershed and natural fish barriers, it is anticipated that stocked species of fish could potentially come into contact with individuals of Desert pupfish only on a rare basis following large scale flooding events. As provided in the BO, any desert pupfish displaced out of the reintroduction area is assumed to be lost due to the presence of non-native predators and competitors. Any individuals of the stocked species that reach habitats containing displaced desert pupfish could prey on or compete with the desert pupfish; however, as these individuals are already considered lost, this does not create an additional adverse impact.

Gila Topminnow

Gila topminnows occupy three streams in the Agua Fria Watershed upstream of Lake Pleasant. These are Tule Creek, Larry Creek, and Lousy Canyon. No critical habitat was established for Gila topminnow in the Agua Fria Watershed. Gila topminnows were initially stocked into Tule Creek in 1968, but due to cattle grazing and floods they needed to be restocked in 1981. Gila topminnow has persisted in the creek since that time. In 1992 a fish barrier was installed on Tule Creek to prevent the upstream movement of non-native fish. Surveys since that time have only reported longfin dace and Gila topminnow occupying the creek. Gila topminnows were stocked in the year 2000 into Larry Creek and Lousy Canyon. Multiple surveys post stocking have determined that both of these populations are established, reproducing, and recruiting. Lousy Canyon and Larry Creek are unique systems in that they are at the top of relatively small basins. They appear to be very well isolated from the mainstem Agua Fria River, in part because they were fishless before being stocked with endangered fishes, although there are no documented barriers to fish movement. The Biological Opinion (BO) (2-21-99-F-031) for the reintroduction of Gila topminnow and Desert Pupfish into Silver Creek, Larry Creek and Lousy Canyon states, "The Agua Fria River downstream of all three stocking sites is occupied by green sunfish and mosquitofish. These two non-native fishes represent a biological barrier that would preclude both topminnow and pupfish from becoming established outside the maximum dispersal area." In addition to this statement the BO also further supports this point by stating, "Any movement of these two fishes into the Agua Fria River would be considered temporary and subject to 100% incidental take from non-native fishes, and other activities."

Potential Impacts

Because of the ephemeral and intermittent nature of the watershed and natural fish barriers, it is anticipated that stocked species of fish would come into contact with individuals of Gila topminnow only on a rare basis following large scale flooding events. As provided in the BO, any Gila topminnow displaced out of the reintroduction area is assumed to be lost due to the presence of non-stocked non-native predators and competitors. Any individuals of the stocked species that reach habitats containing displaced desert pupfish could prey on or compete with the desert pupfish; however, as these individuals are already considered lost, this does not create an additional adverse impact.

Northern Mexican Gartersnake

Stocking complex analysis: Although the Agua Fria drainage lies within the historical range of northern Mexican gartersnakes, the likelihood the species would be exposed to fish stocked at Lynx Lake, Fain Lake or Horse Thief Basin is low. There are no records for northern Mexican gartersnakes from any of the stocking sites (HDMS 2009, AGFD Riparian Herpetofauna Database 2009, V. Boyarski pers. comm. 2009). Northern Mexican gartersnakes were previously observed at several sites along the Agua Fria drainage, though only two records fall within the 20

km buffered stocking complex and they include a 1985 record from Horseshoe Bar (Rosen and Schwalbe 1988) and a historical record (ca. 1900) along Granite Creek (HDMS). Additional sites where northern Mexican gartersnakes have been observed in the Agua Fria drainage, but outside of the buffered stocking complex include: Table Mesa Road (1984-85), Bloody Basin Road (1980), Big Bug Creek confluence (1980), Little Ash Creek (1984), and Ash Creek (1992) (Rosen and Schwalbe 1988, HDMS 2009, AGFD Riparian Herpetofauna Database 2009). From 2004-2005, Holycross et al. (2006) surveyed 11 sites along the Agua Fria River for northern Mexican gartersnakes, including previously known locations, but did not find the species. In addition, bullfrogs and crayfish have been documented along much of the Agua Fria, making the habitat less suitable for gartersnakes. Based on data reported in Holycross et al. (2006) and the lack of any documented observations since the late 1980s to early 1990s, the U.S. Fish and Wildlife Service determined that northern Mexican gartersnakes are likely extirpated from the Agua Fria drainage (USFWS 2008a). However, sites exist in the Agua Fria drainage that might be suitable for future northern Mexican gartersnake recovery activities.

Downstream analysis: If fish were to disperse downstream of Lynx Lake, Fain Lake or Horse Thief Basin, the likelihood that northern Mexican gartersnakes would be exposed to stocked fish is low because, as detailed above, the species has likely been extirpated from the Agua Fria drainage (USFWS 2008a).

Spikedace

The only record of spikedace in the Agua Fria River was documented in 1943 near Rock Springs (Kansas GAP 2009). The Designation of Critical Habitat for the Spikedace (72 FR 13355 13422), is at sites that were occupied at the time of listing, occupied during the time of the designation, or where features essential to the conservation of the species exist. Neither the Agua Fria River nor any of its tributaries were designated for critical habitat. For this reason, spikedace are considered extirpated from the Agua Fria River.

Potential Impacts

Due to the extirpation of spikedace from the Agua Fria River, no potential impacts from the stockings of Horsethief Basin, Lynx, or Fain Lakes would be anticipated.

LOWER GILA RIVER SUB-WATERSHED

Physical Geographic Description

Drainage area

The lower Gila River begins at Phoenix at the confluence of the Gila and Salt Rivers, and ends about 150 miles downstream at its confluence with the Colorado River near Yuma. The drainage area is large, and including the Agua Fria sub-watershed, covers 14,857 square miles (9,509,290 acres). The lower Gila below Painted Rock Dam is depicted in Figure 36. Inflows are limited to

water releases from upstream dams, wash flows from rainfall events, wastewater effluent releases, and drainage/seepage from the Wellton-Mohawk Irrigation and Drainage District. The river is intermittent along its length in this reach. This basin contains low elevation mountain ranges surrounding plains and valleys with desert scrub vegetation (ADWR 2006).

Range of elevations
Elevations range from 1092 feet near Phoenix to 141 feet near the confluence with the Colorado River near Yuma.

Tributaries
No perennial tributaries enter the Gila River in this reach. There are several major washes; however, they only flow after rainfall events.

LOWER GILA-YUMA COMPLEX
The Lower Gila River Sub Watershed (Figure 36) contains three proposed stocking sites; Wellton Golf Course Pond, Redondo Pond and Fortuna Pond. These three locations form one stocking complex, the Lower Gila Complex, because they are in proximity to the each other and the Lower Gila River, which is intermittent within this reach, running east to west (Figure 37). Two of the three waters proposed for stocking are closed systems.

Wellton Golf Course Pond
Site Description
This 1.5 acre pond is located on a golf course in the town of Wellton. The pond was constructed in the 1980s as a water hazard on the golf course (Figure 38). It is near the bottom of the watershed/complex and is owned by the town of Wellton.

Management of Water Body
Wellton Pond has not been actively managed as a fishery in the past; however, the local community has expressed an interest in conducting a fishing clinic/derby at this site. The Department would like the ability to stock this pond to facilitate future fishing clinics/derbies. The Department’s stocking database indicates that "Wellton Ponds" was stocked with 200 mosquitofish and 500 tilapia in 1976. However, it is likely that the stocked pond was a smaller pond located in the vicinity of this pond, since the pond addressed in this consultation did not exist in 1976 (L. Whitaker, pers. comm.). Wellton Pond as identified in this consultation is not known to have been previously stocked.

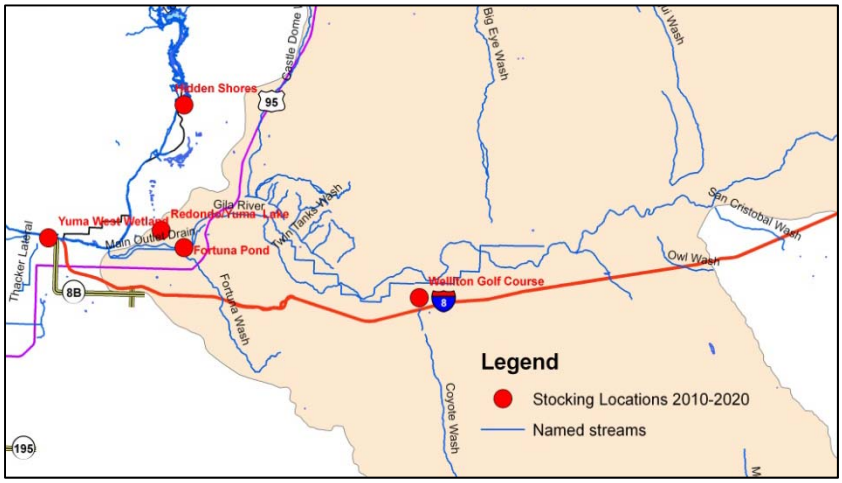

Figure 36. Lower Gila River sub-watershed. Wellton Golf Course, Fortuna Pond, and Redondo (Yuma Lakes) are located at lower reaches of the Gila River.

Figure 37. Map of Lower Gila Complex with stocking sites (sub-watershed shaded yellow), Laguna Dam and Morelos Dam identified.

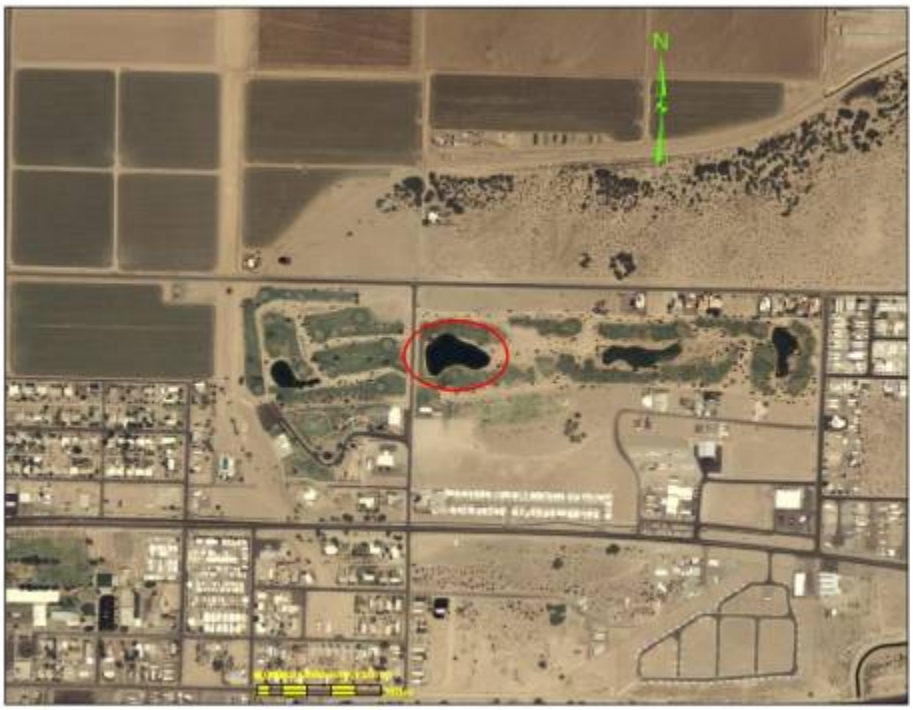

Figure 38. Aerial photo of Wellton Golf Course Pond (circled in red).

Proposed Action

Rainbow Trout, largemouth bass, channel catfish and bluegill sunfish for the period covered by this consultation.

A total of up to 2,000 catchable fish would be stocked once annually; species to be stocked could include one or more of the following species: rainbow trout, largemouth bass, channel catfish or bluegill sunfish depending on availability, cost and time of year. Sub-catchable bluegill sunfish or largemouth bass may also be stocked in place of the catchables.

Water Distribution / Connectivity

Water is supplied by a well and there is no outflow/overflow from the pond. The pond is considered permanent and the surface elevation does not fluctuate largely. The pond is isolated with no hydrologic connection to the Colorado or Gila Rivers, and is considered to be a closed system.

Fish Movement

Fish cannot escape or enter this pond because it is a closed system.

Community Description

No surveys have been conducted on this pond and no fish are known to occur in the pond; however it is suspected that carp, tilapia, and mosquitofish may be present.

Consultation Species or Critical Habitat
Please see the Lower Gila – Yuma Lakes complex analysis for a discussion of consultation species including Yuma clapper rail.

Fortuna Pond

Site Description
Fortuna Pond is a 9-acre impoundment located about 9 miles east of Yuma, adjacent to the Gila River. Land ownership is Bureau of Land Management (BLM), Bureau of Reclamation (BR) withdrawn. Fortuna Pond was constructed in 1985 by the BR as mitigation for lost fishing opportunities that resulted from the construction of the Yuma Desalting Plant west of Yuma. This pond is located close to the City of Yuma and receives heavy fishing and outdoor recreation activity. Facilities include parking lots, picnic areas, two fishing jetties, and unimproved camp sites. There are dirt roads to the site, no boat ramp, and boat motors are restricted to electric only (Figure 39).

Figure 39. Photo of Fortuna Pond.

Management of Water Body
The BR stocked Fortuna Pond for several years following its construction, although stocking records have not been located, and is required to provide and maintain sport fish angling opportunities. The Department began stocking the pond in 1999 and currently stocks the pond with both warm and cold water species to facilitate fishing clinics/derbies and to maintain the

fishery, which receives heavy fishing pressure year-round (Table 26). In recent years the pond has been stocked with catchable size channel catfish, 2 to 4 times per year during the warm part of the year, and with catchable size rainbow trout, 3 times per year during the winter months. Fishing clinics/derbies are generally scheduled to coincide with stocking events. Previous consultations provided for the stocking of rainbow trout and largemouth bass.

Fortuna Pond is managed primarily as a put-and-take intensive use channel catfish and rainbow trout fishery, and secondarily as a warm water, self-sustaining largemouth bass, and bluegill fishery. As such, supplemental stockings of largemouth bass and bluegill may be required to maintain the desired level of those species in this pond to support angler opportunity and demand.

Table 26. Fortuna Pond stocking history 1999 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Rainbow trout	1999	2009	30	59,287
Channel catfish	2006	2008	8	7,612
Total			38	66,899

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, and bluegill sunfish for the period covered by this consultation.

Catchable sized rainbow trout would be stocked October through March; numbers of rainbow trout to be stocked would be from 0 to 16,000 fish annually (~ 1,000 to 4,000 fish per stocking).

Catchable sized channel catfish will be stocked during the warmer months; however, stockings of channel catfish could occur any time during the year. Numbers of channel catfish to be stocked will be from 0 to 16,000 fish annually (~ 1,000 to 4,000 fish per stocking).

Catchable or sub-catchable largemouth bass and/or bluegill sunfish may be stocked as needed at any time during the year to augment existing populations, or to recover fishery following a catastrophic event. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Fortuna Pond is maintained by inflow from a ground-water well. Outflow occurs through a screened pipe located at the surface of the pond, then through a culvert and ditch that leads to the Gila River (Figure 40 and Figure 41). The outflow is screened with a mesh size of less than a ½ inch, is maintained by the BR as necessary, and the screen prevents medium to large fish from

escaping; however, the pond is considered connected to the Gila River due to the outflow. The pond is inside the primary levee for the Gila River but is isolated from the river, except for the outflow, by a secondary levee surrounding the pond.

Figure 40. Aerial photo of Fortuna Pond.

Figure 41. Aerial photo of Fortuna Pond.

Once the water reaches the Gila River it travels downstream approximately 6 miles to the confluence of the Gila and Colorado rivers. This stretch of the Gila River is choked with vegetation and normal flows are extremely low. Notable flood events have occurred in late spring in four of the past 20 years: 1992, 1993, 1995, and 2005. Mean monthly discharge data for the past 20 years along the Lower Gila River downstream from Painted Rock Dam (USGS gauge 09519800) and also just upstream from Fortuna Pond near Dome (USGS gauge 09520500) indicate that during non-flood years, flows in the Lower Gila are on average less than 35 cfs (Figure 42). Flows are lowest in July through December and higher in the winter and early spring months. During the four notable flood years on record, maximum mean monthly flows ranged from 1,235 cfs in 1995 to 22,550 cfs in 1993 at the Dome.

It is not uncommon to find stretches where there is only sub-surface flow. The Gila River enters the Colorado River about 8 miles below Laguna Dam and 12 miles above Morelos Dam in what is called the Yuma Division of the Colorado River. Once in the Colorado River, water travels down to Morelos Dam and is then diverted into a canal system that delivers water to Mexico per treaty agreement. There is normally no water delivered downstream of the Morelos Dam except for a small amount of “leakage” that passes through the dam and continues down the Colorado River for a short distance until it goes sub-surface. Only on rare occasions does sufficient water flow through Morelos Dam that surface flows reach Mexico. Those rare occasions would be during times of inadvertent irrigation overruns and during flood control releases. The last

significant flow below Morelos Dam came during flood control releases in the winter of 1997-1998.

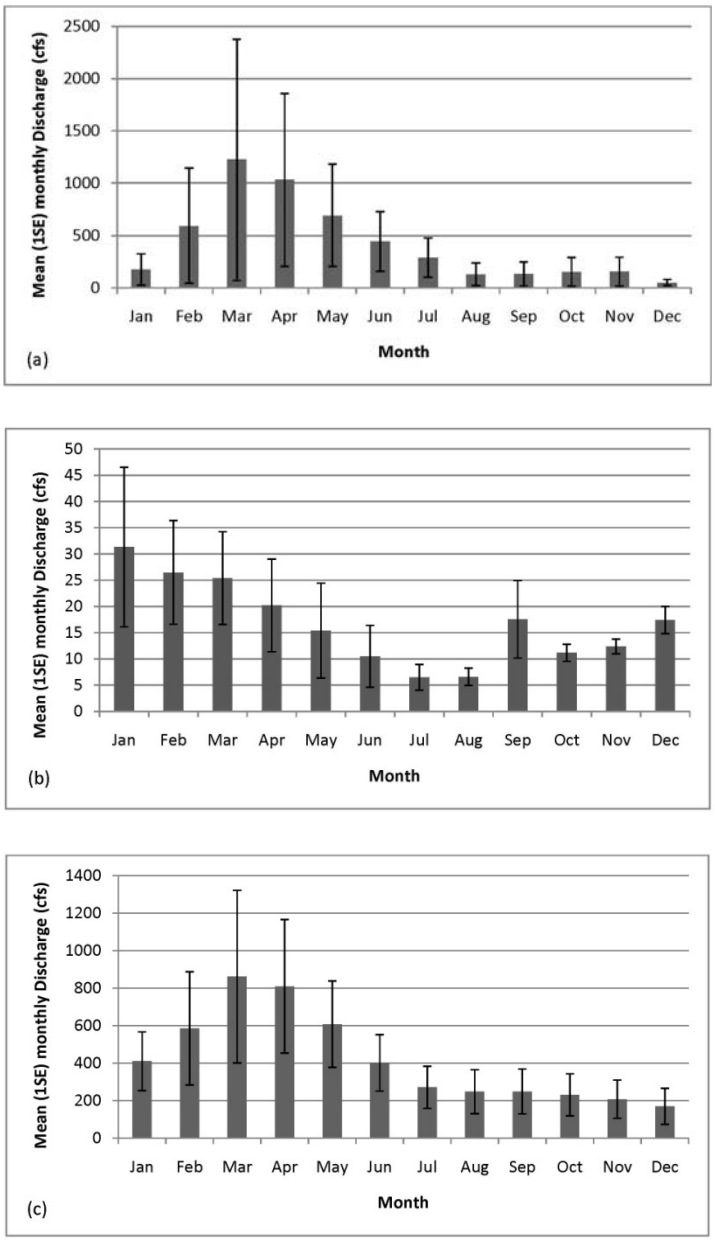

Figure 42. USGS mean (1SE) monthly discharge (cfs) for 3 gauges on the Gila River.

Figure (a) gauge station 09520500 on the Lower Gila River near Dome, AZ, just upstream from Fortuna Pond from 1990 – 2009 (b) gauge station 09520500 on the Lower Gila River near Dome, AZ, just upstream from Fortuna Pond from 1990 – 2009 with flood years 1992, 1993, 1995, 2005 removed, and (c) gauge station 09519800 on the Lower Gila River below Painted Rock Dam 1989 – 2008.

Fish Movement

Medium to large-sized fish cannot leave the pond due to the screening structure on the outtake pipe. Upstream movement of small fish that may have been spawned by stocked fish that escape through the screen would be very limited in distance, because large sections of the Gila River above Fortuna Pond and below Painted Rock Dam are typically dry, with no surface flow. Movement would be most likely to occur during flood events in which the Gila River flows heavily, because normal flows are very low and can go subsurface in spots downstream from Fortuna Pond. Painted Rock Dam, approximately 87 miles upstream of Fortuna Pond and west of Gila Bend is a barrier for upstream fish movement during times of occasional high flows.

Small fish passing through the screened outlet could move downstream to the Colorado River during times when flows are sufficient to transport fish; this would most likely occur during winter months when flows are higher on average. Upstream movement of any small fish reaching the Colorado River from Fortuna Pond would be blocked by Laguna Dam. Fish moving downstream in the Colorado River would normally be blocked by Morelos Dam or end up in the canal system in Mexico, which provides municipal, industrial, and agriculture water. Only in extremely rare occasions such as flood control releases would fish be able to move past Morelos Dam and into Mexico via the Colorado River.

Community Description

Fisheries surveys of Fortuna Pond from 1999 to 2003 detected the following species: largemouth bass, bluegill, redear sunfish, green sunfish, tilapia, carp, and threadfin shad (Table 27). Channel catfish and striped mullet also occur. Rainbow trout are stocked seasonally, and are present in the cooler months of the year.

Fisheries surveys of the Yuma Division of the Colorado River from 1991 to 2003 show robust populations of non-native fish species including largemouth bass, smallmouth bass, redear, bluegill, warmouth, crappie, tilapia, threadfin shad, channel catfish, flathead catfish, carp, yellow bullhead, and goldfish (Table 28). Razorback suckers and bonytail chub have been documented in the Colorado River upstream from Laguna Dam; however neither species have been detected in surveys in the Yuma Division.

These stretches of the Gila and Colorado Rivers also contain invasive species including bullfrogs, crayfish, quagga mussels, and giant salvinia.

Yuma clapper rails are resident in some areas of the Lower Gila or Colorado River, but not in the immediate shoreline of Fortuna Pond.

Table 27. Summary of electrofishing fisheries surveys at Fortuna Pond during October 1999 (1 EFU = 15 minutes of pedal time).

Year/Month	Effort	Species	Num. Sampled	% of Total	Min Len. (mm)	Max Len. (mm)
1999 October	3.14 EFU	largemouth bass	22	100	100	595
2000 October	2.81	largemouth bass	16	100	59	383
2003 November	3.4	largemouth bass	25	100	115	556

Table 28. Summary of fish surveys in the Yuma Division.

Year	Species	Num. Sampled	% of Total	Min Len.(mm)	Max Len.(mm)
1991	largemouth bass	80	81	113	532
	channel catfish	11	11	97	631
	flathead catfish	5	5	423	810
	striped bass	2	2	196	431
	smallmouth bass	1	1	171	171
1992	largemouth bass	66	42	97	512
	bluegill	50	32	61	205
	redear sunfish	1	1	204	204
	warmouth	1	1	194	194
	channel catfish	7	4	358	648
	flathead catfish	2	1	529	794
	carp	20	13	146	381
	goldfish	10	6	120	228
1993	largemouth bass	68	52	147	585
	flathead catfish	2	4	372	800
	striped mullet	61	47	201	380
1994	largemouth bass	89	68	100	545
	black crappie	1	1	226	226
	channel catfish	5	4	173	694
	flathead catfish	8	6	410	960
	striped mullet	28	21	285	403
1995	largemouth bass	164	94	133	590
	channel catfish	4	2	120	582
	flathead catfish	6	3	710	1060
1996	largemouth bass	177	83	101	605
	black crappie	1	0	298	298
	channel catfish	6	3	138	680
	flathead catfish	15	7	322	1072

Year	Species	Num. Sampled	% of Total	Min Len.(mm)	Max Len.(mm)
	striped bass	1	0	157	157
	striped mullet	12	6	265	430
	smallmouth bass	1	0	165	165
1997	largemouth bass	339	94	87	694
	black crappie	5	1	142	317
	channel catfish	4	1	263	602
	flathead catfish	5	1	349	835
	machete	7	2	163	205
1998	largemouth bass	110	88	131	677
	black crappie	2	2	193	203
	channel catfish	5	4	408	634
	flathead catfish	6	5	231	865
	striped bass	1	1	172	172
	striped mullet	1	1	255	255
1999	largemouth bass	47	12	69	604
	bluegill	233	60	47	199
	redear sunfish	4	1	104	112
	black crappie	2	1	118	208
	tilapia	9	2	63	363
	channel catfish	1	0	591	591
	flathead catfish	2	1	623	863
	carp	42	11	356	636
	goldfish	30	2	271	448
	striped mullet	8	8	168	441
	smallmouth bass	1	0	305	305
	threadfin shad	8	2	78	145
2000	largemouth bass	214	93	89	635
	black crappie	2	1	97	134
	channel catfish	6	3	254	508
	flathead catfish	7	3	147	940
2001	largemouth bass	71	97	91	568
	black crappie	1	1	192	192
	flathead catfish	1	1	493	493
2002	largemouth bass	198	97	85	605
	black crappie	1	0	255	255
	channel catfish	3	1	237	591

Year	Species	Num. Sampled	% of Total	Min Len.(mm)	Max Len.(mm)
	flathead catfish	1	0	603	603

Consultation Species and Critical Habitat
No listed or candidate fish species have been detected in surveys in the Gila River downstream from Painted Rock Dam, or in the Yuma or Laguna Divisions of the Colorado River below Imperial Dam; the closest occurrences are upstream from Laguna Dam in the Colorado River.

The only listed species known to be at, or near, Fortuna Pond are the Yuma clapper rail. Clapper rails are present in the lower Gila and Colorado Rivers. Please see the Lower Gila – Yuma Lakes complex analysis for a discussion of consultation species including Yuma clapper rail and yellow-billed cuckoo.

Bonytail chub
Currently no self-sustaining populations of bonytail chub are known to exist in the wild; wild populations of bonytail chub in the lower Colorado River below Parker Dam are considered extirpated. The nearest documented occurrence of bonytail chub to this site is approximately 65 miles upstream in the Colorado River, and that site is separated from this proposed stocking site by 2 dams. Bonytail chub have been stocked into isolated ponds above Imperial Dam at Imperial National Wildlife Refuge (LCR MSCP 2009a) and into the river further upstream. Due to extremely low survivability of stocked bonytail chub in the lower Colorado River (Schooley et al. 2008), there will most likely be a hiatus in stocking bonytail chub below Palo Verde Dam. This would further reduce the potential number of bonytail chub in the Colorado River between Imperial Dam and Palo Verde Dam over the next 10 years.

There is no critical habitat designated below Parker Dam for bonytail chub. The nearest critical habitat is more than 100 miles upstream from Fortuna Pond, in the Colorado River.

Potential Impacts
Potential impacts to bonytail chub from stocked trout, channel catfish, largemouth bass, and bluegill sunfish or their progeny would include predation and competition. Only catchable size fish are proposed for stocking in Fortuna Pond and they cannot escape the pond due to the screened outlet; stocked fish would have to reproduce and their progeny would have to escape through this screened outlet. Water does not constantly flow out of the pond and even if eggs, fry, or small fish reached the Gila or Colorado Rivers they would likely be preyed upon by the robust populations of non-native fish, bullfrogs, crayfish, and birds found in, and along, these rivers. Since bonytail chub are not presently known to occur below Imperial Dam, it is extremely unlikely that they or their progeny, would come into contact with fish proposed for stocking in Fortuna Pond. Any progeny of stocked fish that escaped and survived would not be expected to

have any meaningful or measurable impact on the existing populations of non-native fish in the lower Gila and Colorado Rivers.

Non native fish in the Yuma Division of the Colorado River are blocked by Laguna Dam and Imperial Dam from moving upstream to where bonytail have been stocked or documented as having occurred in the past. There is a slight possibility that stocked bonytail could migrate down to Imperial Dam, pass through Imperial Dam and Laguna Dam, and end up in the Yuma Division in proximity to surviving progeny of fish proposed for stocking in Fortuna Pond. However, bonytail chub have not been documented below Imperial Dam in recent history and based on changes to stocking policies it is unlikely they would show up or occur there during the period covered by this consultation.

Razorback Sucker

Razorback suckers have been stocked into the Imperial Division of the Colorado River and into ponds at Imperial National Wildlife Refuge in recent years (Schooley et al 2008; LCR MSCP 2009a). Razorback suckers were also stocked in the Imperial Division for research purposes in the late 1990s (Bradford and Gurtin 2000). In addition to these more localized stockings; razorback suckers are also stocked further upstream in the Colorado River and could move down into the vicinity of Imperial Dam. However, due to the extremely low survivability of stocked razorback suckers in the Lower Colorado River (Schooley et al. 2008), there will most likely be a hiatus in stocking razorback suckers below Palo Verde Dam. That would reduce the potential number of razorback suckers in the Colorado River between Imperial Dam and Palo Verde Dam over the next 10 years. Razorback suckers have not been documented in the Colorado River below Imperial Dam or in the lower Gila River in recent history.

There is no designated critical habitat for the razorback sucker below Imperial Dam. This stocking site is separated from designated critical habitat by 2 dams.

Potential Impacts

Potential impacts to razorback suckers from stocked trout, channel catfish, largemouth bass, and bluegill sunfish or their progeny would include predation and competition. Only catchable size fish are proposed for stocking in Fortuna Pond and they cannot escape the pond due to the screened outlet; stocked fish would have to reproduce and their progeny would have to escape through this screened outlet. Water does not constantly flow out of the pond and even if eggs, fry, or small fish reached the Gila or Colorado Rivers they would likely be preyed upon by the robust populations of non-native fish, bullfrogs, crayfish, and birds found in, and along, these rivers. Since razorback suckers are not known to occur below Imperial Dam, it is extremely unlikely that razorback suckers and their progeny would come into contact with fish proposed for stocking in Fortuna Pond. Any progeny of stocked fish that escaped and survived would not be

expected to have any meaningful or measurable impact on the existing populations of non-native fish in the lower Gila and Colorado Rivers.

Non-native fish in the Yuma Division of the Colorado River are blocked by Laguna Dam and Imperial Dam from moving upstream to where razorback suckers have been stocked or documented as occurring in the past. There is a slight possibility that stocked razorback suckers could migrate down to Imperial Dam, pass through Imperial Dam and Laguna Dam, and end up in the Yuma Division in proximity to surviving progeny of fish proposed for stocking in Fortuna Pond. However, razorback suckers have not been documented below Imperial Dam in recent history, and based on changes to stocking policies, it is unlikely they would show up or occur there during the period covered by this consultation.

Redondo Pond (Yuma Lakes)

Site Description

Redondo Pond, also known as Yuma Lakes, is an 11-acre pond formed in a retired gravel pit (Figure 43). The pit was created in the late 1950s as material was taken from it and used in the construction of the Gila Gravity Main Canal. The south end of the pond is privately owned (Wellton-Mohawk Irrigation District) while balance of the pond is owned by BLM. It is located about 8 miles east of Yuma and 0.8 miles north of the Gila River and is at the bottom of the watershed/complex. The pond is located close to the City of Yuma and receives heavy fishing and outdoor recreation activity (Figure 44).

Figure 43. Photo of Redondo Lake.

The private portion of the pond is developed as a trailer park with a beach. There is a primitive dirt boat launch on the BLM land that is only appropriate for small boats; restrictions limiting boat engines to a single electric motor are currently in place. No public recreational facilities exist, apart from the primitive boat launch and unimproved camping sites. There are currently plans to construct a small parking lot, walking and wheelchair path, and a fishing dock to increase angler access. Long-term plans include further development of parking areas, toilets, trash receptacles, improved boat ramp, and improved vehicle, pedestrian, and fishing access. Angler access to the shoreline is currently very poor on the public portion of the pond. The edges of the pond are generally very steep, except on the privately-owned portion, and heavily vegetated with small saltcedar and arrowweed.

Figure 44. Aerial photo of Redondo Lake.

Management of Water Body

For the past several years management of this pond has been mostly passive. It has not been stocked since 1974, except for one recent stocking of channel catfish (Table 29). There is current planning underway to increase management and fishing opportunities at this pond. Recent surveys and reports from the public indicate a poor fishery currently exists at this site. The management objective for Redondo Pond is to provide both a warm water and cold water fishery near the urban center of Yuma. Stocking is required to create and maintain the desired fishery due to heavy fishing pressure. The pond will be managed primarily as a put-and-take intensive use fishery for rainbow trout and channel catfish, and secondarily as a self-reproducing warm water fishery for largemouth bass and bluegill. Supplemental stockings of largemouth bass and bluegill may also be required to maintain the desired level of those species in this pond.

Table 29. Redondo Pond stocking history 1970 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Channel catfish	1970	2009	3	5,952
Largemouth bass	1970	1974	2	680
Redear sunfish	1974	1974	1	930
Tadpole	1980	1980	1	500
Total			7	8,062

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, and bluegill for the period covered by this consultation.

Catchable sized rainbow trout would be stocked October through March; numbers of rainbow trout to be stocked would be from 0 to 16,000 fish annually (approximately 1,000 to 4,000 fish per stocking).

Catchable sized channel catfish will be stocked during the warmer months; however, stockings of channel catfish could occur any time during the year. Numbers of channel catfish to be stocked will be from 0 to 16,000 fish per stocking (approximately 1,000 to 4,000 fish per stocking).

Catchable or sub-catchable largemouth bass and/or bluegill sunfish may be stocked as needed basis at any time during the year to augment existing populations, or to recover fishery following

a catastrophic event. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
The pond is sustained by ground-water and inflow from a channel that captures seepage from the Gila Gravity Main Canal. The pond is permanent with very little fluctuation in surface elevation. The inflow channel and pond are not connected to any other water conveyance structures or systems. The pond does not overflow and is considered to be a closed system.

Fish Movement
Fish cannot escape or move from this pond because it is a closed system.

Community Description
Fisheries surveys from 1981 to 2007 detected the following species: largemouth bass, bluegill, redear sunfish, green sunfish, warmouth, black crappie, tilapia, channel catfish, carp and yellow bullhead. The current assemblage seems to be much less diverse, with largemouth bass and bluegills making up 94 percent of the catch on the 2007 electrofishing survey. Freshwater jellyfish also occur in the pond.

Consultation Species and Critical Habitat
Please see the Lower Gila–Yuma Lakes complex analysis for a discussion of consultation species, which includes Yuma clapper rail.

LOWER GILA–YUMA LAKES COMPLEX ANALYSIS
Consultation Species and Critical Habitat
Yuma Clapper Rail
The nearest known occurrence was documented in 1997 along the Gila over a mile from Fortuna and Redondo Ponds with additional occurrences (2001, 2003) upstream in the Gila over 6 miles. Minimal cattail habitat is present at either site, adjacent portions of Gila River contain marsh habitat.

There is no suitable habitat on Wellton Golf Course Pond or adjacent to the pond; habitat on Gila River is several miles away.

Potential Impacts
Yuma clapper rails are found along the Gila River nearby Fortuna Pond and Redondo Lake. There may be a limited amount of cattail in Fortuna Pond and Redondo Lake, but it is not sufficient to support Yuma clapper rails on site so there will be limited exposure to the rail from sport fish stocking at this site. Competition for food is unlikely since Yuma clapper rail habitat is not in the stocking site. Noise disturbance from anglers using the pond may reach occupied habitats in the Gila River, but is likely to be minimal due to distance and noise has not been identified as a concern for Yuma clapper rail.

No potential impacts would be anticipated for Wellton Golf Course Pond.

WILLCOX PLAYA WATERSHED

Physical geographic description

Drainage area
The Willcox Playa watershed encompasses approximately 1,680 square miles and is a hydrologically closed basin (Figure 45). The surrounding landscape drains into the typically dry Willcox Playa lakebed where water captured in the playa becomes trapped until it infiltrates into the ground or evaporates.

Range of elevations
The watershed ranges in elevation from 4100 feet above MSL to its highest point at 10,600 feet above MSL in the Pinaleño Mountains on the northern boundary of the watershed.

Summary of Major Tributaries/Sub-watersheds
There are numerous tributaries within this basin; however the Willcox Playa is comprised mostly of ephemeral drainages that only contain water following significant rainfall events. Only Grant and Big Creeks in the Pinaleño Mountains and West Turkey and Rucker Creeks located in the Chiricahua Mountains and Leslie Canyon in the Swisshelm Mountains are identified as perennial streams. Big Creek is believed to be fishless, Grant Creek has hybrid Apache x Rainbow trout, and Leslie, West Turkey and Rucker are managed for native Yaqui fishes. All of these creeks are isolated from Riggs Flat Lake, either by topography, or by the vast Wilcox basin itself, which is dry much of the year and saline when it contains water.

Vegetation
Vegetation in the Willcox Basin is primarily semi-desert grassland with smaller areas madrean evergreen woodland and Rocky Mountain and montane conifer forest. Riparian vegetation includes conifer oak and mixed broadleaf on Turkey Creek and conifer oak on Rucker Creek.

Stocking Sites
There is only one stocking site located in this closed basin, Riggs Flat Lake, located in the Pinaleno Mountains.

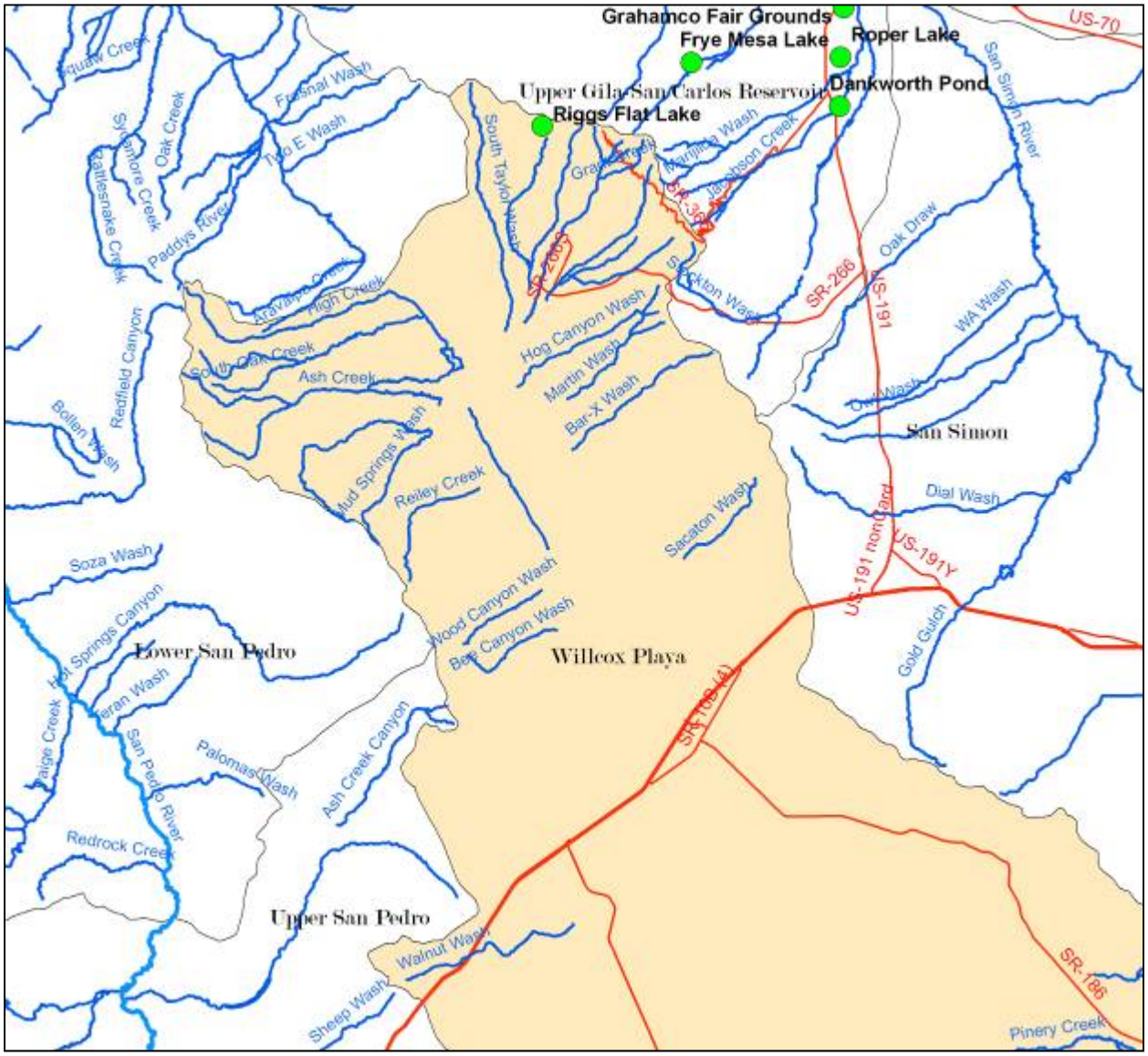

Figure 45. Willcox Playa Sub-Watershed

Riggs Flat Lake

Site Description

Riggs Flat Lake is located near Merrill Peak in the Pinaleño Mountains on the Safford Ranger District of the Coronado National Forest. Constructed in 1954, this small 11 acre man-made reservoir near the town of Safford, Arizona was formed by a concrete dam on an unnamed tributary to East Babcock Canyon. The lake is located very near the top of the watershed surrounded by alpine forests at an elevation of 8,700 feet (Figure 46). Recreation around the lake includes fishing, camping, hiking and hunting. This lake is in a Forest Service campground

where there is an improved concrete boat ramp. Due to the elevation and the poor winter access, the Forest Service closes this location from October through May each year.

Land ownership for the watershed is comprised of federally owned lands managed by the United States Forest Service, United States Military and the Department of Interior's Bureau of Land Management. Interspersed within the action area are both State and privately owned lands.

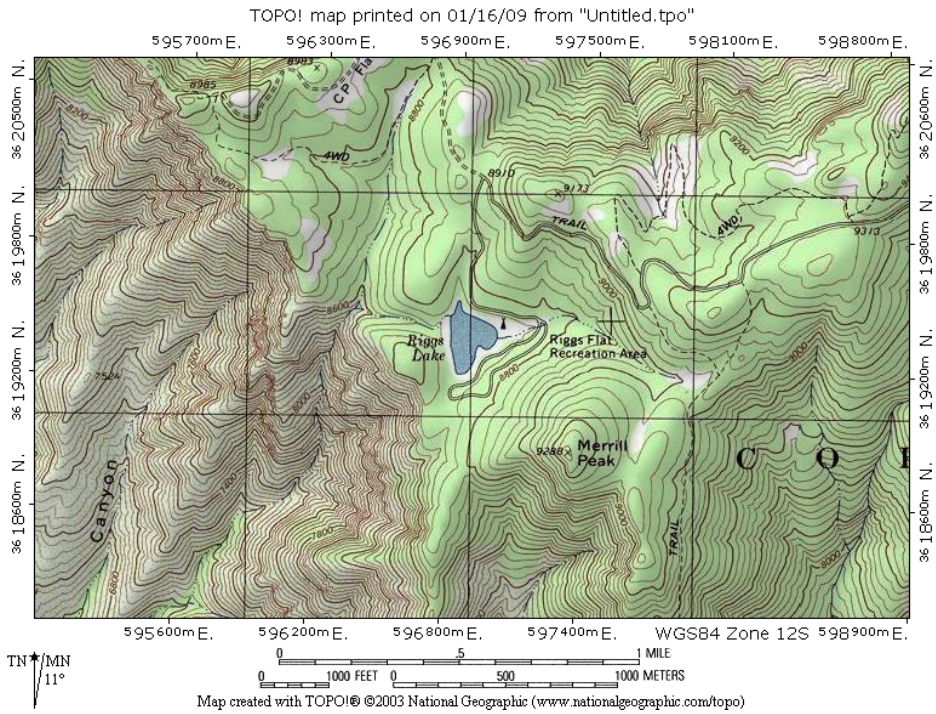

Figure 46. Riggs Flat Lake

Management of Water Body

The lake is managed primarily as an intensive use put and take rainbow trout fishery with a secondary opportunity as a put grow and take brown and brook trout fishery. Catchable rainbow trout are stocked multiple times between the months of April through October and brown and brook trout are stocked multiple times annually. Periodically, the Department has stocked large fish of all three species to promote and increase interest in the fishery. The Statewide Angler Survey conducted in 2004 found that there were 6,586 angler user days at Riggs Flat Lake (Pringle 2004). Because of the large amount of aquatic vegetation at this lake, pH levels are unusually high during the latter part of the summer, which leads to conditions that prohibit stocking catchable trout. The Department plans to mitigate this problem by introducing white amurs to reduce the overall amount of aquatic vegetation and alleviate associated water quality problems. The stocking history at this lake shows that only trout species have been stocked by the Department at this lake (Table 30).

Table 30. Historic fish stocking at Riggs Flat Lake.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Rainbow trout	1954	2007	257	707,885
Brown trout	1969	2005	16	63,812
Brook trout	1955	2006	16	93,000
Apache trout	1970	1970	1	4,000
Total			290	868,697

Proposed Action

The Department proposes to stock rainbow trout, brown trout, brook trout and white amur for the period covered by this consultation.

The Department would stock catchable sized rainbow trout multiple times annually from April through October. The number of catchable sized rainbow trout stocked per year would range from 0 to 30,000.

The Department would stock brown trout multiple times annually from April through October. The number of fingerling brown trout stocked annually would range from 0 to 10,000. Periodically, as available, this population may be augmented with catchable sized trout; the number of catchable sized brown trout stocked would range from 0 to 10,000 annually.

The Department may stock brook trout multiple times annually from April through October. The number of fingerling brook trout stocked annually would range from 0 to 10,000. Periodically, as available, this population may be augmented with catchable sized brook trout; the number of catchable sized Brook trout stocked annually would range from 0 to 10,000.

The Department would stock white amurs ranging in size up to 15 inches in length annually from April through October to control aquatic vegetation. The number of white amurs stocked annually would range from 0 to 1,000.

Water Distribution / Connectivity

The watershed above Riggs Flat Lake encompasses approximately 11,000 acres and all of the drainages that comprise the inflow and outflow to and from Riggs Flat Lake are ephemeral. While the lake typically maintains a majority of its water, the level of the lake does fluctuate 4 to 5 feet throughout the year. Lower water levels correspond to times of little precipitation in the

summer prior to the beginning of the monsoon season. Rainfall and snow melt are the only water sources for this lake.

In the event of spill, water would flow out of the spillway and down an unnamed tributary of East Babcock Canyon for approximately 3 miles to the confluence with East Babcock Canyon. At this point, the water would flow 2 miles to the confluence with West Babcock Canyon at which point the drainage becomes Babcock Canyon. Water would then continue on 2 miles to the confluence of Jesus Canyon and then 3 miles to the confluence with Grant Creek. Grant Creek then flows 7 miles to the confluence with Ash Creek in the Sulpher Springs Valley. Water in Ash Creek flows approximately 10 miles to the Graham County and Cochise County line at which point the creek becomes poorly defined and water spreads out into sheet flow approximately 15 miles north of the Willcox Playa. The Willcox Playa is an ancient closed basin lakebed with no outflow opportunities. Any water that reaches the Willcox Playa is essentially trapped there until it evaporates.

Riggs Flat Lake terminates in sheet flow into the Willcox Playa and is not hydrologically connected to any drainage's outside of the Willcox Playa; therefore, Riggs Flat Lake is considered a closed system.

Fish Movement

Fish could only leave Riggs Flat Lake during high flow events, which cause water to flow over the spillway into the unnamed canyon below the lake. Such events typically occur during the summer monsoon season and early spring during snow melt. Fish would move downstream as described in the previous section. Fish transported downstream would be prevented from moving back upstream to the stocking location or into other tributaries by natural barriers.

The Babcock Canyon complex below Riggs Flat Lake is a series of narrow canyons dominated by steep gradient, highly confined ephemeral channels. Trout could persist for a brief time; however, they would not persist for long because the channels would dry after the flow event. Fish traveling beyond the Babcock Canyon Complex into Jesus and then into Grant Creek are subjected to the same ephemeral conditions only these canyons are less defined, have lower slope gradients and become much broader. Grant Creek, prior to the confluence with Ash Creek, is interrupted by active agricultural fields southwest of the town of Bonita, Arizona, where the channel becomes very broad with little gradient. Any fish transported this far is not likely to survive because of the presence of the active agricultural fields where the flow spreads out into sheet flow with very little depth for fish to swim or survive.

Fish are not likely to move upstream from Riggs Flat Lake due to poorly defined ephemeral stream channels upstream of the lake. However, if fish did manage to leave the lake in an upstream direction the opportunity for them to move would be at most ½ mile upstream in a small unnamed tributary that feeds the lake from the east and is at the top of the watershed.

Because of the ephemeral nature of the upstream stream channels, fish would not persist for any period of time and would perish once flows subsided and conditions began to dry following the event.

Community Description

Currently, the fish population at Riggs Flat Lake consists only of stocked trout species and fathead minnows. There are no records documenting the introduction of fathead minnows to the lake. Beyond their continuing existence as a self sustaining population, there is little known about this species at the lake. Rainbow, brook and brown trout do not reproduce at this lake because there is no suitable spawning habitat. Because the trout populations at this lake are maintained only through stocking, the Department has never conducted a fish survey at this location.

There is no definitive information to determine if Apache trout, stocked in the 1970's, persist; however, since the lake lacks habitat for natural reproduction, it is unlikely that they are present.

Consultation Species or Critical Habitat

Mexican Spotted Owl and Critical Habitat

The stocking location is within Mexican spotted owl (MSO) critical habitat (CH), occurs within a buffer, and also occurs within a PAC. There appears to be an opportunity for angler access around the perimeter of the lake based on topographic and world imagery maps.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within boundary of at least one MSO PACs in the general vicinity of the site. There may be some disturbance of MSOs at the nest site, roosting or foraging areas within the PAC during the breeding season.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Mount Graham Red Squirrel and Critical Habitat

The Mount Graham red squirrel was listed as endangered in 1987. Critical habitat occurs in three areas in the Pinaleños (Hawk Peak/Mount Graham, Webb Peak, and Heliograph Peak) and covers a total of about 2,000 acres; Riggs Flat Lake, and the immediate vicinity, is not located within designated critical habitat for the squirrel.

Habitat suitability for the red squirrel depends on the ability of the forest to produce reliable and adequate conifer cone crops for food and microclimate conditions suitable for storing of closed cones in middens. These conditions are met by mature to old-growth stands that include either Douglas-fir or Engelmann spruce, or both, and have closed canopies. Habitat quality increases when large downed logs, snags, and interlocking branch networks are present. These elements provide red squirrels with adequate food resources, perching, storage and nesting sites, runways that allow cone retrieval in the winter, and escape routes for the avoidance of predators.

Red squirrels are highly territorial and maintain middens within their territories. Typically, the same midden will be used by succeeding generations of squirrels. Survival rates vary yearly and are related to the amount of cones produced. The current number of known middens, which includes those that are active, inactive, and abandoned, is 1288; only 44 located in the vicinity (within ½ mile) of Riggs Flat Lake. The population has been estimated since 1986 with estimates ranging from 99 to 562 squirrels; there is no statistical evidence suggesting a rise or decline in the population from these estimates (T. Snow pers. comm.). The fall 2009 survey estimated the population at 250 (+/- 11) squirrels.

Potential Impacts

The Mount Graham Red Squirrel Recovery Team agreed that habitat loss was the most significant reason for listing the Mt. Graham red squirrel as endangered (unpubl. meeting notes 2002). Human development, including developed recreation sites such as Riggs Flat Lake and the associated campground, is considered a threat because it includes the direct effect of removal of vegetation, which could result in decreased food sources, potential increase of tree blow-down, changes in microhabitat, and increased vulnerability to predation. Cumulative effects resulting from the presence of the lake and campground include potential for increased habitat fragmentation, potential for population isolation, and increased tourism. Increases in tourism and development may lead to noise disturbance and increased traffic. Greater traffic may lead to increasing deaths from vehicles. Additional losses to squirrel habitat could be caused by potential forest fires, road construction and improvement, new recreation development, dispersed camping, and collection of dead and down wood. Stocking of sportfish and angling at Riggs Flat Lake, along with the associated recreational opportunities in the vicinity of the lake, may result in indirect effects to Mount Graham red squirrels such as dispersed camping, increased risk of fire, removal of downed logs, and potential for increased vehicle traffic. General angler activities

(e.g. fishing, boating or canoeing, and hiking around the shoreline) would not likely effect red squirrels (T. Snow pers. comm.).

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Salt River Watershed

BLACK RIVER SUB-WATERSHED

Physical geographic description

The Black River sub-watershed is located in east central Arizona, south of the Little Colorado River watershed and west and north of the Gila River watershed (Figure 1 and Figure 2). Along with the White River, the Black River comprises the headwaters of the Salt River watershed. The Black River rises from a network of perennial creeks supported by springs and snowmelt in the White Mountains in Apache, Gila, and Greenlee Counties. The total drainage area is 1,256 square miles. Elevations within the sub-watershed range from over 10,000 feet near the headwaters in the White Mountains to 4,350 feet near the confluence with the White River, where the two rivers become the Salt River.

The headwaters portion of the Black River sub-watershed contains numerous perennial tributary streams and several small lakes. The Black River itself has two main branches; the East and West Forks. Other significant tributaries include Centerfire Creek, Beaver Creek, Fish Creek, Snake Creek, Conklin Creek, Reservation Creek, Bear Wallow Creek, Paddy Creek and Big Bonito Creek. Lakes in the drainage were all created by man and include Ackre Lake, Big Lake, Crescent Lake, Reservation Lake, Hurricane Lake, Drift Fence Lake, Pacheta Lake, Tonto Lake, and Sierra Blanca Lake.

The Black River sub-watershed is on the Apache National Forest, Fort Apache Indian Reservation, San Carlos Indian Reservation, and a small amount of private land is found as inholdings in the Forest.

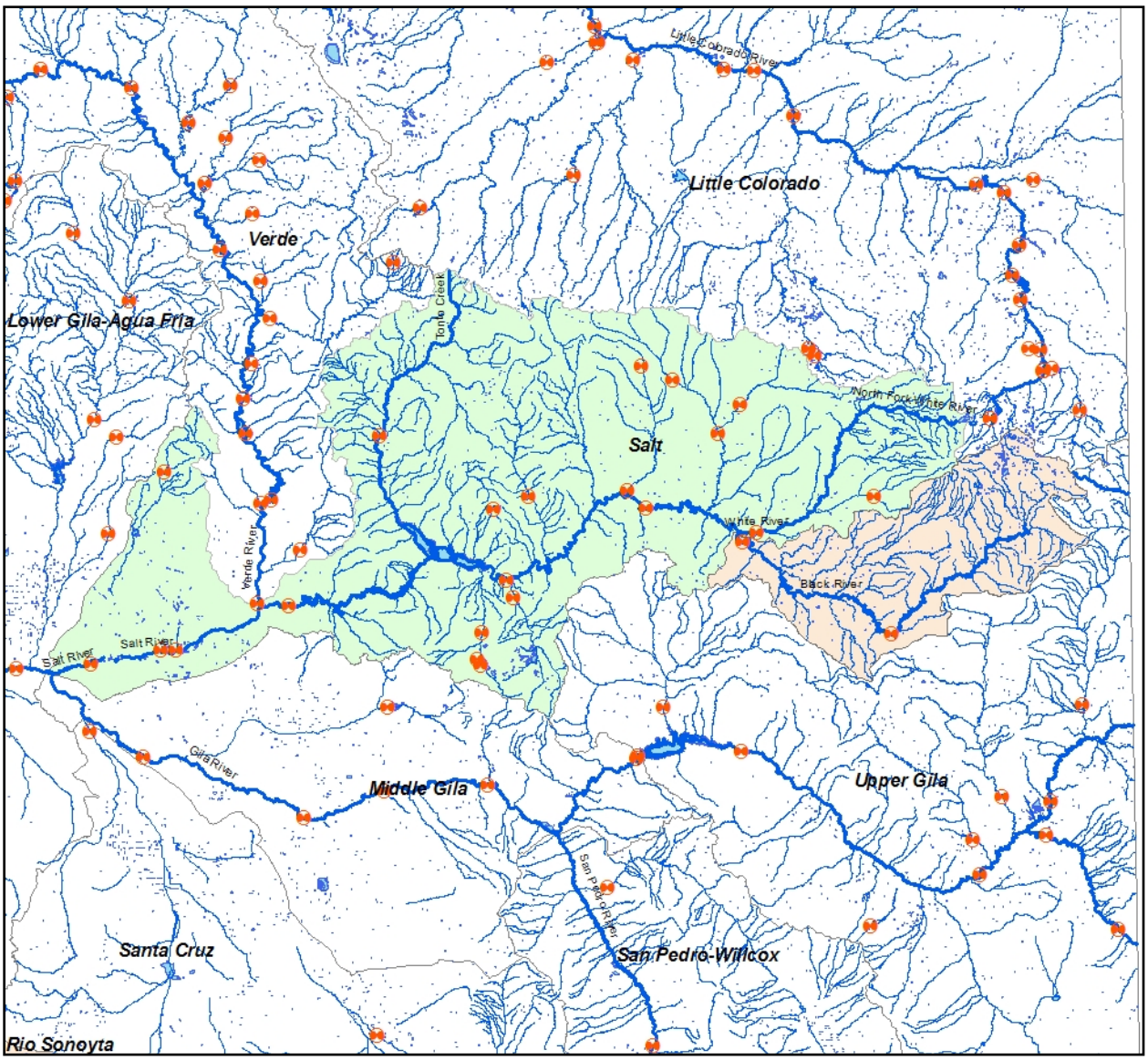

Figure 1. Black River sub-watershed location (pink shade) within the Salt River watershed (green shade) with USGS gauging stations (orange circles).

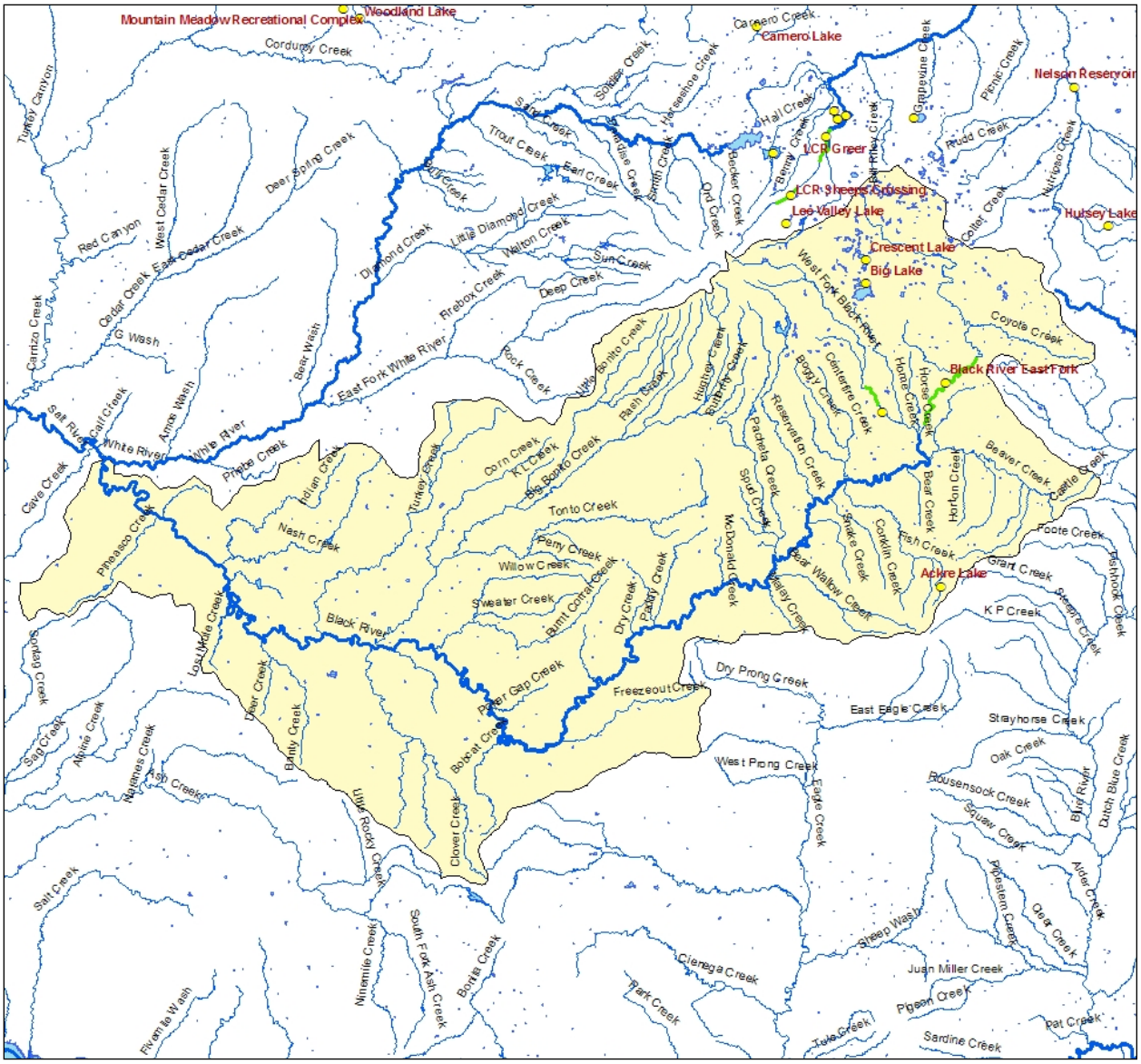

Figure 2. Black River sub-watershed with stocking locations.

Black River Complex

Stocking site descriptions

There are five stocking sites in the Black River sub-watershed; Crescent and Big lakes, located on an unnamed tributary to the North Fork of the East Fork of the Black River, the East and West forks of the Black River, and Ackre Lake, located in the headwaters of Fish Creek which flows into the Black River (Figure 3). Big Lake and Crescent Lake are both very near the top of the North Fork of the East Fork of the Black River, and are connected to it by an ephemeral channel. It is about 4.5 miles from Big Lake to the North Fork of the East Fork of the Black River, from that point, it is over 9 miles to the Three Forks area where several tributaries come together to form the East Fork. (13.8 miles from Big Lake to Three Forks). It is about 0.7 miles from

Crescent Lake to the same ephemeral tributary coming from Big Lake, then approximately 4.4 miles to the North Fork of the East Fork of the Black River, and from that point, it is over 9 miles to the Three Forks area (14.3 miles from Crescent Lake to Three Forks). The East Fork stocking area is approximately 4.5 miles below Three Forks. The West Fork stocking area is 3.3 miles above the confluence with the East Fork along FR68A. Fish Creek is a tributary to the Black River located 9.9 miles below the confluence of the East Fork and West Fork of the Black River; the headwaters of Fish Creek contain Ackre Lake, approximately 12.1 miles upstream from the Black River.

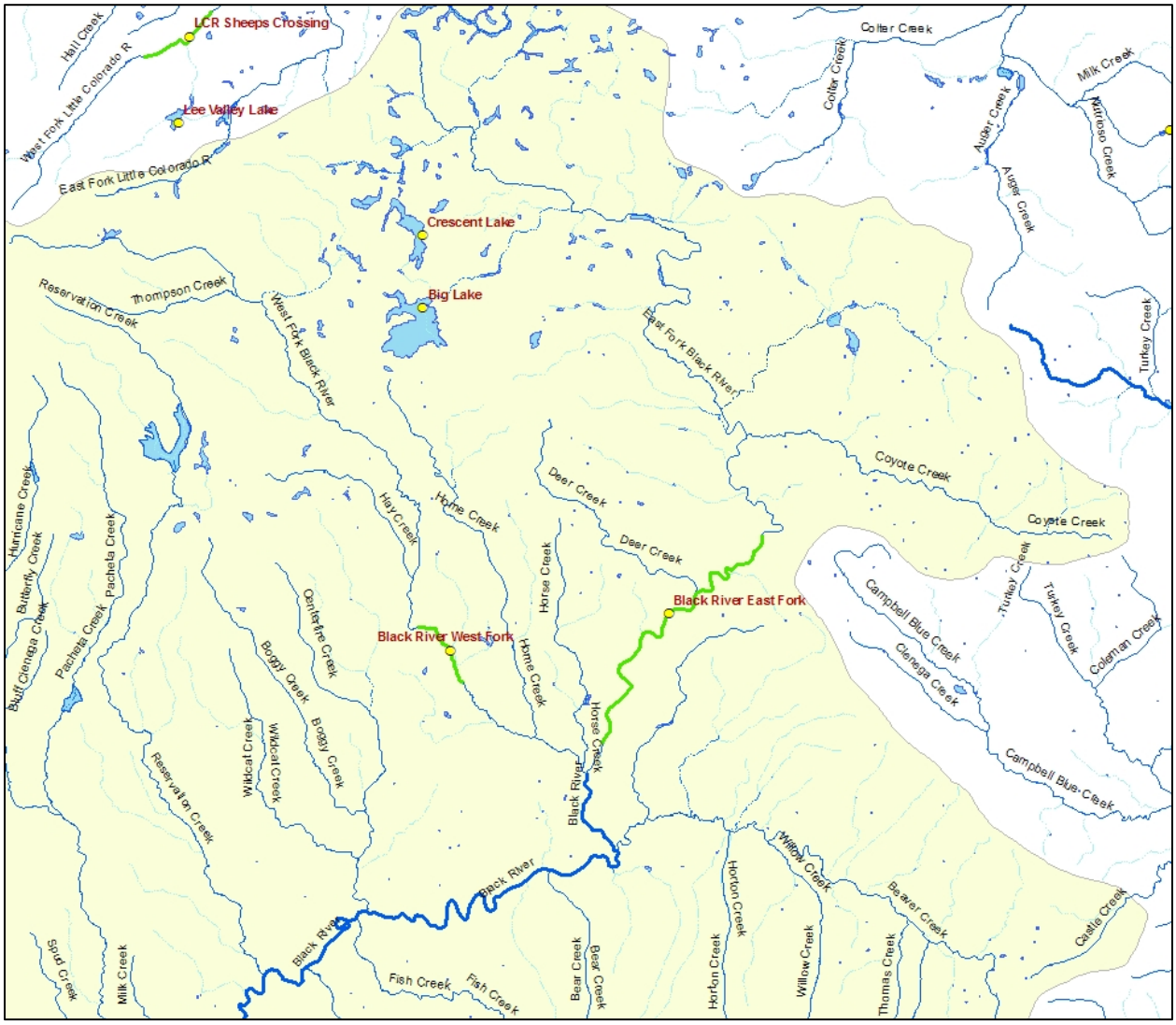

Figure 3. Black River Complex (stocking reaches shaded green) within the Black River sub-watershed.

Crescent Lake

Site Description

Crescent Lake is a 100-acre impoundment on an intermittent unnamed tributary of the headwaters of the North Fork of the East Fork of the Black River (Figure 4 and Figure 5). The Crescent Lake dam was constructed in 1934 on the Apache-Sitgreaves National Forest at an elevation of 9043 feet. Crescent Lake is located near the top of the Black River complex, approximately 21 miles southwest of Springerville.

Figure 4. Photo of Crescent Lake with knoll in upper right corner (southeast side of lake) containing a bald eagle nest site.

Management of Water Body

The primary fishery is a put-grow-and-take coldwater fishery with rainbow and brook trout. Fingerling, sub-catchable, and catchable size trout are stocked multiple times during the stocking season, primarily in spring and early summer, but occasionally in the fall. Numbers and sizes vary depending upon over winter survival and fish kill occurrences. The fishery is intensive use in spring through fall, with light winter ice-fishing use. Past stocking history is shown in Table 1.

Figure 5. Crescent Lake dam, showing Hwy 273 crossing over dam with no spillway.

Table 1. Stocking History for Crescent Lake

Species	First Year	Last Year	Num of Stockings	Number Stocked
Brook trout	1973	2009	113	1,742,597
Cutthroat trout	1945	1953	4	180,000
Rainbow trout	1940	2009	210	4,856,981
Total			327	7,081,578

Historically, Crescent Lake was stocked primarily with fingerling trout in the spring and fall, utilizing the productivity of the lake to grow stocked trout to catchable size. The lake freezes over in the winter and the frequent winterkills, and occasional summer kills, have created problems with this management approach, because trout were not surviving long enough to reach catchable size. Table 2 outlines the fish kill history at Crescent Lake from 1990 to 2009. Crescent Lake is fairly shallow, averaging 10 feet deep and less when the water level is low due to drought. Combined with a heavy nutrient load, Crescent Lake experiences heavy aquatic weed growth, blue-green algae blooms, high pH levels, leading to frequent fish kills both in late summer and the winter. The Department attempts to harvest aquatic weeds to thin the aggressive weed growth during the summer, but the launch ramps are often not deep enough during low water levels to launch the large harvesters. Currently, a winterkill study is being conducted on Crescent (and Lee Valley Lake and Carnero Lake) to gather baseline information that would

assist in making management recommendations for reducing the frequency of fish kills. The stocking approach at Crescent has gradually changed to stocking primarily subcatchables and catchables, allowing stocked trout to reach catchable size in less time. If the winterkill project is successful, the Department desires the flexibility to stock fingerling trout again.

Table 2. Winter and summer kill history of the Crescent Lake fishery from 1990 to 2009.

Year	Winter kill	Summer kill
1990	Partial	-
1991	Total	-
1992	Total	-
1993	-	-
1994	-	-
1995	Partial	-
1996	-	-
1997	-	-
1998	Partial	-
1999	-	-
2000	-	Partial
2001	Total	-
2002	Total	-
2003	Total	-
2004	Total	Partial
2005	Total	-
2006	-	Partial
2007	-	Partial
2008	Partial	-
2009	Partial	-

The recreational facilities around the lake are managed by the U.S. Forest Service, maintaining the restroom facilities, ramadas/picnic benches, boat docks and fishing piers, and boat ramps at three locations on the lake. These locations are: dam area at north end of lake, south end of lake, and mid-lake on west side. The Forest also administers the special use permit for the concession store, which sells tackle, snacks and rents boats. Camping is not allowed at the lake, however, campgrounds at Big Lake are located only a few miles away. Powerboats are restricted to a single electric motor or a single gasoline engine not exceeding 10 horsepower.

Crescent Lake is accessed by a maintained all-weather road (Hwy 273) or paved state highway (Hwy 261) and has a concession, ramadas/picnic benches, and 3 boat launch ramps. Hwy 273 is in the process of being paved. The lake and concessions are typically accessible from April to

November. The lake does receive some ice fishing use during the winter by anglers accessing the lake by snowmobile. The concession has not operated much in the last 12 years because of the poor fishing conditions at Crescent Lake during this long-term drought cycle.

Angler access is highest at the dam, the south and west boat ramps, and additional parking/restroom facility on the west side. The east shoreline receives the least use, but anglers can walk anywhere around the lake since it is so small. The only use data is on angler use, collected by on-site angler creel surveys in 1980 (25,276 AUD), 1986 (13,506 AUD), 2000 (13,564 AUD), 2004 (4,450 AUD), and 2005 (11,099 AUD), and by mail-out survey in 2001 (19,981 AUD) (Pringle 2004). Angler use dropped dramatically in 2004 due to a large summer fish kill that year.

Proposed action

The Department proposes to stock rainbow trout and brook trout into Crescent Lake for the period covered by this consultation.

Fingerling, sub-catchable, and catchable rainbow trout will be stocked multiple times from April to October annually; numbers of rainbow trout stocked may range from 0 to 75,000 trout annually.

Fingerling, sub-catchable, and catchable brook trout will be stocked multiple times from April to October annually; numbers of brook trout stocked may range from 0 to 35,000 trout annually.

Water Distribution / Connectivity

Crescent Lake has no permanent inflow stream and the watershed is extremely small, normally just enough to offset evaporation. Winter precipitation contributes most of the Crescent Lake water input, with summer monsoons having little effect on water levels.

Information from long time residents in Springerville indicate that Crescent Lake does spill; however, it does not appear to spill often and it is has been 15 years or more since it last spilled. Rick Law, concessionaire at the Big Lake and Crescent Lake stores for many years, thought the lake may have spilled in the early 1990s, but was unable to recall with any certainty. Biologists in the area have never seen it spill, or even knew that it was able to spill until recently upon hearing comments from long time residents of the area. The lake was originally thought to not spill because the spillway area is inconspicuous and no current employees, or persons previously questioned, had seen it spill or knew it would spill. This spill history information was recently obtained during a fish management planning process for Crescent and other lakes in the area, which involved interested local residents and businesses

A diversion ditch was constructed between Crescent Lake and Big Lake after Big Lake was impounded. The diversion was used to fill Big Lake and has not been used since. Water does not run through the diversion ditch to Big Lake at anytime during the year.

When full, the lake would spill from the southern end into a different drainage than the drainage that was dammed to create the lake (Figure 6). No water is released from the dam. The spillway area is not well defined and no channel is present near the spillway. The spill apparently flows wide and shallow overland through grassland until it reaches an obvious drainage ¼ mile away. .

Once in the obvious drainage, spill water would flow for 0.4 miles to an unnamed tributary of the North Fork of the East Fork of the Black River, approximately 0.1 mile downstream of the Big Lake spillway. From this point, the spill would flow in the same manner as spill from Big Lake would flow, approximately 4.4 miles to the North Fork of the East Fork of the Black River, then 9.2 miles down the North Fork to Three Forks, then down 12.2 miles of the East Fork of the Black River to the confluence with the West Fork of the Black River.

The obvious drainage down to the Big Lake tributary is intermittent, running only during spring snowmelt runoff, and only flows with water from Crescent Lake when the lake spills (Figure 7). When the lake does spill again, it is assumed that it would spill only during the spring during snowmelt runoff, and then drop down below the spillway level as the runoff subsides.

The natural drainage downstream of the dam travels 2.2 miles from Crescent Lake to the North Fork of the East Fork of Black River and is normally dry. It runs with water only during spring runoff or extreme monsoon events. These flows do not come from Crescent Lake. Dipping Vat Reservoir, a shallow 40-acre waterfowl water is located on this drainage approximately half way between Crescent Lake and the North Fork. The North Fork of the East Fork of the Black River is also normally dry at the confluence with this ephemeral tributary, running only during spring runoff and extreme monsoon events. Permanent flow begins not far downstream in the North Fork of the East Fork of the Black River, just downstream of State Highway 261.

See the Big Lake analysis for detailed description of water distribution and connectivity from the Big Lake tributary downstream.

Figure 6. Aerial image of Crescent Lake (2009 World Imagery, ESRI).

Crescent Lake Dam is located at the north end of the lake, however if the lake spills, water escapement occurs at the south end of the lake over a grassy area and towards downstream of Big Lake.

Figure 7. Topo map of the water/runoff spill path should Crescent Lake spill (red line; pers. com Mike Lopez).

Fish Movement

Stocked trout in Crescent Lake cannot escape the reservoir unless it spills, which has not happened in the last 15 years. There are no water releases through the dam. If the lake does spill, trout would leave to the south into a wide and shallow low gradient channel that flows through mostly terrestrial grassland until it reaches an obvious drainage ¼ mile away. It is likely these channel conditions prevent trout from reaching the unnamed drainage. However, if they did reach the unnamed drainage coming from Crescent Lake, they would usually die because it dries entirely every year as soon as snowmelt ends. In very rare circumstances, trout might make it into the upper end of the North Fork of the East Fork of the Black River and perennial flow. A survey of the unnamed tributary downstream of Big Lake did not detect any stocked fish species

(see Big Lake Community Description). Because water does not spill at the dam at the north end of the lake, fish will not escape to move north of the lake into Dipping Vat Reservoir, which permanently holds water but is not known to support fish. A visual and dip net survey was conducted at Dipping Vat in 1990 and no fish were observed or found.

For fish movement downstream of the Big Lake tributary, refer to the Big Lake analysis below.

Community Description
Rainbow trout, brook trout, fathead minnow, crayfish and tiger salamander are found in Crescent Lake. Results of the last five years of survey history are listed in Table 3 with the catch composed of the stocked species, rainbow trout and brook trout. No fish were found in the 2004 and 2005 surveys because of winterkill.

Table 3. Five year fish survey history for Crescent Lake using experimental gillnets.

Year	Sample Period	Species	Number Caught	Size Range
2009	April	Brook trout	31	294-362
2008	April	Rainbow trout	1	423
2007	April	Rainbow trout Brook trout	48 5	262-514 279-382
2005	April	-	0	-
2004	April	-	0	-

The drainage from Crescent Lake to the Big Lake tributary does not contain fish and it dries up every year.

The Big Lake tributary from the Big Lake dam downstream to the North Fork of the East Fork of the Black River contains speckled dace, Sonora sucker, fathead minnow and crayfish. See the Big Lake analysis below for details on the surveys of that tributary.

The North Fork of East Fork of Black River just below the confluence with the ephemeral tributary from Big Lake contained speckled dace, fathead minnow, and numerous crayfish. Desert sucker, Sonora sucker, speckled dace, fathead minnow, brown trout, rainbow trout, hybrid trout, and numerous crayfish were found in other areas of the North Fork of the East Fork. California floater (*Anadonta californiensis*) was found near Crosby Crossing on the North Fork, and further down at Three Forks. See the Big Lake analysis below for details of the surveys.

Loach minnow occupy the North Fork of East Fork of Black River approximately 13.2 miles below Crescent Lake. The Three Forks springsnail occupies a spring at Three Forks

approximately 14.2 miles below Crescent, and a spring complex at the head of Boneyard Creek approximately 18.5 miles from Crescent.

Bald eagles nest on a knoll near Crescent Lake and there are Mexican spotted owls within 5 miles; the lake is located outside the bald eagle DPS. New Mexico meadow jumping mice were historically found in the vicinity of Crescent Lake. Narrow-headed garter snakes are found throughout much of the East Fork (see Black River complex analysis).

Consultation Species or Critical Habitat
Potential impacts to Chiricahua and northern leopard frogs are addressed below. Should stocked rainbow or brook trout escape Crescent lake and move downstream, potential impacts to Apache trout, narrow-headed and northern Mexican garter snakes, loach minnow and critical habitat, roundtail chub and three forks springsnail downstream of Big Lake are addressed in the Black River Complex analysis.

Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog
Local Analysis: Crescent Lake and the Black River buffered stocking complex are within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to fish stocked in Crescent Lake is low. However, the likelihood that frogs could be exposed to fish stocked in other sites within the complex is high. There are no historical records for Chiricahua leopard frogs from Crescent Lake itself; though, there are historical records for Chiricahua leopard frogs from 6 sites within the buffered stocking complex: Crabtree Creek (1988), Deer Creek (2001), East Fork Black River (Buffalo Crossing footbridge) (1974), East Fork Black River (Three Forks) (2008), Concho Bill Spring (2009), and Lake Sierra Blanca (2008) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys

taking place between 1990 and 2009 (Figure 8; HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Subsequent surveys have found that Chiricahua leopard frogs occupy the area within the Black River buffered stocking complex. In addition, this area, including 3 of the sites mentioned above, is part of ongoing recovery activities for the Chiricahua leopard frog. However, it is not likely that stocked fish in Crescent Lake are able to disperse to occupied Chiricahua leopard frog sites because spills happen infrequently and it is likely that trout would perish before they reached deep enough drainages to move further downstream.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish from Crescent Lake or the Black River buffered stocking complex is low. The lake spills infrequently and it is likely that trout would perish before they reached deep enough drainages to move further downstream. In addition, there are no historical records for Chiricahua leopard frogs outside of the buffered stocking complex where stocked fish may be able to disperse.

Northern Leopard Frog

Local Analysis: Crescent Lake and the Black River buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Crescent Lake or other stocking sites within the complex is low. There is one historical record for northern leopard frogs from one site in the complex: East Fork Black River (Three Forks) from 1979 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs have not been observed at East Fork Black River (Three Forks) during several subsequent surveys or from other sites surveyed in the Black River buffered stocking complex. Due to the extensive surveying of this area and the lack of northern leopard frog observations, it is likely that northern leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish from Crescent Lake or the Black River buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex. In addition, the lake spills infrequently and it is likely that trout would perish before they reached deep enough drainages to move further downstream.

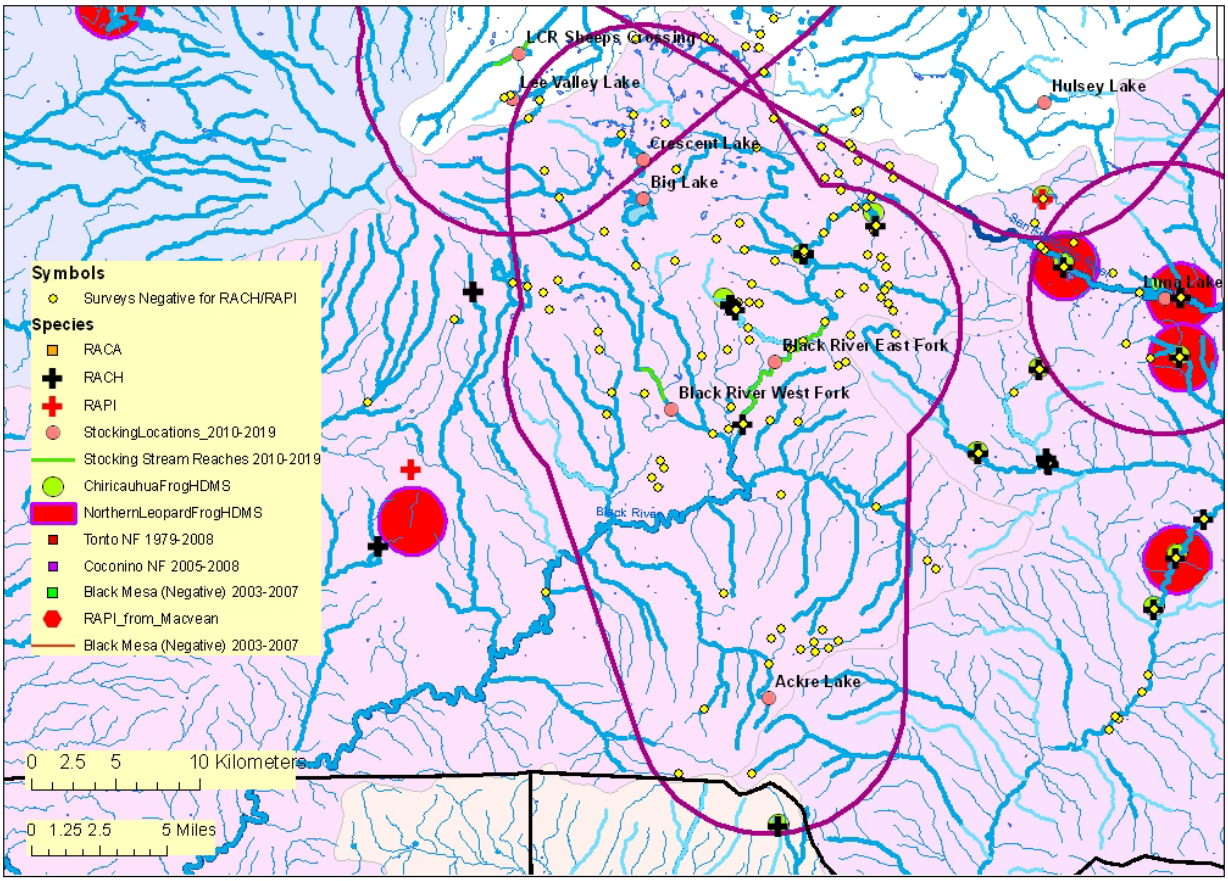

Figure 8. Map of Black River buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Big Lake

Site Description

Big Lake is a 532-acre impoundment located on an ephemeral tributary of the headwaters of the North Fork of the East Fork of the Black River on the Apache-Sitgreaves National Forest. Big Lake is located at 8985 feet elevation approximately 18 miles southwest of Springerville. The dam at Big Lake was constructed in the 1930s and the lake was originally managed primarily as habitat for waterfowl until the dam was raised 10 feet in 1953. Since that time, Big Lake has been the premier trout fishing lake in the White Mountains and Arizona.

Management of Water Body

Big Lake is managed as an intensive use put-grow-and-take cold water fishery. Fingerling, sub-catchable, and catchable rainbow, cutthroat, brook, and Apache trout are stocked multiple times during the stocking season from May through October (Table 4). The fishery is intensively used in spring through fall, with light winter ice-fishing use. Multiple trout species are stocked to provide a diversity of opportunity while maintaining high catch rates. Apache trout are stocked sparingly into Big Lake only when a surplus of hatchery Apache trout occurs combined with unsuitable stocking conditions in regular Apache trout stocking sites. Apache trout stocked in the past had poor return to creel rates, thus are not a major objective at Big Lake. The primary management approach is stocking fingerling and subcatchable rainbow, brook, and cutthroat trout, and allowing the productivity of the lake to grow trout to catchable size. Catchable trout and Apache trout are stocked sparingly.

Table 4. Stocking history for Big Lake.

Species	**First Year**	**Last Year**	**Num of years stocked**	**Number Stocked**
Apache trout	1999	2003	5	28,733
Arctic grayling	1940	1970	30	3,941,800
Brook trout	1936	2008	72	3,310,446
Brown trout	1942	1942	1	402
Cutthroat trout	1940	2008	68	7,859,340
“Native” trout	1936	1939	4	178,400
Rainbow trout	1936	2008	72	4,723,990
Tadpole	1968	1968	1	575
Total				20,043,686

Big Lake had been stocked exclusively with fingerling trout in the spring and fall for many years. Inconsistencies in the survival and return to creel of the fall fingerlings have triggered a change to stocking spring fingerlings at a certain size and switching to subcatchables for the cutthroat trout and fall rainbow trout stockings. This approach appears to be having better results (higher catch rates and higher return to creel), and angler creel surveys have been scheduled in the near future to determine actual results. The lake is popular with all types of anglers because of the good trout fishing. Bank anglers can be very successful, with high catch rates in the spring and fall. Good water quality year around also keeps the catch rates higher than surrounding waters through the summer months, plus there are no excessive weed problems that interfere with boat anglers. This lake is popular with fishermen because it consistently produces full bag

limits, but is also popular with fly fishermen that come for the species diversity and occasional large rainbow and cutthroat trout.

Big Lake is accessed by paved state highways (Hwy 261 and 273) and several all weather roads, and has a concession, ramadas/picnic benches, and 3 boat launch ramps. Bank anglers have access to the entire shoreline (Figure 9), but typically concentrate around parking areas around the lake (Figure 10). The lake and concession are typically accessible from April to November, with the lake freezing over during the winter months. The concession rents boats and boat angling is popular on Big Lake. The lake does receive ice fishing use during the winter by anglers accessing the lake by snowmobile. The Forest Service maintains several campgrounds, boat ramps, boat docks, and picnic areas at Big Lake. The Forest Service also administers a special use permit for the concession.

Figure 9. Photo of Big Lake anglers.

Angler use data consists of on-site angler creel surveys in 1980 (75,851 AUD), 1986 (41,635 AUD), 2000 (94,062 AUD), 2004 (46,482 AUD), and 2005 (66,669 AUD) and by mail out survey in 2001 (124,576 AUD; Pringle 2004). Big Lake is ranked as the highest use water in the state for trout fishing, as determined by angler use days for trout species (Pringle 2004), and

brings in over 19% of the total angler use in the Pinetop Region/White Mountains area. It is an extremely important fishery in this area, and the total angler use is expected to increase. State Highway 273, the main route for visitors coming from the Phoenix and Tucson metro areas, recently underwent major reconstruction in 2007-2008, and was paved in 2009. The US Forest Service also recently expanded the campgrounds at Big Lake in anticipation of the highway improvements. Starting in 2010, it will be much easier to get to Big Lake, with expanded campgrounds that will keep more people at the lake.

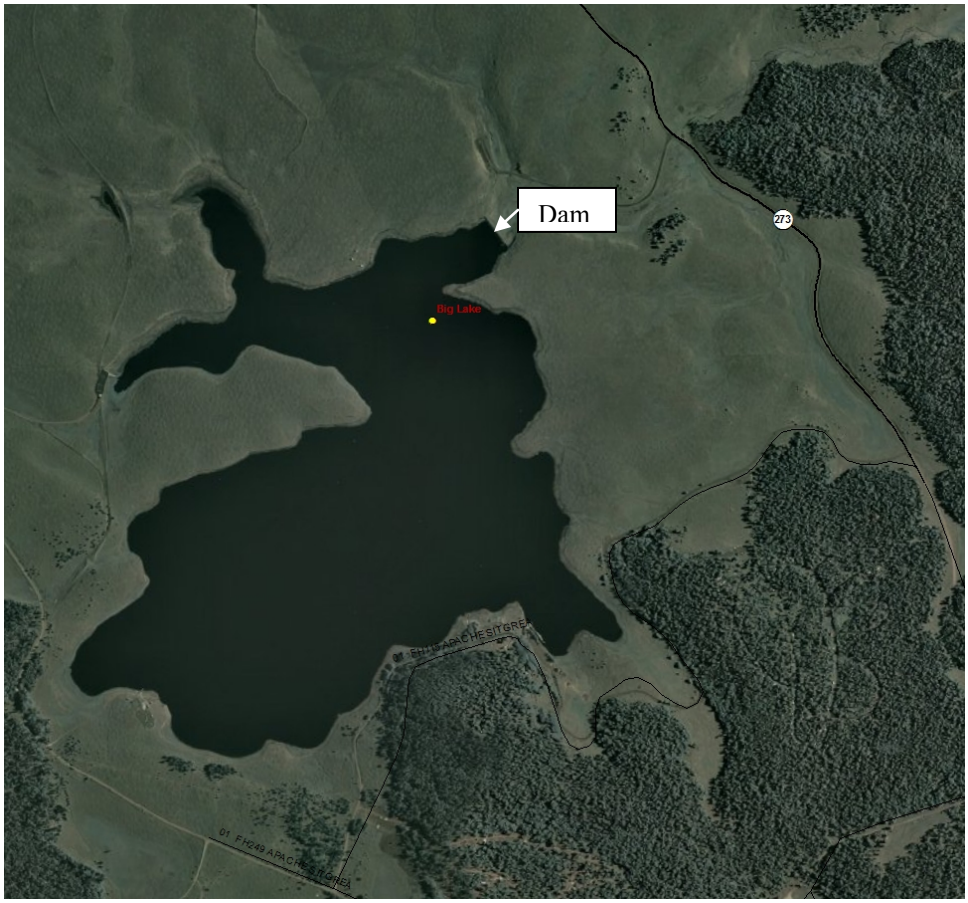

Figure 10. Aerial image of Big Lake (2009 World Imagery, ESRI). The dam is located at the north east end of the lake, and there are two access points from Hwy 273.

A stocking evaluation was conducted at Big Lake in 2004 and 2005 (Meyer et al 2006), outlining stocking recommendations and trout management at Big Lake. A lake management plan is currently being developed for Big Lake, as part of a geographical lake management plan. The stocking evaluation and draft management plan are consistent with this proposal.

Proposed Action

The Department proposes to stock rainbow trout, cutthroat trout, brook trout, and Apache trout in Big Lake for the period covered by this consultation.

Fingerling, sub-catchable, and catchable trout will be stocked multiple times from April to October annually; numbers of rainbow trout stocked may be from 0 to 300,000 trout; 0 to 130,000 cutthroat trout; 0 to 130,000 brook trout; and 0 to 5,000 Apache trout annually.

Water Distribution / Connectivity

Big Lake has no permanent inflow stream and the watershed is extremely small, normally just enough to offset evaporation. The tributary from Big Lake to the North Fork of the East Fork of Black River is approximately 4.5 miles in length and normally does not maintain constant flow throughout. This tributary maintains permanent pools but most are not connected during the summer months. A comprehensive stream habitat survey in 2000 found 76 out of 120 aquatic habitats transects to be dry. Only 35 transects were found to have continuous water, and 11 transects fell on isolated pools. Big Lake has spilled to the North Fork in the past, but not since AGFD records have been kept, starting in 1996. A remote gauge was installed within the last five years to record lake levels which will assist further with maintaining spill records into the future. According to Rick Law, concessionaire for many years at Big Lake, the last spill at Big Lake occurred in the early 1990s.

No water is released from Big Lake for irrigation or other downstream uses. When the lake does spill (very infrequently), it will flow 4.5 miles down the intermittent unnamed tributary (with some permanent isolated pools) to the North Fork of the East Fork of the Black River. The spill from Crescent Lake enters the unnamed tributary approximately 0.1 mile downstream of the Big Lake dam. The North Fork perennial water flows downstream for 9.2 miles to Three Forks, where the North Fork at Boneyard Creek and another unnamed tributary come together to form the East Fork. Ground water inputs via a series of springs including the Head of the Black River Springs support the perennial flows in the North Fork beginning approximately 3.8 miles upstream of the confluence. A small tributary with some permanent flow at Chambers Draw also enters into the North Fork 0.4 mile downstream of the tributary from Big Lake.

From Three Forks, the East Fork flow is perennial for 12.2 miles to the confluence with the West Fork of Black River, where they form the mainstem. Several intermittent tributaries, which contain some permanent water, enter into the East Fork between Three Forks and the confluence, including Coyote Creek, Open Draw, and Deer Creek, 1.2 miles, 2.9 miles, and 7.2 miles downstream of Three Forks, respectively.

The Black River flow is perennial for 113.7 miles to the confluence with the White River, where they form the Salt River. A number of perennial tributaries enter into the Black River, including Beaver Creek, Bear Creek, Centerfire Creek, Fish Creek, Conklin Creek, Reservation Creek, Snake Creek, Pacheta Creek, Bear Wallow Creek, Paddy Creek, and Big Bonito Creek.

Fish Movement

Stocked trout in Big Lake cannot escape the lake unless the lake spills, which has not occurred since the early 1990s. When it does spill, trout do have the ability to escape down the unnamed tributary and into the North Fork of East Fork of Black River. An escaped trout would likely not survive long in the unnamed tributary, since most of it dries in the summer months, and the pools may not support trout for long (see Aquatic Community description of Big Lake tributary). Once in the North Fork, an escaped trout could swim upstream or downstream towards Three Forks. A trout could persist in the North Fork, as it is perennial and suitable trout habitat.

At Three Forks, an escaped trout could swim upstream in Boneyard Creek for 4.0 miles to the dam at Sierra Blanca Lake and/or the Boneyard Springs Bog. Boneyard Creek is perennial and suitable trout habitat, where a trout could persist. Boneyard Springs flows into a marshy bog area that is the headwaters of Boneyard Creek; however, it is unlikely an escaped trout would travel through the bog and into the springs itself, because of the very low flow of the springs. A trout could potentially swim up the unnamed tributary that enters the Three Forks area from the west, but likely would do so only during high flows, since the flow in this tributary is very low. The Three Forks Spring flows into this tributary a short distance up from its confluence with the North Fork, but an escaped trout would likely not swim up into this spring because of its very low flows (and not subject to high flows like the tributary).

From Three Forks, an escaped trout could also swim downstream in the East Fork of Black River down to the confluence with the West Fork Black River. The East Fork is perennial and suitable trout habitat, so a trout could persist here also. An escaped trout could also swim up into Coyote Creek, Open Draw, and/or Deer Creek, but likely only during high flows because of the very low flow of these tributaries.

For movement downstream of the East Fork, see the East Fork Black River analysis.

Community Description

Rainbow trout, cutthroat trout, brook trout, fathead minnow, crayfish, and tiger salamander are currently found in Big Lake (Table 5). Apache trout were last stocked in 2003 and are not considered to be currently present in the lake. Annual gillnetting surveys in Big Lake have not caught Apache trout since 2003. They were either caught out quickly or did not persist amongst the competition with other trout in the lake; most likely the latter since creel surveys have shown poor return to creel by Apache trout in Big Lake. One unidentified sucker was collected in 2008 and another in 2003; however, these are considered to be isolated records, as no suckers have been recorded in Big Lake before or after these collections, despite annual surveys with gillnets (and some trap nets) since 1960.

Table 5. Five Year Survey History for Big Lake using experimental gillnets.

Year	Sample Period	Species	Number Caught	Size range (mm TL)
2009	May	Rainbow trout Cutthroat trout Brook trout	118 21 2	167-590 236-508 312-379
2008	May	Rainbow trout Brook trout Cutthroat trout Unidentified sucker	66 45 28 1	220-421 240-421 220-498 500
2007	May	Rainbow trout Brook trout Cutthroat trout	35 21 7	208-467 220-272 375-564
2006	April	Rainbow trout Cutthroat trout	23 34	235-378 215-362
2005	May	Rainbow trout Cutthroat trout Brook trout	81 76 20	220-419 222-530 116-443

The tributary from Big Lake to the North Fork of the East Fork Black River contains speckled dace, fathead minnow, Sonora sucker, and crayfish as detected in a 2000 fish survey (Table 6). An earlier survey conducted in June 1995 found one rainbow trout and 33 brown trout (Marsh 1997), but no trout were found during the 2000 survey (3-pass depletion), indicating that they are so uncommon that they were not detected, or do not persist in this tributary. The brown trout likely came upstream into the tributary from the North Fork where they are numerous; brown trout are not stocked into Big Lake or Crescent Lake. It is possible the one rainbow trout escaped from Big Lake or Crescent Lake during a spill event in the early 1990s, or could have also come up from the North Fork.

Table 6. Summary of fish surveys of 24 sites on the tributary from Big Lake to North Fork of the East Fork Black River, 2000.

The survey sites were 50 meters long and spaced at regular intervals throughout the stream. A backpack electroshocker was used to complete a 3-pass depletion sampling at each site, when water was present.

Species Collected	Number Collected	Size Range (mm TL)
Speckled dace	460	23-89
Sonora sucker	18	136-302
Fathead minnow	576	23-75

Table 7 indicates the stocking history for the North Fork of the East Fork of the Black River. The North Fork of the East Fork at the confluence with the tributary from Big Lake contained speckled dace, desert sucker, fathead minnow, and crayfish, as detected in a 2001 survey, and speckled dace, desert sucker, Sonora sucker, loach minnow, fathead minnow, brown trout, and hybrid rainbow x apache (hybrid) trout throughout the North Fork as detected in surveys in 2000 and 2001 (Table 8).

Hybrid rainbow x Apache trout are wild and self sustaining in the North Fork, likely originating from historic Apache trout populations in the drainage and rainbow trout that were historically stocked into the North Fork as far back as 1936. Some trout escaping from Big Lake and Crescent Lake when they spill may also have reproduced with native Apache trout. Hybrids have been documented in the North Fork prior to hatchery Apache trout stocked into either Big Lake or in the East Fork Black River. Marsh (1997) also reported hybrid rainbow-Apache trout in the North Fork in 1989 prior to stocking of hatchery Apache trout in the East Fork (1996).

Table 7. AGFD Stocking History for the North Fork of the East Fork of the Black River.

Species	First Year	Last Year	Num of Stockings	Number Stocked
Arctic grayling	1969	1969	2	10,000
Brook trout	1933	1963	2	30,501
Brown trout	1938	1959	11	48,515
Rainbow trout	1936	1986	174	143,541
Total				232,557

Chambers Draw, a small tributary to the North Fork between the tributary from Big Lake and Crosby Crossing contains hybrid rainbow-Apache trout. This population is very small, although likely contributes hybrid trout into the North Fork.

Loach minnow are considered to occupy the North Fork of the East Fork, approximately 12.8 miles downstream of Big Lake. Loach minnow occupied range is considered to extend from 0.9 miles upstream of Three Forks, as found in 2000, downstream into the East Fork of Black River,

approximately 0.5 miles upstream of Open Draw (Marsh 1997). From the confluence of the unnamed tributary downstream of Big Lake with the North Fork of the East Fork of the Black, it is approximately 8.3 miles downstream to occupied loach minnow habitat and another 0.9 miles to Three Forks (13.7 miles total from Big Lake to Three Forks).

Anadonta mussels are present in the North Fork around Crosby Crossing, and at one time were present at Three Forks, and are present in Boneyard Creek. Three Forks springsnails are present at an offchannel springhead at Three Forks, and also at a spring bog at the head of Boneyard Creek.

Table 8. North Fork of East Fork of Black River 2000 and 2001 survey at 47 survey site:

Surveys sites were regularly spaced throughout the stream. The lower portion of the North Fork was surveyed in 2000 and the upper portion was surveyed in. In 2000, surveys were started at the Three Forks area and surveyors worked upstream; however, due to the intensity of the surveys, the anticipated number and extend of stream length was not completed. As such, 2001 surveys began where the 2000 surveys left off. A backpack electroshocker was used to complete 3 depletion passes through 50 meters at each site.

Species Collected	Number Collected
Speckled dace	15,497
Loach minnow	28
Desert sucker	1,839
Sonora sucker	162
Brown trout	34
Hybrid trout	15
Fathead minnow	1,915

Recent surveys in the Three Forks area in 2007, 2008, and 2009 have not found loach minnow, but have found speckled dace, desert sucker, Sonora sucker, rainbow trout, Apache trout, cutthroat trout, and brown trout in the North Fork (Carter 2007; Robinson et al 2008; Robinson et al 2009: Table 9). The one cutthroat trout reported in 2008 at Boneyard Creek is likely a misidentified hatchery Apache trout based on reviews of a photo of the fish (M. Lopez, pers. comm.). This fish is assumed to come from either the East Fork or Big Lake.

For recent survey results of all of the East Fork Black River and further downstream, refer to the East Fork Black River analysis below.

Table 9. Surveys in the North Fork East Fork Black River, upper East Fork Black River, Boneyard Creek, and Coyote Creek in 2007, 2008, 2009.

Stream	**Species Collected**	**Number Collected by Year**

		2007	2008	2009
North Fork East Fork Black River	Speckled dace	286	753	886
	Desert sucker	92	39	13
	Sonora sucker	1	-	-
	Brown trout	8	48	56
	Rainbow trout	-	6	-
	Unidentified sucker	-	2	2
East Fork Black River	Speckled dace	204	241	251
	Desert sucker	37	17	15
	Sonora sucker	1	1	-
	Brown trout	30	28	73
Bonyard Creek	Speckled dace	68	459	104
	Desert sucker	7	16	1
	Sonora sucker	1	1	-
	Brown trout	25	48	28
	Brook trout	-	5	9
	Apache trout	-	1	-
	Cutthroat trout*	-	1	-
	Unidentified sucker	-	8	-
Coyote Creek	Speckled dace	not surveyed	105	20
	Desert sucker		-	4
	Unidentified sucker		-	1

* Likely a misidentified hatchery Apache trout based on reviews of a photo of the fish (M. Lopez, pers. comm.)

Chiricahua leopard frogs are located in Sierra Blanca Lake at the head of Boneyard Creek, and may be present at Three Forks. Narrow-headed garter snakes have been documented recently downstream of Three Forks in 2004 (M. Lopez, pers. comm.), and in the Black River below Forest Road 25 bridge in 2009 (Brennan and Rosen 2009). Northern Mexican garter snakes may occur downstream in the Black River with the closest known population at the confluence with Paddy Creek. Refer to the East Fork Black River analysis for species composition in the East Fork and further downstream in the Black River that may be impacted.

Bald eagles nest on a knoll near Crescent Lake, approximately 1.3 miles from Big Lake and may use the lake for foraging; Big Lake is outside the bald eagle DPS. There are Mexican spotted owls within five miles. New Mexico meadow jumping mice have historical records from the nearby vicinity.

Consultation species and Critical Habitat
Potential impacts to Apache trout (stocked at Big Lake), Chiricahua and northern leopard frogs are addressed below. Should stocked Apache or rainbow trout escape Big Lake and move downstream, potential impacts to Apache trout, narrow-headed and northern Mexican garter snakes, loach minnow and critical habitat, roundtail chub and three forks springsnail downstream of Big Lake are addressed in the Black River Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Apache trout
Hatchery reared Apache trout are occasionally stocked into Big Lake to provide sport fishing opportunities. Hatchery Apache trout are also stocked downstream of Big Lake in the East Fork Black River and lower West Fork Black River. Pure populations of recovery population Apache trout are present downstream of Big Lake in the headwaters of the West Fork Black River, Stinky Creek and Hayground Creek (tributaries of West Fork), Fish Creek, Conklin Creek, and Bear Wallow Creek (tributaries of Black River). All recovery populations are isolated from non-native fishes by constructed fish barriers, 2 each on upper West Fork and Bear Wallow, and one each on Stinky, Hayground, Fish, and Conklin creeks.

Potential Impacts

Stocked Apache trout co-stocked with other species:

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of

the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts is found in Apache trout interactions section (Chapter 4).

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Chiricahua leopard frog

Local Analysis: Big Lake and the Black River buffered stocking complex are within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to fish stocked in Big Lake is low. However, the likelihood that frogs could be exposed to fish stocked in other sites within the complex is high. There are no historical records for Chiricahua leopard frogs from Big Lake itself; though there are historical records for Chiricahua leopard frogs from 6 sites within the complex: Crabtree Creek (1988), Deer Creek (2001), East Fork Black River (Buffalo Crossing footbridge) (1974), East Fork Black River (Three Forks) (2008), Concho Bill Spring (2009), and Lake Sierra Blanca (2008) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Subsequent surveys have found that Chiricahua leopard frogs occupy the area

within the Black River buffered stocking complex. In addition, this area, including 3 of the sites mentioned above, is part of ongoing recovery activities for the Chiricahua leopard frog. However, it is not likely that stocked fish in Big Lake are able to disperse to occupied Chiricahua leopard frog sites, stocked fish at other sites within the complex may.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish from Big Lake or the Black River buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Northern Leopard Frog

Local Analysis: Big Lake and the Black River buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Big Lake or other stocking sites within the complex is low. There is 1 historical record for northern leopard frogs from 1 site in the complex: East Fork Black River (Three Forks) from 1979 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs have not been observed at East Fork Black River (Three Forks) during many subsequent surveys or from other sites surveyed in the Black River buffered stocking complex. Due to the extensive surveying of this area and the lack of northern leopard frog observations, it is likely that northern leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish from Big Lake or the Black River buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

East Fork Black River

Site Description

The stocking site is a series of stocking sites within a 6.75-mile reach on the lower end of the East Fork of the Black River (Figure 3). The stocking reach extends from approximately at the Buffalo Crossing Campground (Figure 11) upstream to the Diamond Rock Campground (Figure 12), approximately 4.5 miles below Three Forks. The East Fork of the Black River is a perennial stream fed by springs, snowmelt, rainfall events, and groundwater contributions. The entire East Fork Black River is located on the Apache-Sitgreaves National Forest, and the stocking reach is approximately 9 miles west of Alpine. The East Fork Black River stocking site is located downstream of Big Lake and Crescent Lake. The East Fork meets with the West Fork Black River a short distance downstream of the stocking reach to form the Black River. Other stocking

sites in the complex are located in the West Fork, and in Ackre Lake which drains into the Black River.

Figure 11. East Fork Black River stocking reach at Buffalo Crossing.

Management of Water Body

The primary fishery in the stocked reach from Buffalo Crossing upstream to Diamond Rock is a cold water intensive use Apache trout put-and-take fishery (Table 10). Catchable size trout are stocked weekly from May through September. Rainbow trout had been primarily stocked from 1933 to 1996, although brown trout were also stocked numerous times from 1935-1981. The species stocked into the East Fork was changed in 1996 to Apache trout, and only Apache trout have been stocked since 1997 because of concerns for native fishes and other sensitive aquatic organisms in the drainage.

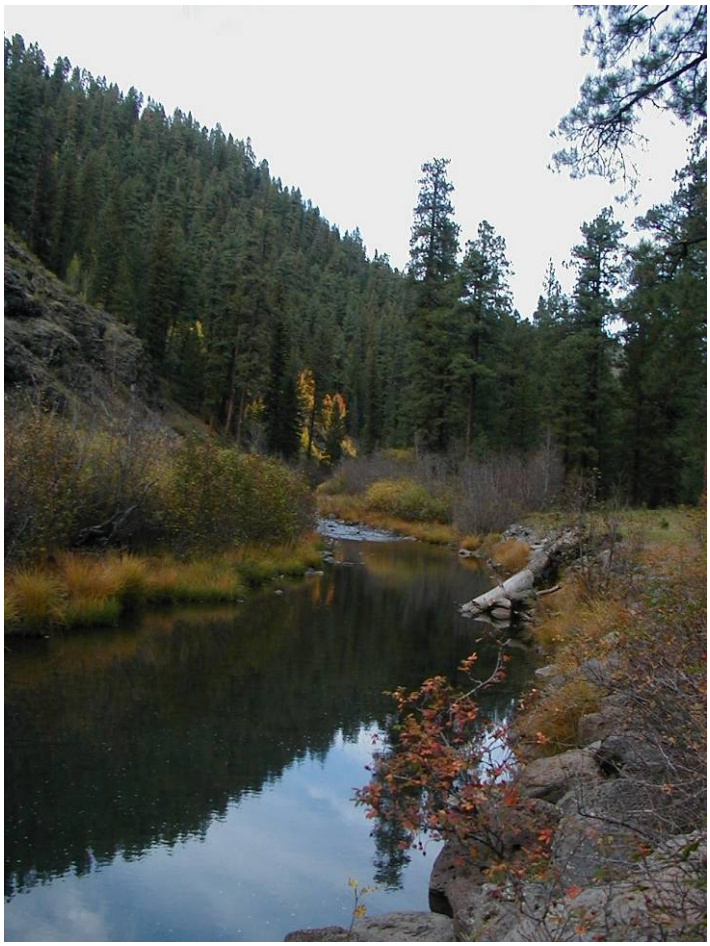

Figure 12. East Fork Black River stocking reach near Diamond Rock.

Table 10. Stocking history for East Fork Black River.

Species	First Year	Last Year	Number of Stockings	Number Stocked
Apache trout	1996	2009	232	286,264
Arctic grayling	1969	1969	1	10,000
Brook trout	1933	1940	6	48,620
Brown trout	1935	1981	52	291,131
Native trout*	1933	1937	6	59,410
Rainbow trout	1933	2008	739	1,499,207
Total				2,194,632

The east fork is accessed by all weather gravel Forest Road 276, a maintained dirt road that parallels the river throughout the stocking reach (Figure 13). There are four Forest Service campgrounds along the stocking reach.

Anglers can easily access the river all along Forest Road 276, but usually concentrate at larger pool habitats in the stocking reach where the trout are stocked. Angler use data were collected by on-site angler creel surveys in 1982 (17,262 AUD), 1987 (14,461 AUD), 1995 (13,389 AUD), 1996 (8,379), and 1997 (13,517 AUD), and by mail out survey in 2001 (33,334 AUD; Pringle 2004). Angler use in 1996 was depressed because of Forest closures in mid-summer that year. The East Fork of Black River is typically accessible from March through November, and receives very little winter use, depending upon the severity of the winter. A fisheries management plan is currently being developed by the Forest Service for the East Fork Black River as part of a wide scale plan for the Apache National Forest area.

The East Fork Black River is currently stocked entirely with Apache trout, which has mostly met the needs of anglers. All Apache trout stocked into the East Fork come from one hatchery and occasionally circumstances result in problems stocking Apache trout. When higher than expected mortalities at Silver Creek Hatchery reduces available Apache trout, reductions in the number of fish stocked is necessary. The occasional use of rainbow trout to fill in gaps in Apache trout numbers would help maintain a more consistent fishery. This is not likely to increase impacts on sensitive species, since the total numbers of fish stocked would not increase (only use rainbows when hatchery is short on Apache trout), rainbow trout are easier to catch and exhibit higher catch rates, and likely function in the stream much the same way an Apache trout would despite being nonnative while Apache trout are native.

Figure 13. East Fork Black River stocking reach along Forest Road 276.

Proposed action

The Department proposes to stock Apache trout and rainbow trout into the East Fork Black River for the period covered by this consultation.

Catchable Apache trout and rainbow trout would be stocked weekly from May through September. Total numbers of trout stocked may be from 0 to 40,000 trout annually. Stocking Apache trout would be the preferred objective, however, rainbow trout may be substituted when hatchery supply of Apache trout are not sufficient to stock the river at the desired rates. The addition of rainbow trout for the next ten years is a change from the previous stocking plan.

Water Distribution / Connectivity

The entire East Fork Black River is perennial and is fed by the perennial North Fork East Fork Black River (see Big Lake analysis for water distribution in the North Fork) and perennial Boneyard Creek. Boneyard Creek begins at the Boneyard Bog Springs, and then flows for 4.3 miles to meet the North Fork and another unnamed tributary at Three Forks to form the East Fork Black River. Sierra Blanca Lake is located at the headwaters of Boneyard Creek, although it is connected but off channel from the main channel of Boneyard Creek.

The unnamed tributary at Three Forks that flows in the East Fork of the Black from the northwest is small and does not contribute much water, although the Three Forks Spring is off channel and flows into this tributary just upstream of its confluence with the East Fork. A small natural pond is also connected to this tributary just upstream of the confluence.

Coyote Creek is another small tributary that enters the East Fork Black River approximately 1.2 miles downstream of Three Forks. This stream occasionally dries through much of its length, although it does maintain permanent pools. Open Draw is another small tributary that enters the East Fork Black River approximately 2.9 miles downstream of Three Forks. The permanency of this stream is unknown, although it is very small. Deer Creek is another small tributary that enters the East Fork Black River approximately 7.2 miles downstream of Three Forks. Concho Bill Springs is located in upper Deer Creek, approximately 3.6 miles upstream of the East Fork.

The East Fork Black River meets with the West Fork Black River to form the mainstem Black River. The Black River continues to flow south, then west for 113 miles into the Fort Apache Indian Reservation and San Carlos Indian Reservation, where it meets with the White River to form the Salt River. The Black River is also perennial throughout its entire course.

Permanent tributaries enter into the Black River on the Apache National Forest, including Beaver Creek (1.9 miles downstream of the confluence of the East Fork and West Fork of Black Rivers), Bear Creek (3.9 miles), Centerfire Creek (9.3 miles), Fish Creek (9.6 miles), Conklin Creek (11.6 miles), Reservation Creek (12.8 miles), and Snake Creek (14.8 miles). Other major tributaries that enter the Black River on the reservations include Pacheta Creek, Bear Wallow Creek, Paddy Creek, and Big Bonito Creek.

Fish Movement

Trout stocked into the East Fork Black River can move upstream in perennial water to Three Forks, and into the North Fork of the East Fork of Black River or into Boneyard Creek. Fish are unlikely to move upstream through Boneyard Creek into Sierra Blanca Lake since there is a dam on the lake. Stocked trout could not reach the Boneyard Bog Spring area because the bog is really heavily vegetated and there are no perennial flows entering Sierra Blanca. The Lake probably spills every year, but only during spring run-off events. Movement into tributaries of the North Fork is likely restricted to high flow seasons, such as spring runoff, because of low flows and often dry reaches in tributaries other than Boneyard Creek. Movement into tributaries of the East Fork Black River is also likely restricted to high flow seasons, such as spring runoff, because of low flows and often dry reaches in the tributaries.

It is possible for stocked trout to move downstream in perennial water to the confluence with the West Fork Black River. At this point, a stocked trout could move upstream into the West Fork unimpeded until it reached a constructed fish barrier 13.5 miles above the confluence (Figure 14). A second constructed fish barrier is located 0.3 miles upstream of the lower barrier (Figure 15). Several tributaries to the West Fork Black River enter downstream of these fish barriers. A dispersing fish could enter the lower portion of these tributaries until they reach constructed fish barriers on all three tributaries. Home Creek is located 1.2 miles upstream of the East Fork and West Fork confluence, with constructed fish barriers at 1.3 miles and 1.7 miles upstream of the West Fork (Figure 16). Hayground Creek is located 6.6 miles upstream of the East Fork and West Fork confluence, with a constructed fish barrier 0.1 mile above the West Fork (Figure 17). Stinky Creek is located 11.6 miles upstream of the East Fork and West Fork confluence, with a constructed fish barrier 0.2 miles above the West Fork (Figure 18).

It is also possible for a stocked trout to continue down into the Black River. All of the Black River on the National Forest is suitable trout habitat and may support dispersing trout, but at some point downstream on the reservations, the river reaches an elevation where the river becomes too warm to support trout. Dispersing trout may also swim up into the tributary streams, but would likely do so mainly during high flows because of the normal low flows in these streams, despite being perennial. A dispersing trout moving up into tributaries, could go no further than constructed fish barriers on Centerfire Creek (1.5 miles above the Black; Figure 19), Fish Creek (0.6 miles; Figure 20), Conklin Creek (1.4 miles; Figure 21), and Snake Creek (0.1 miles; Figure 22). A trout could move some distance up Reservation Creek, but can only get into a very small stretch of lower Soldier Creek until it reached a natural waterfall (Figure 23). Constructed fish barriers also exist on Bear Wallow Creek (Figure 24 and Figure 25) and Big Bonito Creek.

Figure 14. West Fork Black River lower fish barrier (located above West Fork Black stocking reach).

Figure 15. West Fork Black River upper fish barrier.

Figure 16. Home Creek upper fish barrier.

Figure 17. Hayground Creek fish barrier.

Figure 18. Stinky Creek fish barrier.

Figure 19. Centerfire Creek fish barrier.

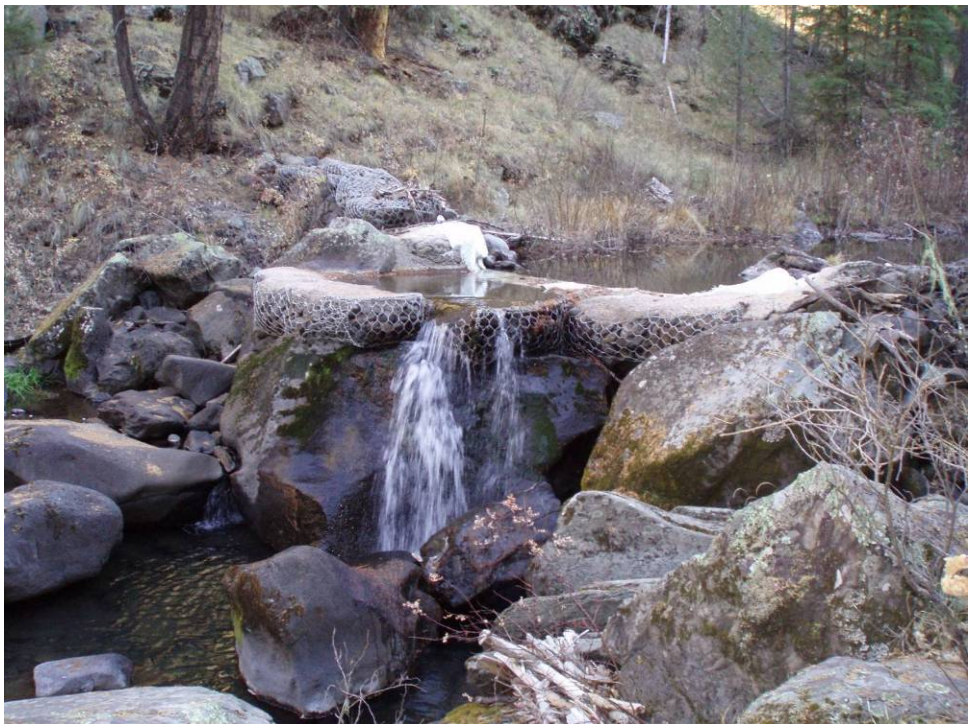

Figure 20. Fish Creek fish barrier.

Figure 21. Conklin Creek fish barrier.

Figure 22. Snake Creek fish barrier.

Figure 23. Soldier Creek waterfalls (fish barrier).

Figure 24. Bear Wallow lower fish barrier on San Carlos Reservation.

Figure 25. Bear Wallow upper fish barrier on Apache-Sitgreaves National Forest.

All waters in the Black River watershed are suitable trout habitat, except for some very small tributaries because of extremely low flows, plus the lower portion of the Black River on the reservations, where the water becomes too warm in these lower elevations to support trout.

Community Description

The stocked reach on the East Fork currently contains wild brown trout, stocked Apache trout, desert sucker, Sonora sucker, speckled dace, and numerous crayfish. These species were collected in the stocking reach during surveys in 1988 and 1996, as shown in Table 11. These sites were originally surveyed in July-August 1988, and were repeated in 1996. The 1988 survey was conducted during the stocking season and rainbow trout were collected within the stocking reach, since rainbows were being stocked at that time, up to 1996. In 1988, no rainbow trout were collected below the stocking reach or above the stocking reach Table 12). Apache trout stockings began in 1996; 90% of the trout stocked in the East Fork that year were Apache trout. Only Apache trout have been stocked starting in 1997. The 1996 survey looking for stocked trout was conducted in October-November, after the stocking season ended in September. No hatchery trout were collected at any station in the East Fork during these surveys, in the stocking reach, or above or below illustrating that stocked trout do not remain in the system following the stocking season. The 1988 survey documented no movement of stocked trout out of the stocking reach, since hatchery rainbow trout were collected only in the stocking reach. The 1996 survey documented no persistence of hatchery Apache trout approximately 2 months after the stocking season.

Table 11. East Fork Black River surveys within the stocking site in 1988 and 1996. Survey sites 2-5 through 3-7are located within the stocking reach.

Stations 1-1 through 2-4 are located below the stocking reach. The permanent stations established on the East Fork Black River in 1988 were 100 meters in length, and were sampled with 3 depletion passes with a backpack electroshocker (Novy and Lopez 1991b).

Survey Site	**Species**	**Year**	
		1988	**1996**
1-1	Speckled dace	26	76
	Desert sucker	52	13
	Sonora sucker	20	4
	Brown trout	5	12
1-2*	Speckled dace	49	37
	Desert sucker	52	29
	Sonora sucker	15	7
	Brown trout	7	18
2-3*	Speckled dace	458	177

Survey Site	Species	Year	
		1988	1996
	Desert sucker	24	36
	Sonora sucker	11	7
	Brown trout	5	12
2-4*	Speckled dace	19	21
	Sonora sucker	14	5
	Brown trout	7	2
	Brown trout	-	24
2-5**	Speckled dace	29	50
	Desert sucker	17	20
	Sonora sucker	9	6
	Brown trout	4	32
3-6**	Speckled dace	127	11
	Desert sucker	104	11
	Sonora sucker	21	14
	Brown trout	35	37
	Rainbow trout	2	-
3-7**	Speckled dace	187	54
	Desert sucker	381	26
	Sonora sucker	12	3
	Brown trout	8	31
	Rainbow trout	2	-

** Survey sites are located below the stocking reach*

***survey sites are located within the stocking reach*

Loach minnow occupied habitat is 2.1 miles upstream from the uppermost stocking site in this reach. Surveys conducted in the East Fork Black River upstream of the stocking site also detected speckled dace, desert sucker, Sonora sucker, and brown trout in 1988 and 1996 (Table 12). Survey sites 3-8 through 4-11 are all located above the stocking reach. Loach minnow were collected at sites 3-9, 4-10 and 4-11 in 1996, but were not documented in 1988. Loach minnow were first identified in the East Fork in 1996 and loach minnow may have been collected in 1988 but misidentified as speckled dace since crews were not looking for loach minnow (M. Lopez, pers. comm.). No hatchery trout were collected in the sites above the stocking reach in 1988 or in 1996.

Table 12. East Fork Black River surveys upstream of stocking site in 1988 and 1996.

The permanent stations established on the East Fork Black River in 1988 were 100 meters in length, and were sampled with 3 depletion passes with a backpack electroshocker (Novy and Lopez 1991b).

Survey site	**Species**	**Year**	
		1988	**1996**
3-8	Speckled dace Desert sucker Sonora sucker Brown trout	318 89 3 4	Not surveyed
3-9	Speckled dace Desert sucker Sonora sucker Brown trout Loach minnow	155 378 9 3 -	738 128 11 - 33
4-10	Speckled dace Desert sucker Sonora sucker Brown trout Loach minnow	293 357 30 3 -	786 188 16 2 3
4-11	Speckled dace Desert sucker Sonora sucker Brown trout Loach minnow	175 249 9 3 -	633 62 20 3 1

The permanent sites on the East Fork Black River were re-surveyed 3 times in 2009, once in the spring prior to stocking season, once in July during the stocking season and once again in November after the stocking season (Table 13). These surveys followed the methods originally used by Novy and Lopez (1991b) in 1988, and repeated in 1996.

Table 13. East Fork Black River surveys at permanent GAWS sites in 2009.

Sites 1-1 through 2-4 are located below the stocking reach; sites 2-5 through 3-7 are located within the stocking reach; sites 3-7.2 through 4-11 are located above the stocking reach. Sites 3-6.5, 7.1 and 7.2 were newly added in 2009 and were not surveyed in 1988 or 1996. The stations were 100 meters in length, and were sampled with 2- 4 depletion passes with a backpack electroshocker (Novy and Lopez 1991b).

Survey Site	**Species Collected**	**Survey date**		
		Spring (pre stocking)	**Summer (stocking)**	**Fall (post stocking)**

Survey Site	Species Collected	Survey date		
		Spring (pre stocking)	Summer (stocking)	Fall (post stocking)
1-1	Brown trout	58	36	37
	Speckled dace	-	412	-
	Desert sucker	-	4	-
1-2	Brown trout	Not surveyed	89	49
	Apache trout		2	-
	Speckled dace		554	-
	Desert sucker		67	-
	Sonora sucker		3	-
2-3	Brown trout	21	66	73
	Apache trout	-	-	1
	Speckled dace	-	489	-
	Desert sucker	-	7	-
2-4	Brown trout	23	40	38
	Speckled dace	-	236	-
	Desert sucker	-	1	-
	Sonora sucker	-	14	-
3-5	Brown trout	43	237	68
	Apache trout	-	1	-
	Speckled dace	-	517	-
	Desert sucker	-	5	-
	Sonora sucker	-	4	-
3-6	Brown trout	60	55	74
	Apache trout	-	1	-
	Speckled dace	-	127	-
	Desert sucker	-	7	-
	Sonora sucker	-	6	-
3-6.5	Brown trout	Not surveyed	66	25
	Apache trout		2	-
	Speckled dace		116	-
	Desert sucker		4	-
	Sonora sucker		1	-
3-7	Brown trout	70	184	128
	Apache trout	-	1	-
	Speckled dace	-	39	-
	Desert sucker	-	17	-
3-7.1	Brown trout	31	79	Not surveyed
	Speckled dace	-	4	

Survey Site	Species Collected	Survey date		
		Spring (pre stocking)	Summer (stocking)	Fall (post stocking)
	Desert sucker Sonora sucker	- -	79 3	
3-7.2	Brown trout Speckled dace Desert sucker Sonora sucker	22 - - -	35 24 67 3	Not surveyed
3-8	Brown trout Speckled dace Desert sucker Sonora sucker	15 - - -	26 291 12 1	139*
3-9	Brown trout Speckled dace Desert sucker Sonora sucker	Not surveyed	53 182 25 1	
4-10	Brown trout Brook trout Speckled dace Desert sucker	Not surveyed	68 1 416 20	
4-11	Brown trout Speckled dace Desert sucker Fathead minnow	Not surveyed	70 310 8 1	35

* During the Fall surveys, survey crews completed the 100 m sites closest to the upstream end of the stocking reach to try to document any movement upstream of stocked fish. From sites 3-8 through 4-10 the crews did not survey 100 m sites, rather they walked upstream and electrofished every pool in attempt to evaluate whether there are pools that could harbor fish between survey stations. This was an effort to be more thorough in trying to detect possible stocked trout that moved upstream; in total 130 brown trout were collected.

The 2009 surveys were conducted in an attempt to determine if stocked trout are moving out of the stocking reach or persisting after stocking. The spring and fall surveys collected only trout, although other native species were present. Sites 3-9 through 4-11 were not surveyed in the spring to minimize potential impacts on loach minnow. A full survey of all species was conducted in the summer survey. The spring surveys documented no carryover hatchery trout from the 2008 stocking season at any of the stations. The only trout found in the spring were wild brown trout. The summer surveys found some hatchery Apache trout in the stocking reach (n=5), compared to 542 wild brown trout in the same sites. The summer surveys also

documented 2 hatchery Apache trout that had moved downstream of the stocking reach, into station 1-2 (2.3 miles below the stocking reach). The summer surveys also documented another trout, 1 brook trout in station 4-10. This brook trout likely came downstream from a wild population of brook trout that exist in Boneyard Creek. Station 4-10 is located approximately 0.5 miles downstream of the Boneyard Creek confluence. Only 1 Apache trout was documented to persist after the stocking season ended. This trout was found at station 2-3, which is downstream of the stocking reach, thus it had dispersed out of the stocking reach. No hatchery trout were found upstream of the stocking reach in any of the 3 surveys. Stations 3-8, 3-9 and 4-10 were not surveyed in the fall survey, however, a crew electrofished each major pool (where catchable size trout would most likely be located) from site 3-8 to just below 4-11. Only wild brown trout were found, except for the 1 wild brook trout in the summer survey. Robinson et al (2008) documented at least 1 hatchery Apache trout in Boneyard Creek (see Table 9 above), illustrating that stocked trout do move upstream as well. These data illustrate several things

Hatchery trout stocked into the East Fork Black River do disperse out of the stocking reach, both upstream and downstream, but do so in very low numbers.

Hatchery trout do persist for a short period (at least 2 months) after the stocking season has ended, but do not persist long-term. The 1996 survey and 2009 spring survey show that hatchery trout did not persist (enough to be detected) from the 1996 stocking season and 2008 stocking season, respectively. Also, the total number of hatchery trout collected is very low in all surveys, even during the stocking season, illustrating that most trout are likely caught out quickly, within days of a stocking event.

Wild brown trout are increasing in numbers from 1988 through 2009, speckled dace are maintaining populations, and suckers are decreasing. Population estimates show a statistically significant increase in brown trout from 1988 to 1996, and also from 1996 to 2009 (Table 14). The sum of fish collected in multiple depletion passes and may not fully illustrate the change.

Table 14. Population estimates (SE) for trout, suckers, speckled dace and loach minnow in the East Fork Black River for 1988, 1996 and 2009.

Estimates are the average of population estimates in 100 meter survey stations on the East Fork Black River. All trout in these population estimates were brown trout, except for 1988 which includes 0.4 rainbow trout per station.

Date	**Trout**	**Desert sucker**	**Sonora sucker**	**Speckled dace**	**Loach minnow**
July 1988	9.4 (3.8)	236 (82)	18.4 (3.5)	224 (67)	
Oct-Nov 1996	19.9 (5.3)^	68 (25)^	9.9 (2.1)^	298 (111)	4.9 (4.3)
May 2009	45.6 (8.7)^				

^Statistically significant differences (90% CI)

Recent surveys in the upper East Fork Black River in 2007, 2008, and 2009 (Carter 2007, Robinson et al. 2008, Robinson et al. 2009), upstream of the stocking reach, detected speckled dace, desert sucker, Sonora sucker, and brown trout as shown in Table 9, above.

Tributary Coyote Creek contains loach minnow, speckled dace, desert sucker, Sonora sucker, fathead minnow, and brown trout (Table 15); surveys in Coyote Creek were conducted in 2000. One loach minnow was collected at station 1-3, 564 meters upstream of the East Fork Black River.

Tributary Open Draw contains speckled dace and fathead minnow, with both species documented in surveys in 1988 and 1996 (Marsh 1997 and Table 16).

Table 15. Survey of Coyote Creek in 2000. Twenty-four 50-meter stations were established throughout the stream and electrofished with 3 depletion passes.

Species Collected	**Number Collected**
Loach minnow	1
Speckled dace	3,501
Desert sucker	329
Sonora sucker	3
Fathead minnow	14
Brown trout	5

Table 16. Surveys of Open Draw in 1988 and 1996, from Forest Road 582 downstream for 1 mile (Marsh 1997).

Survey Date	**Species Collected**	**Number Collected**
June 1988	Speckled dace Fathead minnow	1032 26
August 1996	Speckled dace Fathead minnow	8 77

Tributary Deer Creek was determined to be fishless in surveys conducted in 1996 and 1999. In 1996, surveys were conducted on the stream near Concho Bill Spring without finding fish (Marsh 1997). In 1999, a pool at Concho Bill Spring was seined and electrofished by Department personnel, plus a length of stream below the pool was electrofished, without finding fish. A conservation population of Chiricahua leopard frogs was established at Concho Bill Spring, located at the head of Deer Creek approximately 3.6 miles up from the East Fork Black River.

Smallmouth bass and roundtail chub occur a short distance downstream in the mainstem Black River but have not been documented in the East Fork. A recent survey in the Black River downstream of the stocking site also detected speckled dace, desert sucker, Sonora sucker, fathead minnow, and rainbow X apache trout hybrids in 2005 (Table 17). McKell documented both smallmouth bass and roundtail chub in the Black River at the confluence with Bear Creek, approximately 6.7 miles downstream of the stocking reach on the East Fork Black River. Voeltz (2007) also documented brown trout, roundtail chub, smallmouth bass, desert sucker, Sonora sucker, and speckled dace in the Black River at Wildcat Crossing.

There are historical and recent records of narrow-headed garter snakes above, within and downstream of the East Fork Black River stocking reach, and above and below the West Fork Black River stocking reaches (see complex analysis for details). The entire Black River stocking complex is out of the distributional range of northern Mexican garter snakes (see complex analysis for details).

Table 17. Species and numbers of fish collected in the 2005 Black River survey (McKell 2005a).

Species	**Method**	
	Hoop nets*	**Electroshocking****
Sonora sucker	2	13
Roundtail chub	199	98
Desert sucker	1	33
Speckled dace	25	428
Smallmouth bass	-	6
Hybrid trout	-	14
Brown trout	-	23
Fathead minnow	-	1
Unidentified sucker	-	6

**Effort = 261.95 hours*

*** Effort = 197.6 minutes*

Beaver Creek, tributary to the Black River approximately 4.7 miles downstream of the East Fork stocking reach, contains speckled dace, desert sucker and brown trout, as documented in a survey conducted in 2008 (Weiss and Lopez 2008 and Table 18).

Table 18. Survey in Beaver Creek in 2008 (Weiss and Lopez 2008)

Species Collected	**Number Collected**
Speckled dace	158
Desert sucker	49
Brown trout	14

Hannagan Creek, a headwater tributary to Beaver Creek, contains Apache trout, brown trout, and speckled dace according to a survey conducted in 1990 (Novy and Lopez 1991 and Table 19). Some pure Apache trout are present above a road culvert barrier in Hannagan Creek; however, Carmichael et al (1993) report that many of the trout are rainbow-Apache hybrids.

Table 19. Species, numbers and size range of fish collected in a 1990 survey of Hannagan Creek (Novy and Lopez 1991).

In this table, Apache trout includes pure Apache trout and hybrid rainbow-Apache trout.

Reach	Species Collected	Number Collected	Size Range (mm TL)
1	Speckled dace	78	24-63
2	Apache trout	4	77-96
3	Apache trout Brown trout	54 1	71-167 126
4	Apache trout	43	67-156

Bear Creek, tributary to the Black River approximately 6.7 miles downstream of the stocking reach on the East Fork, contains brown trout and rainbow trout, as documented by Marsh (1997) in 1996 (Table 20).

Table 20. Species and numbers of fish collected in a 1996 survey of Bear Creek (Marsh 1997).

Species Collected	Number collected
Brown trout	67
Rainbow trout	1

Centerfire Creek, tributary to the Black River approximately 12.0 miles downstream of the stocking reach on the East Fork, contained Apache trout, brown trout and speckled dace, as documented by Novy and Lopez (1991) in 1988 (Table 21). Some pure Apache trout are present in Centerfire Creek; however, Carmichael et al (1993) reported that the stream also contains mostly rainbow-Apache hybrids. A visual survey of much of the stream in 2007 during extremely low flow observed no fish above a constructed fish barrier located at the confluence with Wildcat Creek (Lopez 2008; Figure 19).

Table 21. Species, numbers and size range of fish collected in Centerfire Creek in 1988 (Novy and Lopez 1991).

Reach	Species Collected	Number Collected	Size Range (mm TL)
1	Brown trout	58	101-341

	Apache trout Speckled dace	51 262	39-214 26-121
2	Brown trout Apache trout Speckled dace	54 45 51	103-290 86-198 33-125
3	Brown trout Apache trout Speckled dace	13 65 61	128-352 81-211 49-112

Fish Creek, tributary to the Black River approximately 12.3 miles downstream of the stocking reach on the East Fork, contains pure Apache trout and speckled dace upstream of a constructed fish barrier (Lopez et al 2007; Figure 26). Prior to chemical treatment to remove non-native fish species, Fish Creek contained Apache trout, rainbow-Apache hybrids, brown trout, fathead minnow and speckled dace (Carmichael et al 1993, Lopez and Meyer 2006). See the Ackre Lake analysis for additional details on Fish Creek and Ackre Lake (located at the headwaters of Fish Creek), and for species composition on the Black River and tributaries downstream of Fish Creek.

The Mexican spotted owl is in the vicinity of the stocking site.

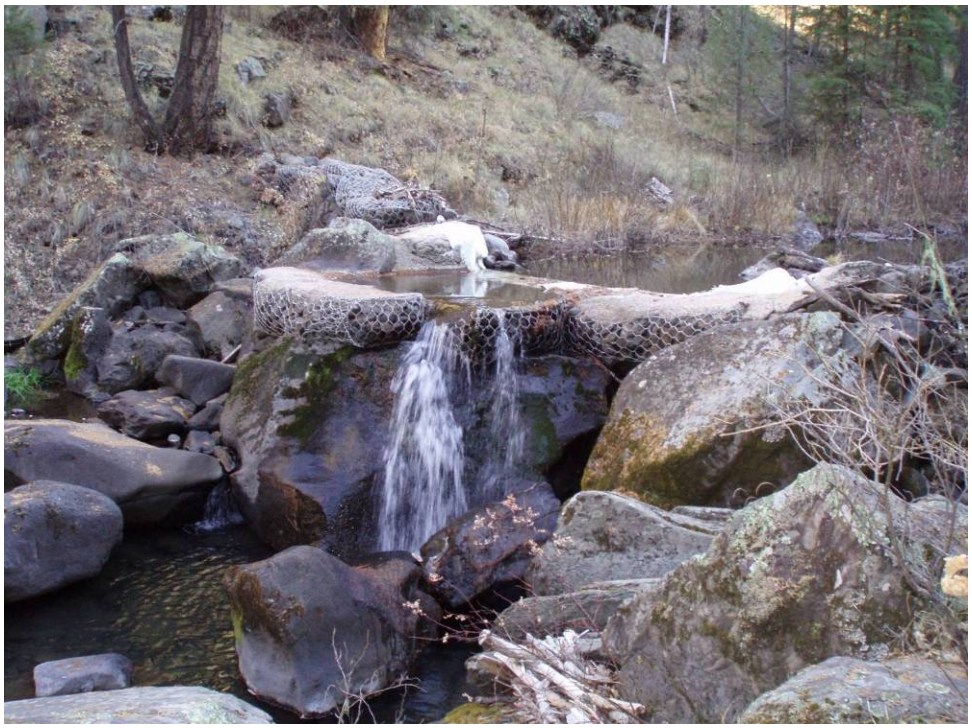

Figure 26. Fish Creek fish barrier.

Consultation Species or Critical Habitat
Potential impacts to Apache trout stocked in the East fork of the Black River, Chiricahua and northern leopard frogs and Mexican spotted owl are addressed below. Should stocked Apache or rainbow trout move upstream or downstream from the stocking reach, potential impacts to Apache trout, narrow-headed and northern Mexican garter snakes, loach minnow and critical habitat, roundtail chub and three forks springsnail downstream of Big Lake are addressed in the Black River Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Apache Trout
Hatchery Apache trout are stocked into the East Fork and the West Fork of the Black River to provide fishing opportunities. Recovery populations of Apache trout are also located in upper West Fork Black River, as well as in tributaries of the West Fork (Hayground Creek and Stinky Creek). Apache trout established in Home Creek, tributary to the West Fork, are considered to have perished when the stream dried entirely in 2002. Recovery populations of Apache trout are also located in tributaries of the Black River, including Fish Creek, Soldier Creek (tributary to Reservation Creek, which is tributary to Black River), Bear Wallow Creek, and Big Bonito Creek.

While at large in the East Fork, stocked Apache trout may compete with wild brown trout, and, if stocked, rainbow trout for food and space. However, Wang and White (1994) found that hatchery cutthroat trout had a significant competitive disadvantage in the presence of wild brown trout and Apache trout would also likely have the same disadvantage. Apache trout may be able to reproduce in the East Fork, however, likely do not persist long enough to spawn. Large brown trout may prey on stocked Apache trout as well as any Apache trout eggs or larval and juvenile. The presence of rainbow x Apache trout hybrids in the North Fork of East Fork of Black River is not necessarily proof that hatchery Apache trout have been spawning. These hybrids have been

documented in the North Fork prior to hatchery Apache trout being stocked in the East Fork or in Big Lake. Marsh (1997) documents hybrid rainbow-Apache trout in the North Fork in 1990, and Department surveys document hybrids existing decades ago. The Apache contribution to those hybrids was likely the original native population in the drainage, with non-native rainbow trout stocked on top of them. The pure hatchery Apache trout stocked since 1996 do not persist long in the stream (see Community Description in this section). The results documented by surveys in the East Fork that show stocked trout moving very little from the stocking location and persisting only short term, is consistent with other studies of stocked trout. Fay and Pardue (1986) showed that heavily domesticated trout do not last more than four to eight weeks in a stream environment. Apache trout might be expected to persist longer since they are from a wilder genetic stock (not domesticated as long as rainbow trout). Meyer (1995) found that stocked Apache trout did persist longer than domesticated rainbow trout as reported by Heimer et al (1985). Meyer (1995) found 34% of the Apache trout stocked persisted three months after stocking, but only 3% persisted nine months after stocking. The results from the current surveys in 2009 suggest that Apache trout are becoming more domesticated in the hatchery and their survival after stocking in stream habitat is similar to rainbow trout.

There are two sources for lack of persistence of stocked trout in a stream habitat, angler mortality and natural mortality. Angler mortality includes both harvest of the fish caught, plus hooking mortality of released trout. Hooking mortality is becoming more of a factor on streams in Arizona because a higher percent of anglers release trout even when the regulations do not require it. A recent angler creel survey in the East Fork Black River found more trout were released (7,000 trout) than were harvested (4,300 trout). Sources of natural mortality are predation by raccoons, brown trout, and blue herons, and osprey. Very large brown trout exist in the stocking area in the East Fork and likely feed on stocked trout.

Probably the biggest factor in natural mortality is starvation. Domesticated trout stocked into stream habitat are not acclimated to living in a natural stream environment, which can cause fish to expend more energy than they take in and starve to death. Elliot (1975) found that some hatchery trout never learned how to feed on natural items. In addition, it is known that drift feeding trout need to pick optimum sites to maximize growth and survival (Fausch 1984). Bachman (1984) postulated that the main cause of high mortality for stocked trout is energy inefficient behavior, including moving more frequently, not picking optimum feeding sites, and excessive dominance displays. Include the fact that they are stocked at relatively large sizes which increase metabolic costs and they feed less than wild trout (Bachman 1984). Wang and White (1994) found that hatchery cutthroat trout stocked into areas containing healthy populations of brown trout did not feed well and were at a significant competitive disadvantage. Hatchery trout stocked into streams that are devoid of wild trout or other top-of-the-food-chain predators likely persist longer because they do not face high levels of competition or risk of predation, however, the East Fork Black River contains a very healthy population of wild brown

trout, which is expanding. Many of the hatchery trout stocked each week in the East Fork are quickly caught out by anglers, some persist for short periods (weeks) and others succumb to natural mortality, thus are not in the system very long.

Trout stocked in Crescent Lake (rainbow trout, brook trout) and Big Lake (rainbow trout, cutthroat trout, brook trout; Apache trout) could affect stocked Apache trout in the East Fork if trout from the lakes were to escape during a spill event and move downstream into occupied habitats. This escapement is expected to be infrequent, since Big Lake (and Crescent Lake) have not spilled since the early 1990s. Without spilling, there is no way for stocked trout to escape these reservoirs. A survey of the tributary downstream from Big Lake conducted in June 1995 found one rainbow trout and 33 brown trout (Marsh 1997), but no trout were found during the 2000 survey (3-pass depletion), indicating that they are so uncommon that they were not detected, or do not persist in this tributary. The brown trout likely came upstream into the tributary from the North Fork where they are numerous; brown trout are not stocked into Big Lake or Crescent Lake. It is possible the one rainbow trout escaped from Big Lake or Crescent Lake during a spill event in the early 1990s, or could have also come up from the North Fork.

When the reservoirs do spill in the future, trout have the potential to move downstream towards Three Forks. Stocked rainbow, cutthroat, and brook trout may augment the existing nonnative fish community, but in extremely low numbers that do not persist. Fish surveys in 2000, 2001, 2007, and 2009 have found no hatchery trout in the North Fork, Boneyard Creek, or in the upper several miles of the East Fork, documenting only brown trout, rainbow-Apache hybrids, and brook trout during these surveys. The brown trout in this watershed are all wild, with the last brown trout stocked in the East Fork in 1981 (246 subcatchable brown trout were also stocked into the West Fork Black in 1994). The hybrid rainbow x Apache trout are wild and self sustaining in the North Fork, likely originating from historic Apache trout populations in the drainage and rainbow trout that were historically stocked into the North Fork as far back as 1936. Some trout escaping from Big Lake and Crescent Lake when they spill may also have reproduced with native Apache trout. Hybrids have been documented in the North Fork prior to hatchery Apache trout stocked into either Big Lake or in the East Fork Black River. Marsh (1997) also reported hybrid rainbow-Apache trout in the North Fork prior (1989) to stocking hatchery Apache trout in the East Fork (1996). One brook trout was collected in Boneyard Creek in 2009, which are known to be wild and self-sustaining in Boneyard Creek, likely originating from brook trout first stocked in the stream in 1933. Surveys in 2008 found 6 rainbow trout, 5 brook trout, 1 Apache trout, and 1 cutthroat trout, in addition to numerous brown trout, in the Three Forks area (Robinson et al 2008). Four of the rainbow trout were found in the North Fork and 2 in Boneyard Creek. It is not known if these rainbow trout were hatchery fish or wild rainbow-Apache hybrids since that level of identification was not used. It is likely they were wild hybrid trout because rainbow trout have not been stocked in the East Fork Black since 1996 and Big and Crescent lakes have not spilled since the early 1990s. The 5 brook trout were all

collected in Boneyard Creek, likely part of the self-sustaining population in that stream. The 1 cutthroat trout was likely a mis-identification of an Apache trout, since no other cutthroat trout have been documented from these streams, Big Lake where they are currently stocked has not spilled in over 15 years, and photos of fish obtained from the surveyors indicate that the fish was instead a hatchery Apache trout (Mike Lopez pers com). The 1 Apache trout collected in Boneyard Creek was also a hatchery Apache trout, most likely from the East Fork Black River stocking area. Hatchery Apache trout were also stocked into Big Lake from 1999 to 2003, however, that lake has not spilled since the early 1990s and there is no way for those stocked fish to have escaped.

Potential Impacts

Stocked Apache trout co-stocked with other species:

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts is found in Apache trout interactions section (Chapter 4).

Apache trout escapement from recovery areas and exposure to stocked sport fish:

If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas.

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish

move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

Chiricahua Leopard Frog

Local Analysis: East Fork Black River and the Black River buffered stocking complex are within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to fish stocked in East Fork Black River and in some of the other sites in the Black River buffered stocking complex is high. There are records for Chiricahua leopard frogs for East Fork Black River (Buffalo Crossing footbridge) (1974) and East Fork Black River (Three Forks) (2008). There are records for Chiricahua leopard frogs from 4 other sites within the complex: Concho Bill Spring (2009), Crabtree Creek (1988), Deer Creek (2001), and Lake Sierra Blanca (2008) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Subsequent surveys have found that Chiricahua leopard frogs occupy the area within the Black River buffered stocking complex and likely occupy an area of East Fork Black River. In addition, this area, including 3 of the sites mentioned above, is part of ongoing recovery activities for the Chiricahua leopard frog. Stocked fish may move up tributaries to other areas occupied by Chiricahua leopard frogs as well.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish from East Fork Black River or the Black River buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Northern Leopard Frog

Local Analysis: East Fork Black River and the Black River buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in East Fork Black River or other stocking sites within the complex is low. There is 1 historical record for northern leopard frogs from East Fork Black River (Three

Forks) from 1979 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs have not been observed at East Fork Black River (Three Forks) during several subsequent surveys or from other sites surveyed in the Black River buffered stocking complex. Due to the extensive surveying of this area and the lack of northern leopard frog observations, it is likely that northern leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish from the East Fork Black River or the Black River buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Mexican Spotted Owl

The stocking reach of stream is within Mexican spotted owl (MSO) critical habitat (CH), and occurs within a buffer, with a PAC bordering the stream. The topography in the canyon at times is steep potentially limiting angler access at certain locations. There are other established locations along the stocking reach for access.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around MSO PACs in the general vicinity of the site. No physical effects to MSO habitat in the PAC are anticipated, since anglers are not expected to be present in the PAC. There may be some disturbance to MSOs from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

West Fork Black River

Site Description

The West Fork of Black River is a tributary to the Black River, which starts at the confluence with the East Fork Black River, and drains the southeast slope of Mt. Baldy (Figure 3). Portions of the West Fork and tributaries are important recovery habitat for Apache trout. The West Fork is perennial from its headwaters on Mt. Baldy downstream to the East Fork confluence, and the Black River is perennial downstream to the confluence with the White River.

The stocking reach on the lower West Fork of the Black River is 1.4 miles long from the crossing at Forest Road 68 (Figure 27) and the end of Forest Road 68A (near the West Fork Campground, Figure 28). The West Fork is a perennial stream fed by springs, snowmelt, rainfall events, and groundwater contributions. The stocking reach is located entirely on the Apache-Sitgreaves National Forest, about 16 miles west of Alpine.

Figure 27. West Fork Black River stocking site at Forest Road 68 crossing.

Figure 28. West Fork Black River stocking reach in West Fork campground.

Management of Water Body

The current primary objective is to manage for put-and-take intensive use coldwater fishery utilizing Apache trout in the stocking reach near the West Fork campground. However, a large lower West Fork fish barrier is scheduled to be built downstream of the stocking site with an anticipated completion of construction planned 2011 and renovation 2012/2013 with stocking. At that point, the primary objective will be recovery of Apache trout with naturally reproducing fish throughout the entire stream and tributaries upstream of the new barrier. A secondary objective would be management of a put-and-take intensive use coldwater fishery with hatchery Apache trout at the stocking site only to meet angler demand in the campground area. This arrangement will discourage anglers in the campground from illegally stocking non-native salmonids to maintain a better fishery than what wild fish could provide. Rainbow trout were once stocked regularly; however, the stockings were changed to Apache trout in1997 when a recovery population of Apache trout was established above 2 constructed fish barriers upstream of the stocking site (Table 22).

Table 22. Stocking history for West Fork Black River

Species	First Year	Last Year	Num of years stocked	Number Stocked
Apache trout	1995	2009	14	125,644
Rainbow trout	1934	1996	62	904,872
Arctic grayling	1970	1970	1	5,100
Brook trout	1935	1937	3	50,400

Brown trout	1938	1994	56	76,395
Native trout	1938	1938	1	6,100
Total				1,168,511

The West Fork stocking sites are in the perennial reaches of the stream and are connected to other reaches by the water-to-water connection. The confluence with the east fork is 3.48 miles downstream of the lower boundary of the stocking reach in West Fork. The upper West Fork Black River is currently designated as an Apache trout recovery stream with 2 barriers on the upper portion near the Forest Road 116 (more than 13.5 miles upstream from the confluence with the East Fork; Figure 14 and Figure 15 in East Fork Fish Movement section) to protect the Apache trout populations from non-native fish that are found in the lower river, 8.2 miles upstream of the stocking reach. Barriers also exist on tributary streams with Apache trout populations, including Home Creek, Hayground Creek, and Stinky Creek (Figure 16, Figure 17 and Figure 18in East Fork Fish Movement section).

The large fish barrier planned to be built for the lower West Fork Black River and a chemical treatment would remove all non-natives from the upper barrier downstream to the new barrier. Nearly the whole river and tributaries would be managed for a pure self sustaining population of Apache trout, and other suitable native fishes, after these projects are completed. At that time, this stocking site would be located within the recovery population, but would be considered to be compatible with the recovery population. The strain of wild Apache trout in the upper West Fork Black River is of a hatchery origin (East Fork White River strain) and hatchery stockings of East Fork White River strain would be compatible.

Anglers can easily access the river all along Forest Road 68A and the crossing at Forest Road 68, typically from April through November. The area is inaccessible during the winter months. There is one Forest Service campground within the reach. Small portions of private lands are downstream of the stocking site with Forest Service lands below that reach to the confluence with the east fork. Nearly all the land upstream of the stocking site, except for one small piece of private property at Thompson Ranch, and the very headwaters on the Fort Apache Indian Reservation, are on Forest Service land.

Angler use data were collected by on-site angler creel surveys in 1982 (7,325 AUD), 1987 (8,373 AUD), 1993 (4,484 AUD), 1995 (4,794 AUD), and 1996 (2,957 AUD), and by mail out survey in 2001 (20,546 AUD) (Pringle 2004). Angler use in 1996 was depressed due to Forest closures in mid-summer that year.

Proposed action

The Department proposes to stock Apache trout in the West Fork Black River for the period covered by this consultation.

Catchable Apache trout would be stocked weekly from May through September; numbers of Apache trout stocked may be from 0 to 20,000 trout annually.

Water Distribution / Connectivity

The headwaters of the West Fork of the Black River begin on Mt. Baldy on the Fort Apache Indian Reservation from seeps and springs. From the headwaters, the West Fork flows perennial for 20 miles to its confluence with the East Fork of the Black River, where the mainstem Black River is formed. The Black flows perennial to the White River, where the Salt River is formed.

Thompson Creek is a perennial tributary that enters the upper West Fork in the Thompson Ranch/meadow. Thompson Creek also originates on the reservation and flows onto the National Forest. Thompson Creek enters the West Fork approximately 1.1 miles downstream of the Reservation Boundary. Another tributary, Burro Creek, enters the West Fork (from the northeast) also in the Thompson Ranch/meadow, approximately 0.8 miles downstream of the Thompson Creek confluence. The two constructed fish barriers on the West Fork are located 0.9 and 1.2 miles downstream of the Burro Creek confluence (Figure 14 and Figure 15 in East Fork Fish Movement section).

Another perennial tributary, Stinky Creek, enters the West Fork approximately 1.9 miles downstream of the lower fish barrier on the West Fork. The next perennial tributary, Hayground Creek, enters the West Fork approximately 5.0 miles downstream of Stinky Creek.

The upper end of the stocking reach is 1.3 miles downstream of the Hayground Creek confluence. The stream flows through the West Fork campground, the main location for this stocking site for 1.4 miles to the bottom end of the stocking site. From the bottom of the stocking site, the West Fork flows for 3.8 miles to the confluence with the East Fork.

Tributary Home Creek enters the West Fork approximately 1.4 miles upstream of the confluence with the East Fork. Home Creek is frequently mostly dry, but does contain continuous flows during good precipitation years.

See the East Fork Black River analysis for water distribution/connectivity in the Black River and other downstream tributaries.

Fish Movement

Stocked trout could move upstream for 8.2 miles, but then could not get past one of 2 constructed fish barriers to protect Apache trout habitat from non-native brown trout in the lower reaches. A dispersing trout could also swim up into perennial tributaries Hayground Creek and Stinky Creek, but likely only during high flows because of the very low flows coming in from these tributaries. Even during high flows, a dispersing trout could not get past constructed fish barriers in the lower reach of each of these streams.

A dispersing trout could move downstream towards the confluence with the East Fork, from that point, upstream into the East Fork of the Black River and downstream into the Black River. It could move into tributary Home Creek, but only during high flows because the confluence is often dry or running extremely low water. During high flow events, a dispersing trout could not get past 1 of 2 constructed fish barriers located in the lower reach of Home Creek.

For movement up into the East Fork or downstream into the Black River, refer to the East Fork Black River analysis.

Community Description

The stocking site on the West Fork currently contains brown trout, stocked Apache trout, desert sucker, Sonora sucker, speckled dace and crayfish (Table 23). These same species are found upstream to the fish barriers approximately 8.2 miles upstream of the stocking location. One roundtail chub was found in the West Fork downstream of the stocking. A recovery population of Apache trout, plus speckled dace and desert sucker are present upstream of the fish barriers in upper West Fork Black River. In 1989, most rainbow trout stocked were found within the stocking reach, with only two trout found downstream at station 1-3. In 2002, stocked Apache trout were found within the stocked reach; with one found a short distance downstream at station 2-6. Numerous Apache trout found upstream of the stocking location were likely wild fish coming downstream from recovery populations in Hayground Creek (confluence between stations 4-28 and 4-30), in Stinky Creek (confluence between stations 6-41 and 6-43), and upper West Fork Black River (fish barrier between stations 6-50 and 7-51).

Table 23. Species and number of fish collected in West Fork Black River fish surveys in 1988 and 2002.

The stocking reach encompasses survey stations 2-13 through 3-21. The 1989 surveys consisted of 50-meter sites spaced regularly throughout the stream, then electrofished with 3 depletion passes (Novy and Lopez 1991c). The 2002 surveys replicated the same sites and methods. Surveys during both 1989 and 2002 occurred during the summer stocking season.

Station	Species	Number Collected	
		1989	2002
1-1	Speckled dace	83	82
	Desert sucker	79	25
	Sonora Sucker	32	4
	Roundtail chub	-	1
	Brown trout	7	2
1-3	Speckled dace	312	91
	Desert Sucker	132	4
	Sonora Sucker	5	-

Station	Species	Number Collected	
		1989	2002
	Brown trout	12	6
	Rainbow trout	2	-
1-5	Speckled dace	409	124
	Desert Sucker	146	14
	Sonora Sucker	4	-
	Brown trout	5	-
2-6	Speckled dace	321	83
	Desert Sucker	134	42
	Sonora Sucker	10	4
	Brown trout	18	3
	Apache trout	-	1
2-8	Speckled dace	Not surveyed	84
	Desert Sucker	-	6
	Brown trout	-	6
2-10	Speckled dace	Not surveyed	229
	Desert Sucker	-	9
	Sonora Sucker	-	4
	Brown trout	-	37
2-11	Speckled dace	278	205
	Desert Sucker	36	16
	Brown trout	6	18
2-13	Speckled dace	80	142
	Desert Sucker	25	17
	Sonora Sucker	12	3
	Brown trout	56	23
	Rainbow trout	6	-
2-15	Speckled dace	223	208
	Desert Sucker	15	11
	Brown trout	53	50
	Apache trout	-	1
3-16	Speckled dace	372	100
	Desert Sucker	13	5
	Sonora Sucker	1	-
	Brown trout	59	22
	Apache trout	-	21

Station	Species	Number Collected	
		1989	2002
	Rainbow trout	52	-
3-18	Speckled dace	91	86
	Desert Sucker	9	8
	Sonora Sucker	2	1
	Brown trout	55	43
	Apache trout	-	42
	Rainbow trout	29	-
3-20	Speckled dace	271	371
	Desert Sucker	3	-
	Brown trout	34	48
	Apache trout	-	14
	Rainbow trout	21	-
3-21	Speckled dace	154	114
	Desert Sucker	4	18
	Brown trout	47	30
	Apache trout	-	16
	Rainbow trout	2	-
3-23	Speckled dace	91	62
	Desert Sucker	16	1
	Brown trout	36	28
	Apache trout	-	3
	Rainbow trout	2	-
3-25	Speckled dace	293	142
	Desert Sucker	3	2
	Brown trout	53	47
	Apache trout	-	3
4-26	Speckled dace	186	198
	Desert Sucker	-	3
	Brown trout	92	22
4-28	Speckled dace	26	47
	Desert Sucker	2	4
	Sonora Sucker	1	-
	Brown trout	77	39
	Apache trout	-	4
4-30	Speckled dace	32	29

Station	Species	Number Collected	
		1989	2002
	Desert Sucker	-	4
	Brown trout	26	34
5-31	Speckled dace	5	22
	Desert Sucker	-	7
	Brown trout	30	19
5-33	Speckled dace	1	18
	Desert Sucker	12	5
	Brown trout	28	44
5-35	Desert Sucker	3	9
	Sonora Sucker	-	1
	Brown trout	27	38
5-36	Desert Sucker	4	2
	Brown trout	15	31
	Apache trout	-	3
5-38	Speckled dace	-	52
	Desert Sucker	-	2
	Brown trout	46	15
	Apache trout	-	1
6-41	Speckled dace	24	52
	Desert Sucker	2	2
	Brown trout	44	15
	Apache trout	-	1
6-43	Speckled dace	8	25
	Desert Sucker	19	12
	Brown trout	58	38
6-45	Desert Sucker	7	-
	Brown trout	51	34
	Apache trout	-	5
6-46	Speckled dace	-	1
	Brown trout	-	33
6-48	Speckled dace	3	1
	Desert Sucker	1	4
	Brown trout	78	18
	Apache trout	-	7
6-50	Speckled dace	-	61

Station	Species	Number Collected	
		1989	2002
	Brown trout	29	-
	Apache trout	-	16
7-51	Speckled dace	Not surveyed	65
	Apache trout	-	8
7-53	Speckled dace	79	1008
	Desert Sucker	2	8
	Brown trout	12	-
	Apache trout	-	8
7-55	Speckled dace	26	390
	Desert Sucker	-	5
	Brown trout	18	-
	Apache trout	-	7
7-56	Speckled dace	23	234
	Brown trout	26	-
	Apache trout	-	14
7-58	Speckled dace	-	85
	Brown trout	45	-
	Apache trout	-	14
7-60	Speckled dace	-	2
	Brown trout	64	-
	Apache trout	-	13
8-61	Brown trout	56	-
	Apache trout	-	37
8-63	Desert Sucker	-	3
	Brown trout	51	-
	Apache trout	-	38
8-65	Brown trout	60	-
	Apache trout	-	58
8-66	Brown trout	56	-
	Apache trout	-	37
8-68	Desert Sucker	-	1
	Brown trout	69	-
	Apache trout	-	69
8-70	Brown trout	44	-
	Apache trout	-	26

Tributary Home Creek is managed for a recovery population of Apache trout; however, an extremely dry year in 2002 may have dried the stream entirely. Surveys of the stream conditions were conducted by Novy and Lopez (1991), and more recently by the Department in 2003 (no were fish collected).

Tributary Hayground Creek is also managed for a recovery population of Apache trout. Original surveys were conducted in 1988 (Novy and Lopez 1991); however, the stream was chemically treated in 1988 to remove non-native trout and was restocked with pure Apache trout. Since then, brown trout had navigated around the ineffective barrier to reinvade the stream. The barrier has been improved in the past but needs additional improvements, and brown trout are present above the barrier. Once the lower West Fork barrier is completed, Hayground creek would be renovated to remove non-natives.

Tributary Stinky Creek is also managed for a recovery population of Apache trout. Original surveys were conducted in 1989 (Novy and Lopez 1991); however, the stream was chemically treated in 1995 to remove non-native trout and was restocked with pure Apache trout. Since then, brown trout had navigated around the ineffective barrier to reinvade the stream. The barrier was improved in 2009; however brown trout are still present above the barrier, a future renovation is anticipated to remove non-natives.

Brook trout have recently been located in the very headwaters of the Black River and Thompson Creek, both on the reservation, and plans are being made to remove those non-native fish. For species downstream of the stocking reach in the Black River, see the aquatic species assemblage information for the East Fork Black River.

Loach minnow have never been documented in the West Fork, but are found upstream on the East Fork Black River, with critical habitat designated in the East Fork down to the confluence with the West Fork.

There are historical and recent records of narrow-headed garter snakes upstream and downstream of the West Fork Black River stocking reach (see Black River complex analysis for details). The entire Black River stocking complex is out of the distributional range of northern Mexican garter snakes (see Black River complex analysis for details).

New Mexico meadow jumping mouse and Mexican spotted owl are in the vicinity of the stocking site.

Consultation Species or Critical Habitat

Potential impacts to Apache trout stocked in the West Fork of the Black River, Chiricahua and northern leopard frogs, Mexican spotted owl and New Mexico meadow jumping mouse are addressed below. Should stocked Apache move upstream or downstream from the stocking

reach, potential impacts to Apache trout, narrow-headed and northern Mexican garter snakes, loach minnow and critical habitat, roundtail chub and three forks springsnail downstream of Big Lake are addressed in the Black River Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Apache Trout

Hatchery Apache trout are stocked into the West Fork and the East Fork of the Black River to provide fishing opportunities. Recovery populations of Apache trout are also located in upper West Fork Black River, as well as in tributaries of the West Fork (Hayground Creek and Stinky Creek). Apache trout established in Home Creek, tributary to the West Fork, are considered to have perished when the stream dried entirely in 2002. Recovery populations of Apache trout are also located in tributaries of the Black River, including Fish Creek, Soldier Creek (tributary to Reservation Creek, which is tributary to Black River), Bear Wallow Creek, and Big Bonito Creek.

Potential Impacts

Apache trout escapement from recovery areas and exposure to stocked sport fish:

If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas,

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition. While at large in the West Fork, stocked Apache trout compete with brown trout for food and space. Large brown trout may prey on stocked Apache trout as well as any Apache trout eggs or larval and juvenile fish since Apache trout can reproduce in the West Fork or it would not be under consideration as a recovery stream. Angling and natural mortality eventually claim the stocked trout.

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked Apache trout move above the failed barrier they would be considered part of the recovery Apache trout.

Chiricahua leopard frog

Local Analysis: West Fork Black River and the Black River buffered stocking complex are within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to fish stocked in West Fork Black River is high. There are no historical records for Chiricahua leopard frogs for West Fork Black River. There are historical records for Chiricahua leopard frogs from 6 sites within the complex: Crabtree Creek (1988), Deer Creek (2001), East Fork Black River (Buffalo Crossing footbridge) (1974), East Fork Black River (Three Forks) (2008), Concho Bill Spring (2009), and Lake Sierra Blanca (2008) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Subsequent surveys have found that Chiricahua leopard frogs occupy the area within the Black River buffered stocking complex. In addition, this area, including 3 of the sites mentioned above, is part of ongoing recovery activities for the Chiricahua leopard frog. Stocked fish may move up tributaries to areas occupied by Chiricahua leopard frogs.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish from West Fork Black River or the Black River buffered stocking

complex is low. There are no historical records for Chiricahua leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Northern Leopard Frog

Local Analysis: West Fork Black River and the Black River buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in West Fork Black River or other stocking sites within the complex is low. There is 1 historical record for northern leopard frogs with the buffered stocking complex; East Fork Black River (Three Forks) from 1979 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs have not been observed at East Fork Black River (Three Forks) during several subsequent surveys or from other sites surveyed in the Black River buffered stocking complex. Due to the extensive surveying of this area and the lack of northern leopard frog observations, it is likely that northern leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish from the West Fork Black River or the Black River buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Mexican Spotted Owl

The stream reach proposed for stocking is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

New Mexico Meadow Jumping Mouse

New Mexico meadow jumping mice are found along the West Fork near the FR 68 crossing (Frey 2008). The population is within and beyond the stocking area and use by anglers is likely; occurrences at were documented within the stocked reach in 2008 (HDMS data).

Potential Impacts

New Mexico meadow jumping mice use moist, riparian areas adjacent to streams or lakes that support communities of beaked sedge and reed canarygrass (USFWS 2007). Nests are in dry soil areas adjacent to the riparian areas. The mouse is generally nocturnal and it is only active during the growing season of the grasses and forbs it feeds on. Recreationists, including anglers, may create trails through the sedge and canarygrass community to access the stream, thus fragmenting the habitat and possibly allowing better access to the habitat by predators. Since the mice are active at night when recreationists are not present, there is little to no actual disturbance of the mice from presence of people.

Human access to mouse habitat results in trampling of vegetation, fragmentation of habitat patches, and soil compaction that degrades or eliminates habitat for the mouse. Since the mouse has a limited active period, quality habitat for foraging must be available for the mouse to get sufficient food to rear young and survive hibernation (USFWS 2007). There is also an increased risk of predation if the mice must cross trails or other openings to reach habitat patches.

Effects to New Mexico meadow jumping mouse habitat are likely occurring on the West Fork, due to angler use that may be affecting habitat quality. These effects are ongoing and other recreation use contributes to the current conditions. The likelihood or extent of disturbance effects is currently unknown at this site.

<u>Ackre Lake</u>

Site Description

Fish Creek is a tributary to the Black River located 9.9 miles below the confluence of the East Fork and West Fork of the Black River. The Fish Creek drainage area includes two important tributaries, Double Cienega Creek and Corduroy Creek. These three streams are recovery streams for the Apache trout, with a constructed fish barrier located near the confluence of Fish Creek and the Black River. The headwaters of Fish Creek contain Ackre Lake, approximately 12.1 miles upstream from the Black River (Figure 2 in Black River Complex section above).

Ackre Lake is a 2-acre impoundment at approximately 8,600 feet elevation at the head of Fish Creek. It is located on the Apache-Sitgreaves National Forest, approximately 21 miles southwest of Alpine. The lake is fed from a small watershed with snowmelt, rainfall events and groundwater contributions. Nothing is known about the age of the dam. Ackre Lake flows into Fish Creek, which enters the Black River downstream of all other 4 waters in the Black River complex (Figure 29).

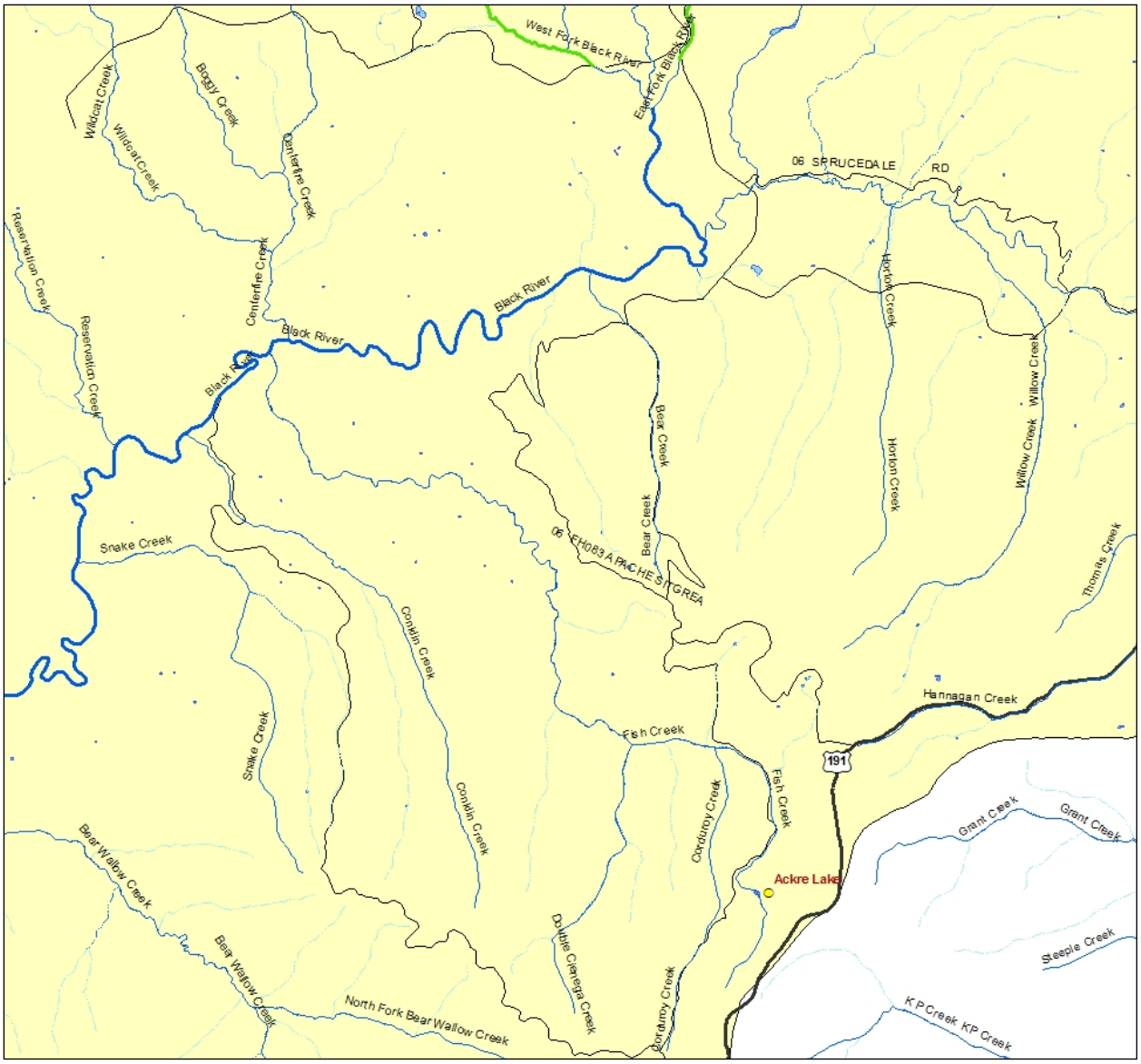

Figure 29. Map of Ackre Lake at the head waters of Fish Creek.

Management of Water Body

The primary fishery is cold water featured species, with Apache trout and Arctic grayling. The choice of these species was to assure the stocked species would be compatible with the wild recovery population of Apache trout downstream in Fish Creek (Table 24). The fishery is lightly used during the summer and fall, with no winter use. Prone to freezing during the winter, Ackre Lake winterkills regularly, requiring occasional restocking to maintain fish. The lake would be stocked up to several times per year with small numbers and fish will be maintained through the fishing season by catch-and-release regulations already in place on the lake.

Table 24. Stocking history for Ackre Lake.

Species	First Year	Last Year	Num of years stocked	Number Stocked
Apache trout	1997	2009	5	2,300
Arctic grayling	1987	2000	9	4,313
Brook trout	1976	1985	8	19,500
Total				25,213

Ackre Lake is accessed by an all-weather dirt road from May through November. There is a parking lot and primitive camping is allowed. Anglers have access to the entire shoreline of Ackre Lake. Boats are typically not used because of the small size of the lake. There are no boat ramps or restrooms. The lake is typically accessible from May through November. There have been no on-site angler creel surveys conducted on Ackre Lake, and anglers that were surveyed in the 2001 Statewide Survey of Arizona Anglers did not identify Ackre Lake as a location at which that they fished at that year (Pringle 2004). Ackre Lake likely receives no to very little ice fishing use because of the remote location, small size, and special regulations.

Fish Creek, along with tributaries Corduroy Creek and Double Cienega Creek, are being managed as a recovery population of Apache trout. A constructed fish barrier is located on the lower end of Fish Creek just above the confluence of the Black River to prevent non-native trout in the Black River from entering Apache trout habitat (Figure 20 in East Fork of the Black section). The stream was chemically treated several times in 2004 and 2005 to remove all non-native trout above the fish barrier prior to establishing a recovery population of Apache trout (Lopez and Meyer 2006). Ackre Lake was chemically treated at the same time to remove non-natives that might be in the lake, since it is directly connected to recovery habitat above the fish barrier.

Ackre Lake has catch and release fishing regulations with artificial lure and fly only gear requirements to maintain fish in the lake for anglers. Ackre Lake is a very long distance from the closest hatchery and it is not economical to stock it frequently. The lake is very small and would be fished out quickly if harvest were allowed. Stocking hatchery Apache trout and Arctic grayling are considered to be compatible with the recovery population of Apache trout downstream of the lake because arctic grayling are rarely picivorous, are short lived in Arizona and there is no chance of hybridization (J. Voeltz pers com; J. Carter pers com).

Anglers currently should not be fishing below the lake. Fish Creek is closed to fishing until the recently established recovery population of Apache trout can expand to meet established population criteria before opening the stream to angling.

Proposed action

The Department proposes to stock Apache trout and Arctic grayling into Ackre Lake for the period covered by this consultation.

Catchable Apache trout and catchable and sub-catchable Arctic grayling would be stocked several times per year; numbers of Apache trout stocked may be from 0 to 750 fish annually and numbers of Arctic grayling stocked may be from 0 to 750 fish annually.

Water Distribution / Connectivity

The lake is fed by a very short stream that dries during drought years. The lake is perennial and maintains a fairly consistent water level. The lake is shallow and subject to winterkills and occasional summer kills. There is no outlet structure on the dam and no water is released downstream for any uses. When the lake fills, it spills over a small spillway and into Fish Creek below the lake (Figure 30 and Figure 31). The lake spills regularly in the spring, but usually does not spill during the summer.

Below Ackre Lake on Fish Creek, the channel is intermittent or ephemeral for approximately 1 mile downstream, at which point the channel becomes perennial. Fish Creek is perennial for about 11 miles downstream to the Black River, with a fish barrier located just upstream from the confluence. Tributary Corduroy Creek enters Fish Creek approximately 2.6 miles downstream of Ackre Lake. Tributary Double Cienega Creek enters Fish Creek approximately 3.6 miles downstream of Ackre Lake. These tributaries are perennial, but usually have low flow and some dry portions in drought years.

Fish Creek enters the Black River 9.6 miles downstream of the confluence of the West Fork and the East Fork. From the Fish Creek confluence, the Black River runs for 104 miles to the confluence with the White River, where the Salt River is formed. The Black River is entirely perennial.

Tributaries entering the Black River downstream of Fish Creek include: Conklin Creek (2.0 miles downstream of Fish Creek confluence), Reservation Creek (3.2 miles downstream of Fish Creek confluence), Snake Creek (5.3 miles), then on the reservations, Paddy Creek, Bear Wallow Creek, and Big Bonito Creek.

For water distribution and connectivity in the Black River upstream of the Fish Creek confluence, refer to the East Fork and West Fork Black River sections.

Figure 30. Ackre Lake showing dam in foreground and small spillway area on left of dam.

Figure 31. Ackre Lake spillway in lower left corner.

Fish Movement
Stocked fish in Ackre Lake may persist; however, the lake is small and weedy and is subject to frequent winterkills and occasional summer kills. Fish may move upstream into the short feeder stream, but cannot go far since it is very short and fish will not persist, since it dries up frequently.

Stocked fish may move downstream of Ackre Lake by going over the spillway when the lake spills in the spring. When the lake is spilling, the upper portion of Fish Creek has continuous flow and fish potentially have access to all of Fish Creek, the tributaries, and even into the Black River.

Once in the Black River, dispersing fish can potentially move up to the East Fork Black River or West Fork Black River. In the West Fork Black River, fish can potentially move up through the West Fork stocking site, upstream, through the stocking reach and continue until reaching a constructed fish barrier in upper West Fork, or into several tributaries along the way (Home Creek, Hayground Creek, and Stinky Creek) only as far as constructed fish barriers on each of these streams. For more details of water distribution and fish movement in the West Fork, see the West Fork Black River analysis. In the East Fork, fish can potentially move up through the East Fork stocking site, into upper East Fork, Boneyard Creek, and the North Fork. For more details of water distribution and fish movement in the East Fork and above that, see the East Fork Black River analysis.

Community Description
Ackre Lake currently contains stocked Apache trout, possibly stocked Arctic grayling, and tiger salamander. Apache trout and speckled dace are present in Fish Creek, Corduroy Creek and Double Cienega Creek downstream of the lake. Since several chemical treatments in 2004 and 2005 of the creek and lake, these are the only fish that have been restocked (Lopez and Meyer 2006; Lopez et al 2007; Lopez 2008). A fish barrier is present on the lower reaches of Fish Creek to prevent movement of non-native species upstream but does not prevent Apache trout or Arctic grayling from leaving the creek and entering the Black River. Brown trout and hybrid trout also occur downstream of the fish barrier. Ackre Lake has not been surveyed since the entire drainage was chemically treated 3 times in 2004 and 2005 to remove non-native brown trout, hybrid trout and fathead minnow. Visual surveys have been conducted on the establishing Apache trout in Fish Creek and electrofishing surveys have been conducted in Fish Creek just above the fish barrier to ensure it is functioning (keeping non-native trout from coming upstream). During the electrofishing surveys in 2007, 2008, and 2009, no fish have been found immediately above the barrier (Lopez 2008; Terrill, in preparation). The wild Apache trout were stocked into Fish Creek in the upper reaches and are not expected to disperse into the lower reaches for several years. Pure Apache trout and speckled dace were restocked into Fish Creek and tributaries, while hatchery Apache trout and Arctic grayling have been stocked into Ackre Lake.

The Black River contains speckled dace, desert sucker, Sonora sucker, roundtail chub, fathead minnow, brown trout, rainbow X apache trout hybrids and smallmouth bass (McKell 2005a and Table 25). Voeltz (2007) also documented brown trout, roundtail chub, smallmouth bass, desert sucker, Sonora sucker, and speckled dace in the Black River at Wildcat Crossing. A recent survey in the Black River in 2009 also documented the same species (M. Lopez, pers. comm.). Roundtail chub in the Black River have been collected upstream and downstream of the Fish Creek confluence (McKell 2005a; Voeltz 2007), and are assumed to be at or very near the confluence.

Table 25. Species, capture method and number of fish collected in the 2005 Black River survey (McKell 2005a).

Species	Number Collected	
	Hoop nets	Electroshocking
Sonora sucker	2	13
Roundtail chub	199	98
Desert sucker	1	33
Speckled dace	25	428
Smallmouth bass	-	6
Hybrid trout	-	14
Brown trout	-	23
Fathead minnow	-	1
Unidentified sucker	-	6

Black River tributary Conklin Creek is currently fishless. The stream was chemically treated several times in 2006 to remove non-native trout (Lopez et al 2007). Improvements were made to the barrier and electrofishing surveys have removed the occasional hybrid trout that accessed the stream prior to improvements to the barrier (Terril, in preparation). Early surveys of the fish community and aquatic habitat in Conklin Creek were described by Novy and Lopez (1991).

Black River tributary Reservation Creek contains brown trout, rainbow trout, speckled dace, desert sucker, and Sonora sucker in the lower reaches on the Apache-Sitgreaves National Forest (Novy and Lopez 1991 and Table 26). Reservation Lake is located on Reservation Creek on the Fort Apache Indian Reservation; this lake is stocked with rainbow trout, brown trout, and brook trout.

Table 26. Species, number and size range of fish collected in a survey of lower Reservation Creek in 1989.

Species Collected	Number Collected	Size Range (mm TL)
Brown trout	561	66-449
Rainbow trout	37	61-265
Speckled dace	143	19-130
Desert sucker	46	116-386
Sonora sucker	5	342-479

Soldier Creek is a tributary to Reservation Creek and holds one of the 13 relict Apache trout populations (USFWS 1983; Figure 23– in East Fork section). It has a natural waterfall at the lower end, and contains only Apache trout above the falls. The stream was comprehensively surveyed in 1989 (Novy and Lopez 1991 and Table 27), finding Apache trout and brown trout, with the brown trout located below the waterfall. The stream has been surveyed numerous times since then, documenting Apache trout above the falls. This stream has been used to provide wild Apache trout to establish Apache trout populations in other streams on the Apache-Sitgreaves National Forest (Lopez and Meyer 2006; Lopez et al 2007; Lopez 2008).

Table 27. Species, number and size range of fish collected in a survey of Soldier Creek in 1989.

Brown trout were found only below the waterfall which serves as a barrier to upstream fish movement.

Species Collected	Number Collected	Size Range (mm TL)
Apache trout	185	39-210
Brown trout	13	73-275

Snake Creek is tributary to the Black River, and currently contains rainbow x Apache hybrid trout and brown trout (Lopez 2008).

Bear Wallow Creek is tributary to the Black River and currently contains Apache trout, rainbow x Apache hybrid trout, and speckled dace.

There are no records of narrow-headed garter snakes from Ackre Lake, and the habitat is unsuitable. There is a record for a narrow-headed garter snake on Fish Creek, downstream of Ackre Lake (see complex analysis for details). The entire Black River stocking complex is out of the distributional range of northern Mexican garter snakes (refer to complex analysis for details).

Mexican spotted owl critical habitat is present in the vicinity of the lake.

Consultation species or Critical Habitat
Potential impacts to Apache trout stocked in Ackre Lake, recovery Apache trout in Fish Creek, Chiricahua and northern leopard frogs and Mexican spotted owl are addressed below. Should stocked Apache move out of Ackre Lake downstream through Fish Creek and enter the Black River, potential impacts to three forks springsnail, northern Mexican and narrow headed garter snakes, loach minnow and critical habitat, recovery Apache trout, and roundtail chub are addressed in the Black River Complex Analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Apache Trout
Fish Creek below Ackre Lake is an Apache trout recovery stream. See the East Fork and West Fork sections for an overview of Apache trout distribution in the Black River.

Potential Impacts

Stocked Apache trout co-stocked with other species:

Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts is found in Apache trout interactions section (Chapter 4).

Stocked sport fishes moving above failed barriers or moving into recovery reaches:

Impacts to recovery Apache trout are not expected occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and Department would attempt to repair the barrier and if necessary retreat the reach to remove non-native fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

There are three stocking sites that are not separated by a barrier from a recovery Apache trout reach; they are: 1) Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River whereby Apache trout stocked into Lee Valley Lake, upstream of the recovery reach, could escape and move into the recovery population. Apache trout are also stocked directly into the recovery population at Sheeps Crossing (see #4 below), 2) a recovery population in the South Fork of the Little Colorado River. This recovery reach is located above a barrier; however, Mexican Hay Lake is located upstream of both the barrier and recovery reach. Apache trout stocked into Mexican Hay Lake may escape and reach the recovery population downstream, and 3) Ackre Lake, located in the headwaters of Fish Creek Fish Creek is a recovery stream, and Apache trout or Arctic grayling may escape Ackre lake and enter the recovery population downstream in Fish Creek. If stocked Apache trout move into Fish Creek, they would either perish, since hatchery trout usually do not persist well in stream environments (Elliot 1975; Bachman 1984; Fay and Pardue 1986; Heimer et al 1985; Meyer 1995) or assimilate into the recovery population. If Apache trout emigrate out of Fish Creek and enter the Black River, they would compete with brown trout for food and space and all size classes would also be at risk of predation by smallmouth bass and large brown trout. Angling and natural mortality eventually claim the stocked trout.

Impacts from wild populations on stocked Apache trout:

The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted.

Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition. Arctic grayling are not piscivorous and would

not be expected to prey on the wild populations of Apache trout in Fish Creek. They may compete with the Apache trout for food and space while in Fish Creek, however, survey data indicates grayling do not persist long in the stream, are not know to reproduce in the stream as evidenced by lack of smaller size classes, and will not hybridize with Apache trout. The number of grayling that may reach Fish Creek is low and the extent of competition limited. Only two Arctic grayling have been documented in Fish Creek, one during an electrofishing survey in the late 1980s and one during a recent visual survey (J. Carter, pers. comm.), both found in the upper portion of Fish Creek, not far from the lake. However, grayling have not been found to persist, and numerous surveys in Fish Creek have failed to find Arctic grayling (Lopez 2008; Terrill, in preparation). Grayling were first stocked in Ackre Lake in 1987 and several chemical treatments in 2004 and 2005 resulted in essentially a total fish collection effort in Fish Creek and no grayling were found. No grayling have ever been documented in the Black River, East Fork Black River or West Fork Black River.

Chiricahua Leopard Frog

Local Analysis: Ackre Lake and the Black River buffered stocking complex are within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to fish stocked in Ackre Lake is moderate. However, the likelihood that frogs could be exposed to fish stocked in other stocking sites within the complex is high. There are no historical records for Chiricahua leopard frogs for Ackre Lake. There are historical records for Chiricahua leopard frogs from 6 sites within the complex; Crabtree Creek (1988), Deer Creek (2001), East Fork Black River (Buffalo Crossing footbridge) (1974), East Fork Black River (Three Forks) (2008), Concho Bill Spring (2009), and Lake Sierra Blanca (2008) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Subsequent surveys have found that Chiricahua leopard frogs occupy the area within the Black River buffered stocking complex. In addition, this area, including 3 of the sites mentioned above, is part of ongoing recovery activities for the Chiricahua leopard frog. Although it is only somewhat likely that stocked fish in Ackre Lake are able to disperse to occupied Chiricahua leopard frog sites, stocked fish at other sites within the complex may.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish from Ackre Lake or the Black River buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Northern Leopard Frog

Local Analysis: Ackre Lake and the Black River buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Ackre Lake or other stocking sites within the complex is low. There is 1 historical

record for northern leopard frogs with the buffered stocking complex; East Fork Black River (Three Forks) from 1979 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (Figure 8, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs have not been observed at East Fork Black River (Three Forks) during several subsequent surveys or from other sites surveyed in the Black River buffered stocking complex. Due to the extensive surveying of this area and the lack of northern leopard frog observations, it is likely that northern leopard frogs no longer occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish from Ackre Lake or the Black River buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Mexican Spotted Owl

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

BLACK RIVER COMPLEX ANALYSIS

Water Distribution / Connectivity

No water is released from Big Lake or Crescent Lake for irrigation or other downstream uses. When the lakes do spill (very infrequently), it will flow 4.5 miles down the intermittent (with some permanent isolated pools) unnamed tributary to the North Fork of the East Fork of the Black River. The spill from Crescent Lake, when it infrequently spills, enters the unnamed tributary approximately 0.1 mile downstream of the Big Lake dam. The North Fork, perennial

water flows downstream for 9.2 miles to Three Forks, where the North Fork, Boneyard Creek, and another unnamed tributary come together to form the East Fork of Black River. Approximately 3.8 miles of the North Fork upstream of the tributary from Big Lake is perennial. A small tributary with some permanent flow, Chambers Draw, also enters into the North Fork 0.4 mile downstream of the tributary from Big Lake.

From Three Forks, the East Fork of Black River flows perennial for 12.2 miles to the confluence with the West Fork of Black River, where they form the mainstem Black River. Several intermittent tributaries which contain some permanent water enter into the East Fork between Three Forks and the confluence, including Coyote Creek, Open Draw, and Deer Creek, 1.2 miles, 2.9 miles, and 7.2 miles downstream of Three Forks, respectively.

The West Fork Black River has several perennial tributaries entering and includes the West Fork Black River stocking reach.

The Black River flow is perennial for 113.7 miles to the confluence with the White River, where they form the Salt River. A number of perennial tributaries enter into the Black River, including Beaver Creek, Bear Creek, Centerfire Creek, Fish Creek, Conklin Creek, Reservation Creek, Snake Creek, Pacheta Creek, Bear Wallow Creek, Paddy Creek, and Big Bonito Creek. The Fish Creek tributary includes the Ackre Lake stocking site that is located 12.3 miles up from the confluence with the Black River.

All of the North Fork, East Fork, West Fork, Black River, and nearly all of Fish Creek are perennial and continuous flow year around. Big Lake and Crescent Lake are connected to these waters only when they spill, which has not occurred since the early 1990s.

Fish Movement

Trout stocked into Big Lake and Crescent Lake can only escape when these lakes spill, which has not occurred since the early 1990s. When they do spill, it is possible for these fish to escape downstream into the Big Lake tributary, the North Fork Black River, Boneyard Creek, the East Fork Black River, much of the West Fork Black River (up to the constructed fish barrier), and the Black River. Stocked trout in the East Fork Black River and West Fork Black River also have access to the same streams, since they are all connected.

Apache trout recovery streams in the watershed have constructed fish barriers that exclude movement of dispersing fish from Big Lake Crescent Lake, East Fork Black River, and West Fork Black River. These Apache trout streams include the upper West Fork Black River, Stinky Creek, Hayground Creek, Home Creek, Hannagan Creek (on tributary Beaver Creek), Centerfire Creek, Fish Creek, Soldier Creek (has a natural waterfall on this tributary to Reservation Creek), Conklin Creek, Snake Creek, Bear Wallow Creek, and Big Bonito Creek.

Fish stocked into Ackre Lake have access to all of Fish Creek above the constructed fish barrier, then also to all the same connection of streams as the other stocking sites once fish exit into the Black River.

Community Description
Refer to previous descriptions of the Big Lake, Crescent Lake, East Fork Black River, West Fork Black River and Ackre Lake sections.

Consultation Species and Critical Habitat
Potential impacts to stocked and recovery Apache trout, loach minnow and critical habitat in the East Fork, northern Mexican and narrow headed garter snakes, roundtail chub and three forks springsnail and are addressed below. Chiricahua and northern leopard frogs and Mexican spotted owl were described in the site consultation species analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican garter snakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Loach Minnow and Critical Habitat
Occupied loach minnow habitat occurs in the lower 0.9 miles of the North Fork of the East Fork Black River and upper 2.4 miles of the East Fork Black River, generally centered around Three Forks. The upper end of occupied habitat occurs about 12.8 miles downstream of Big Lake and 13.5 miles downstream of Crescent Lake. One loach minnow was also documented in the lower reach of Coyote Creek, a tributary to the East Fork 1.2 miles downstream of Three Forks. Loach minnow have not been documented in the West Fork Black River; the nearest occupied habitat is 13.5 from the West Fork stocking site (3.8 miles downstream in the West Fork and then 9.7 miles upstream in the East Fork of the Black River. Loach minnow have not been documented in Fish Creek or the Black River; the nearest occupied habitat is 31.7 miles from Ackre Lake, via Fish Creek, up the Black River, and up East Fork Black River.

Loach minnow critical habitat is designated in all 12.2 miles of the East Fork Black River from the confluence with the West Fork upstream through the Three Forks Area and upstream for 4.4 miles into the North Fork East Fork Black River. The lower 1.4 miles of lower Boneyard Creek, a tributary that comes in at Three Forks, is also designated critical habitat for loach minnow. The upstream end of critical habitat is about 9.3 miles downstream from Big Lake and 10.0 miles downstream of Crescent Lake. The stocking reach on the East Fork lies within designated critical habitat, but not in occupied critical habitat.

The status of the loach minnow population is unclear, since they are difficult to survey for, and the numbers captured in each effort have varied. Bagley et al (1997) reported all age classes were present in surveys from Three Forks to ¼ mile above Open Draw, establishing the population within at least 2.25 miles of river. Surveys conducted by AGFD in 2000 documented loach minnow in the North Fork approximately 0.9 miles upstream of Three Forks, expanding the upstream known range. One loach minnow was also collected in lower Coyote Creek (see Table 9). Marsh et al. (2003) reported loach minnow were found in the reach in every survey from 1997-2002. Numbers since 1996 have been low, with only three in 2004, one in 2005, and none in 2007 (Carter 2007), 2008 (Robinson et al 2008), and 2009 (Robinson et al 2009). It is possible that loach minnow no longer exist in the Three Forks area, but if they do, it is in extremely low densities to where they cannot be detected by intensive sampling. These extremely low densities were likely not caused by escaped stocked trout.

Potential Impacts

Stocking trout at Big Lake and Crescent Lake could affect loach minnow if trout from the lake were to escape during a spill event and move downstream into occupied habitats. This escapement is expected to be very infrequent, since both lakes have not spilled since the early 1990s. Without spilling, there is no way for stocked trout to escape these reservoirs. If the reservoirs spill in the next 10 years, stocked trout have the potential to move downstream towards Three Forks. Fish surveys in 2000, 2001, 2007, and 2009 have found no hatchery trout in the North Fork, Boneyard Creek, or in the upper several miles of the East Fork, documenting only brown trout, rainbow-Apache hybrids, and brook trout during these surveys. The brown trout in this watershed are all wild; with the last brown trout stocked in the East Fork in 1981 (246 subcatchable brown trout were also stocked into the West Fork Black in 1994).

The hybrid rainbow x Apache trout are wild and self sustaining in the North Fork, likely originating from historic Apache trout populations in the drainage and rainbow trout that were historically stocked into the North Fork as far back as 1936. Some trout escaping from Big Lake and Crescent Lake when they have spilled may also have reproduced with native Apache trout. Hybrids have been documented in the North Fork prior to hatchery Apache trout stocked into either Big Lake or in the East Fork Black River. Marsh (1997) also reported hybrid rainbow-Apache trout in the North Fork prior (1989) to stocking hatchery Apache trout in the East Fork

(1996). One brook trout was collected in Boneyard Creek in 2009, which are known to be wild and self-sustaining in Boneyard Creek, likely originating from brook trout first stocked in the stream in 1933. Surveys in 2008 found 6 rainbow trout, 5 brook trout, 1 Apache trout, in addition to numerous brown trout, in the Three Forks area (Robinson et al 2008). Four of the rainbow trout were found in the North Fork and 2 in Boneyard Creek. It is not known if these rainbow trout were hatchery fish or wild rainbow-Apache hybrids since that level of identification was not used. It is likely they were wild hybrid trout because rainbow trout have not been stocked in the East Fork Black since 1996 and Big and Crescent lakes has not spilled since the early 1990s. The 5 brook trout were all collected in Boneyard Creek, likely part of the self-sustaining population in that stream. The one cutthroat trout was likely a mis-identification, since no other cutthroat trout have been documented from these streams, since Big Lake where they are currently stocked has not spilled in over 15 years, and photos of fish obtained from the surveyors indicate that the fish was instead a hatchery Apache trout. The one Apache trout collected in Boneyard Creek was also a hatchery Apache trout, most likely from the East Fork Black River stocking area. Hatchery Apache trout were also stocked into Big Lake from 1999 to 2003, however, that lake has not spilled since the early 1990s and there is no way for those stocked fish to have escaped.

Cutthroat trout are not particularly piscivorous (Behnke 1992, Carlander 1969), nor is Apache trout (Behnke 2002, Clarkson and Dreyer 1996) although small fish may be eaten opportunistically. The fact that two species may have occurred in the same stream historically does not preclude the existence of competition between the two or predation by the native trout on the loach minnow. Brook trout are more piscivorous than rainbow trout. Rainbow trout have been documented feeding on loach minnow (Propst et al. 1998), and while in occupied habitat could prey on small loach minnow. However, Propst et al (1998) also reported that rainbow trout were primarily feeding on aquatic invertebrates, survival of stocked rainbow trout was low, and that stocked rainbow trout had low predation on native fishes. The rainbow trout in the Propst et al (1998) project were stocked immediately in the same habitat as loach minnow, thus would expect higher levels of predation because of high densities of loach minnow and stocked rainbow trout in the same habitat. There is no stocking proposed here in loach minnow occupied habitat, with stocking sites located 12.8 and 13.5 miles upstream (Big and Crescent lakes), and 2.2 miles downstream in the East Fork. Stocked trout would have to disperse to reach occupied habitat and thus would expect low numbers of stocked trout to get that far. The survey data shows a small number of stocked trout coming upstream from the East Fork Black River stocking site, but not persisting long. In addition, densities of loach minnow are extremely low (see below) and the probability of a very occasional stocked trout interacting with a loach minnow in this watershed is extremely low. The literature presents evidence that hatchery trout do not persist long in waters already occupied by wild trout. Elliot (1975) found that some hatchery trout never learned how to feed on natural items. In addition, it is known that drift feeding trout need to pick optimum sites to maximize growth and survival (Faush 1984). Bachman (1984) postulated that

the main cause of high mortality for stocked trout is energy inefficient behavior, including moving more frequently, not picking optimum feeding sites, and excessive dominance displays. Bachman (1984) also reported that stocked trout feed less than wild trout. Survey data in the East Fork Black in 1996 and 2009 show that stocked trout are not persisting long, even in the stocked reach.

While loach minnow are primarily considered to occupy turbulent, rocky, riffle habitats (USFWS 1991; Minckley 1973) and habitat overlap with trout may be minimal, loach minnow were found in relatively slow runs in the North Fork of the East Fork, and, in Pace Creek, in long pools (Marsh et al. 2003). These are areas where trout may encounter loach minnow.

There is some potential for stocked trout to impact loach minnow by predation since stocked trout do occasionally reach occupied habitat, although this potential may be further reduced by competition with wild resident trout. Montgomery and Bernstein (2008) and Raleigh (1984) state that rainbow trout are opportunistic feeders, feeding mainly on aquatic insects, but will also feed on zooplankton, terrestrial insects, and small fishes. However, Wang and White (1994) reported that wild brown trout were much more aggressive than hatchery stocked cutthroat trout, initiating 92% of the aggressive interactions, and thus concluding that stocked hatchery cutthroat trout were at a significant competitive disadvantage in the presence of wild brown trout. The occupied habitat for loach minnow in the North Fork, East Fork and potentially Boneyard Creek are dominated by wild brown trout. This also further explains the low persistence of stocked trout.

Competition for food may occur if dispersing trout reach occupied habitat. Montgomery and Bernstein (2008) and Raleigh (1984) state that rainbow trout are opportunistic feeders, feeding mainly on aquatic insects. USFWS (1991b) state that loach minnow are opportunistic, benthic insectivores, feeding primarily upon riffle-dwelling larval ephemeropterans, simuliid and chironomid dipterans, larvae of plecopterans, trichopterans, and occasionally pupae or emerging adults. USFWS also states that loach minnow are not known to swim in turbulent riffles other than for brief periods, instead actively seeking their food among bottom substrates, rather than pursuing animals entrained in the drift. Raleigh (1984) reports that terrestrial insects contribute significantly to a rainbow trout's diet during the summer months, thus potentially reducing the competition for food during this time. However, benthic fauna comprise nearly all of a rainbow trout's diet during the winter months. Thus, competition for food may occur year around, but is likely greater during winter months. Based on extensive surveys conducted in 1996 and 2009 (spring, summer, fall surveys) in which no hatchery Apache trout were shown to overwinter from the 2008 stocking, and the fall surveys indicate no persistence into the fall from the summer 2009 stocking season (Table 12;Table 13). Furthermore Apache trout are not even found to persist long into the fall, and do not do well in the presence of the strong population of brown trout.

Stocking rainbow trout and Apache trout in the East Fork may affect loach minnow in two ways. The first is when stocked trout move upstream into occupied habitats. The second is that the continual stocking into the reach augments the non-native fish population (if rainbow trout are approved) and reduces the opportunity for loach minnow to expand their population into the stocking reach. Robinson et al (2008) documented at least 1 hatchery Apache trout in Boneyard Creek, which likely came from the East Fork stocking location and swam through the Three Forks area. In the Black complex, hatchery Apache trout have been stocked for the purposes of providing angling recreation only in the East Fork Black, West Fork Black, Ackre Lake, and Big Lake. Big Lake has not spilled since Apache trout have been stocked there, thus they cannot have escaped. Trout stocked into the West Fork and Ackre Lake would have to come through the East Fork Black stocking site before reaching Three Forks and Boneyard Creek, thus the fish was more likely from the East Fork stocking.

Apache trout are not highly piscivorous (Behnke 2002, Clarkson and Dreyer 1996) although small fish may be eaten opportunistically. The fact that two species may have occurred in the same stream historically does not preclude the existence of competition between the two or predation by the native trout on the loach minnow. Stocked rainbow trout have been documented feeding on loach minnow (Propst et al. 1998), however, this was in an environment where the rainbow trout were stocked into an stream with very few resident trout. Hatchery trout stocked into a stream with a healthy population of wild brown trout are likely at a competitive disadvantage (Wang and White 1994), may never learn how to feed on natural items (Elliot 1975), or feed less than wild trout (Bachman 1984). Also, the rainbow trout in the Propst et al (1998) project were stocked immediately in the same habitat as loach minnow, thus one would expect higher levels of predation because of high densities of loach minnow and stocked rainbow trout in the same habitat. Apache and rainbow trout are not proposed to be stocked directly into occupied loach minnow habitat; rather the stocking site is located 2.2 miles downstream of the lowest documented loach minnow occurrence in the East Fork of the Black River. Stocked trout would have to disperse upstream to reach occupied habitat and only very low numbers of stocked trout are expected to move that far, or to not persist long if a trout did disperse. In addition, densities of loach minnow are extremely low and the probability of a very occasional stocked trout interacting with a loach minnow in this watershed is extremely low. See the discussion under the Apache trout potential impacts in the East Fork section for more explanation regarding dispersal of stocked trout from the East Fork stocking reach.

Trout are stocked in the East Fork reach during the period when loach minnow would be spawning, so there is opportunity for predation on loach minnow eggs or juveniles; however loach minnow eggs are typically deposited on the underside of rocks would be expected to minimize accessibility by trout for predation of eggs. While loach minnow are primarily considered to occupy riffle habitats (USFWS 1991b; Minckley 1973) and habitat overlap is likely low, loach minnow were also found in relatively slow runs in the North Fork of the East

Fork, and, in Pace Creek, in long pools (Marsh et al. 2003). These are areas where trout may encounter loach minnow.

There is some potential for stocked trout to impact loach minnow by predation since stocked trout could occasionally reach occupied habitat, although this potential may be further reduced by competition with wild resident trout. Montgomery and Bernstein (2008) and Raleigh (1984) state that rainbow trout are opportunistic feeders, feeding mainly on aquatic insects, but will also feed on zooplankton, terrestrial insects, and small fishes. However, Wang and White (1994) reported that wild brown trout were much more aggressive than hatchery stocked cutthroat trout, initiating 92% of the aggressive interactions, and thus concluding that stocked hatchery cutthroat trout were at a significant competitive disadvantage in the presence of wild brown trout. The occupied habitat for loach minnow in the North Fork, East Fork and potentially Boneyard Creek are dominated by wild brown trout. This also further explains the low persistence of stocked trout.

Stocked Apache trout in the West Fork would have to disperse downstream to the East Fork confluence, then up the East Fork Black through that stocking site and further on to occupied loach minnow habitat. The survey data in the West Fork show that some stocked trout can disperse short distances downstream, but the numbers of dispersing trout are low. See the East Fork Black River analysis for discussion on movement of stocked Apache trout, persistence in the stream, and potential impacts to loach minnow.

Stocked fish in Ackre Lake could potentially impact loach minnow in the Three Forks, but would have to escape Ackre Lake, disperse down the length of Fish Creek (12.3 miles), then up the Black River for 9.6 miles, then up the East Fork Black River for 9.8, including traversing through the East Fork Black River to reach occupied habitat. While this is possible since the stream to stream connection between these sites is continuous during high flows, it is unlikely. No grayling has ever been documented in the Black River or in the East Fork Black River. Hatchery Apache trout have been documented in the Three Forks area (Robinson et al 2008), however, these Apache trout likely originated at the East Fork Black stocking site, although it would be extremely difficult to verify the source location.

The main threats to loach minnow in the Three Forks area are primarily high densities of crayfish and wild brown trout. Carpenter and McIvor (1999) list possible impacts to endangered small fishes by non-native crayfish to include competition for cover, competition for food, direct predation on fish by crayfish, and reduction in macrophytes that native fish may need for cover, nursery habitat, and as a source of macroinvertebrates. Fernandez and Rosen (1996) reported impacts by crayfish to aquatic habitat, invertebrates, and frogs at Three Forks. Childs (1999) reported predation of crayfish on native speckled dace, plus a decreased use of cover by speckled dace in the presence of crayfish. White (1995) reported crayfish predation on eggs of Little

Colorado spinedace, and shifts in habitat use in the presence of crayfish. Crayfish are widely considered by biologists to be a serious threat to small bodied native fishes and their habitat.

Wild brown trout are considered to be more piscivorous and aggressive than other trout (Behnke 2002; Belica 2007; Dunham et al 2004; Wang and White 1994). Stocked trout do have the potential to be predators on small fishes such as loach minnow, but likely would not pose much of a threat in the presence of abundant wild brown trout. Montgomery and Bernstein (2008) and Raleigh (1984) state that rainbow trout are opportunistic feeders, feeding mainly on aquatic insects, but will also feed on zooplankton, terrestrial insects, and small fishes. Propst et al (1998) documented predation on loach minnow by stocked rainbow trout. However, Wang and White (1994) reported that wild brown trout were much more aggressive than hatchery stocked cutthroat trout, initiating 92% of the aggressive interactions, and thus concluding that stocked hatchery cutthroat trout were at a significant competitive disadvantage in the presence of wild brown trout. This competitive disadvantage combined with the very low density of hatchery trout, and the lack of persistence, makes any possible impact quite insignificant. The relative densities of wild brown trout in the Three Forks area during surveys over the last 3 years (2007-2009) dominate the trout present in the lower North Fork, Boneyard Creek, and the upper East Fork and comprise 94% of all trout collected. Wild brook trout make up about 4% of all trout collected. All others combined, including reported rainbow trout (could include wild rainbow-Apache hybrids), hatchery Apache trout, and reported cutthroat trout (assumed to be miss-identified and most likely a hatchery Apache trout) make up only 2% of all trout collected. Plus, the brown trout population is expanding in the East Fork Black River, thus posing an increasing threat. Therefore, a hatchery trout may occasionally disperse into occupied loach minnow habitat, most likely from the East Fork stocking area, and there is opportunity for adverse impacts. The number of times these interactions occur may be low due to the limited number of stocked trout that may access the loach minnow occupied habitat, but when they occur predation or completion may be the result. Other factors influencing the exposure include the competitive disadvantage that stocked trout have to wild brown trout, the short persistence, and extremely low densities of loach minnow.

Critical Habitat

In the designation of critical habitat (USFWS 2007), the North Fork of the East Fork, the East Fork Black River, and Boneyard Creek were acknowledged to support primary constituent elements (PCEs) related to habitat quality (sufficient flow velocities and appropriate gradients, substrates, depths, and habitat types [i.e. riffles, runs]). The suitability of these designated reaches to meet primary constituent element 4 was not specifically mentioned; however, a loach minnow population likely had existed for many years prior to its documentation in 1996 (Marsh et al. 2003), and surveys through 2005 continued to document the species (Robinson et al. 2008).

Loach minnow critical habitat Primary Constituent Element 3(d) specifies: streams that have an abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies. There is some evidence that the food base in the East Fork Black River has been limiting in the past. Old macroinvertebrate surveys in the East Fork found below-resident numbers of macroinvertebrates as described by Magnum (as discussed in Novy and Lopez 1991b). These low numbers were attributed to the sedimentation issues and stress on the habitat in this stream, based on the species of invertebrates present and the poor habitat/riparian conditions. Magnum also stated that these conditions were limiting the sportfishery potential in the stream, which was confirmed by moderately low numbers of brown trout in 1988. Since those surveys 20 years ago, aquatic habitat in the East Fork Black River has changed significantly (Meyer et al 2011b). Cattle grazing has been removed from most of the stream and the aquatic habitat and riparian has responded. This has likely led to an increase in the macroinvertebrate community. There is no data to support this assumption but it can be inferred from the significant increases in the resident brown trout population. The brown trout population in the East Fork is now dramatically greater than it was 20 years ago, and must be supported by a greater food base than existed 20 years ago and is likely no longer limiting. The growth of the brown trout population has occurred during consistent annual hatchery trout stocking. If hatchery stocked trout were significantly impacting the aquatic insect food base, significant increases in wild brown trout numbers would not be occurring. The decline of loach minnow and native suckers in the system are likely due to increased predation by wild brown trout and abundant crayfish; not due to prey limitation from hatchery trout. Studies conducted in 2009 (Meyer et al 2011a) in the Black River show that stocked trout do not persist long in the stream, some of the mortality is likely due to angler harvest, however much is likely due to poor survival of stocked trout in stream environments. Other studies support this same finding (High and Meyer 2009; Meyer et al 2011a - associated citations). Stocked trout have to learn to feed on natural foods after they are stocked. Some do, but most do not survive long enough to pick up those behaviors. The few stocked fish that do are likely the ones that do persist, however, this is a very small number and not likely to cause an impact in the food base that can be detected. A detailed discussion of stocked trout persistence can be found in Chapter 4.

When these PCEs were determined and critical habitat was designated, the Black River was identified as critical habitat despite the already ongoing trout stocking program, and at that time if PCE 3(d) was identified to be present for the Black River it was with a baseline accounting for the ongoing stocking program and therefore PCE 3(d) was considered to either be nonexistent in this critical habitat reach or to be met despite the ongoing trout stocking program. Any competition for resources is addressed under competition for resources in the Potential Impacts to loach minnow and the appropriate section in the interactions document.

Rainbow trout stocked into the East Fork Black River would be stocked directly into designated critical habitat. Rainbow trout, brook trout and cutthroat trout stocked into Big Lake and

Crescent Lake could disperse downstream but they have a low probability of reaching critical habitat as they cannot escape these lakes unless they spill, and they have not spilled since the early 1990s. It is unlikely Arctic grayling stocked into Ackre Lake would escape and disperse into the East Fork loach minnow critical habitat as no grayling have ever been documented in the Black River or the East Fork Black River (See Ackre Lake section which discusses the probability of grayling movement below the Fish Creek Barrier).Primary Constituent Element #4 (PCE4) specifies: habitat devoid of nonnative aquatic species or habitat in which nonnative aquatic species are at levels that allow persistence of loach minnow (USFWS 2007). Non-native brown trout have been established in the East Fork Black River for decades and are the dominant large body fish in the stream, and second in numbers only to speckled dace overall. Non-native crayfish are also very well established and present in incredibly high numbers. These two non-native species were present and numerous when critical habitat was designated constituting the baseline conditions and therefore the habitat was not devoid of non-native aquatic species and this portion of PCE 4 would not apply to the East Fork or North Fork.

The second portion of PCE 4 specifies: habitat in which non-native aquatic species are at levels that allow persistence of loach minnow. That may have been true for the East Fork in the mid 1990s or earlier, but is not true today nor when critical habitat was designated in 2007, thus, the entire PCE 4 does not apply to the East Fork and therefore cannot be impacted. A population estimate for wild brown trout in the East Fork in July 2009 was 15,500 fish, far outnumbering hatchery trout stocked into the stream. 1400 hatchery trout are stocked each week into the East Fork, numbers that are less than 10% of the resident trout. Survey data from 2009 show that the numbers of stocked trout in the system do not compound throughout the season and remain low at any given point (population estimate of 105 hatchery Apache trout in the East Fork in July – middle of the stocking season). Harvest, and more importantly, high mortality and very short persistence, keep numbers of hatchery trout very low. Also, non-native crayfish densities in the East Fork are incredibly high. Robinson et al (2009) found 4 times as many crayfish in the Three Forks area as fish. The levels of non-native aquatic species likely exceed that which can support loach minnow in the East Fork and North Fork of the Black River, but not due to stocked trout. The numbers of wild brown trout and crayfish are very high which are likely having an impact on loach minnow. The collection of loach minnow in this system was one individual in 2005. None have been caught in intensive survey efforts in 2007, 2008, and 2009. Loach minnow may be extirpated from the system and the data shows this is likely due to established (and increasing) wild brown trout and crayfish populations, and possibly also due in some part to habitat changes. As such, PCE4 was not present in the East Fork Black River when critical habitat was designated and therefore stocking non-native trout in the East Fork of the Black River and/or trout or Arctic grayling at Crescent Lake, Big Lake, or Ackre Lake over the next 10 years should not impact critical habitat.

No effects to critical habitat in the East Fork Black River would be possible from stocked Apache trout moving into the reach from the West Fork. The stocked species would not affect PCE 4 because the stocked species is native species.

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Loach Minnow PCE's

1. Permanent, flowing water with no or minimal pollutant levels, including:

   a. Living areas for adult loach minnow with moderate to swift flow velocities between 9.0 to 32.0 in/second (24 to 80 cm/second) in shallow water between approximately 1.0 to 30 inches (3 cm to 75 cm) in depth, with gravel, cobble, and rubble substrates;

   b. Living areas for juvenile loach minnow with moderate to swift flow velocities between 1.0 and 34 in/second (3.0 and 85.0 cm/second) in shallow water between approximately 1.0 to 30 inches (3 cm to 75 cm) in depth with sand, gravel, cobble, and rubble substrates;

   c. Living areas for larval loach minnow with slow to moderate velocities between 3.0 and 20.0 in/ second (9.0 to 50.0 cm/second) in shallow water with sand, gravel, and cobble substrates;

   d. Spawning areas with slow to swift flow velocities in shallow water where cobble and rubble and the spaces between them are not filled in by fine dirt or sand; and

   e. Water with dissolved oxygen levels greater than 3.5 cc/l and no or minimal pollutant levels for pollutants such as copper, arsenic, mercury, and cadmium; human and animal waste products; pesticides; suspended sediments; and gasoline or diesel fuels.

2. Sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Suitable levels of embeddedness are generally maintained by a natural,unregulated hydrograph that allows for periodic flooding or, if flows are modified or regulated, a hydrograph that allows for adequate river functions, such as flows capable of transporting sediments.

3. Streams that have:

   a. Low gradients of less than approximately 2.5 percent;

   b. Water temperatures in the approximate range of 35 to 82 °F (1.7 to 27.8 °C) (with additional natural daily and seasonal variation);

   c. Pool, riffle, run, and backwater components; and

   d. An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies.

4. Habitat devoid of nonnative aquatic species or habitat in which nonnative aquatic species are at levels that allow persistence of loach minnow.

5. Areas within perennial, interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted.

Chiricahua Leopard Frog
See **Local** and Broad Scale analyses under each stocking location.

Northern Leopard Frog
See Local and Broad Scale analyses under each stocking location.

Northern Mexican Garter Snake
Stocking complex analysis: Northern Mexican garter snakes are primarily known from middle-elevations in Arizona from approximately 1,700 – 6,700 feet. Although the status of northern Mexican garter snakes in the Black River remains uncertain, all of the Black River Complex stocking sites are above the known elevation limits of the species, and out of the known range. Therefore, the analysis does not include the potential for northern Mexican garter snakes to be exposed to stocked fishes at Big and Crescent lakes (*ca.* 9,000 feet elevation), Ackre Lake (8,900 feet) or the East or West forks of the Black River (7,500 – 7,900 feet and *ca.* 7,700 feet, respectively).

Downstream analysis: Downstream in the Black River watershed, northern Mexican garter snakes historically occurred in the Black River below the confluence with Paddy Creek (no date) on the boundary of the Fort Apache and San Carlos Indian reservations (USFWS 2008a). This area has not been systematically surveyed recently. Northern Mexican garter snakes have been reported from the Fort Apache Indian Reservation at two tributaries to the Black River: Willow Creek (1965) (HDMS), and Big Bonito Creek (1986) (Rosen and Schwalbe 1988), however none were found during garter snake surveys and trapping efforts at Big Bonito Creek in 2004 (Holycross et al. 2006). Crayfish and non-native fish, including smallmouth bass, occupy the Black River and its tributaries.

Although these areas downstream of the sub-watershed have not been systematically surveyed for garter snakes, and it is unknown if populations persist, trout stocked in the Black River complex have the potential to move downstream, and any northern Mexican garter snakes that persist along the Black River above the White River confluence has the potential of being exposed to those stocked fish.

Narrow-headed Garter Snake
Stocking complex analysis: Narrow-headed garter snakes occupy the Black River subwatershed; the Black River lies within the historical and current range of narrow-headed garter snakes and the species may be found throughout the Black River stocking complex, where there is suitable habitat. In addition to recent narrow-headed garter snake records from the Black River, there are recent records of narrow-headed garter snakes from several tributaries of the Black River, including lower Fish Creek (1994, 2004), Snake Creek (2007), Bear Wallow Creek (2003), and North Fork Bear Wallow Creek at Double Cienega (2004) (Arizona Game and Fish Riparian Herpetofauna Database, HDMS, M. Lopez, pers. comm.). Consequently, there is potential for narrow-headed garter snakes to be exposed to sport fish (brook trout, cutthroat trout,

rainbow trout, Apache trout, and Arctic grayling) stocked within the Black River complex. The Black River also supports an abundant crayfish community and non-native fishes such as smallmouth bass that make those habitats less suitable for narrow-headed garter snakes.

There are no records of narrow-headed garter snakes from Crescent or Big lakes, neither of which is appropriate habitat. There is a recent (2004) record from downstream of those stocking sites along the East Fork Black River, below Three Forks (M. Lopez, pers. comm.). Although narrow-headed garter snakes are unlikely to disperse into either of the lakes, if either of the lakes spills, which occurs infrequently, narrow-headed garter snakes could be exposed to stocked rainbow, brook, Apache, and cutthroat trout which escape into the East Fork Black River.

There are historical and recent records of narrow-headed garter snakes above, within and downstream of the East Fork Black River stocking reach, and above and below the West Fork Black River stocking reaches. Holycross et al. (2006) report a 1957 record from the [West Fork] Black River near Big Lake, and there is also a 1991 observation (HDMS) from the same vicinity, but there have been no recent surveys in that reach. Holycross et al (2006) thought narrow-headed garter snakes had been extirpated from the vicinity of Diamond Rock Campground (records from 1969, 1988) at the northern end of the East Fork stocking reach, which they sampled in August 2004. But, in July 2004 a narrow-headed garter snake was observed about 2.5 river miles upstream of the East Fork Black River stocking reach (M. Lopez, pers. comm.) indicating that a population continued to persist in that reach. Narrow-headed garter snakes have been collected (1988) at Buffalo Crossing about 0.25 river miles upstream of the southern end of the East Fork Black River stocking reach (Holycross et al. 2006). There are numerous recent records (1989-2009) of narrow-headed garter snakes along the Black River between the confluences of Fish Creek and Snake Creek (near Wildcat Crossing), about 11 river miles downstream of the East Fork and West Fork Black River stocking reaches (HDMS).

Narrow-headed garter snakes in the stocking reach, and up and downstream of the stocking reach, may be exposed to stocked fish if garter snakes or stocked fish disperse up or downstream in the Black River. There are no narrow-headed garter snake records from the West Fork Black River stocking reach, though there is a 1991 narrow-headed garter snake record from near Big Lake, that is mapped approximately 1.9 river miles upstream of the stocking reach (HDMS). Apache trout stocked in West Fork Black River may move upstream or downstream of the stocking reach and interact with narrow-headed garter snakes. Narrow-headed garter snakes may disperse into the stocking reach provided suitable habitat exists.

There are no narrow-headed garter snake records from Ackre Lake and the snakes are unlikely to disperse into the lake because it is not suitable habitat. Narrow-headed garter snakes would likely be exposed to stocked trout and Arctic grayling if Ackre Lake spills, which it does regularly in the spring, because the fish could move downstream to lower Fish Creek and the Black River.

Downstream analysis: There are records of historical and current narrow-headed garter snake populations from many sites downstream of the stocking complex. Below Big and Crescent lakes, records have been summarized above for the East Fork Black River. Below the East Fork and West Fork stocking sites, narrow-headed garter snakes have been reported and collected from the Black River below Wildcat Point (including lower Fish Creek downstream from Ackre Lake) over the past 20 years (1989, 1991, 1993, 1995, 2004, 2005, 2007, 2008) (HDMS, Fernandez and Rosen 1996, Holycross et al. 2006). Most recently, Brennan and Rosen (2009) studied a population of narrow-headed garter snakes in an approximately 4 mile stretch of the Black River below Wildcat Point. Although snakes persist in that reach, individuals apparently suffer from crayfish predation and predation attempts, something that was not seen in 1995 (Fernandez and Rosen 1996). Farther downstream, there are recent records from tributaries including Bear Wallow Creek and Snake Creek (2003, 2007, respectively) (HDMS, AGFD Riparian Herpetofauna Database). On the Fort Apache and San Carlos Indian reservations, there are records from the Black River near Paddy Creek (1967) and below Sharp Creek (1982), and from one tributary, Big Bonito Creek (1986) (Rosen and Schwalbe 1988). There are also at least four pre-1970 records from the White River (Rosen and Schwalbe 1988, Holycross et al. 2006, HDMS, AGFD Riparian Herpetofauna Database).

The condition of the Black River and its tributaries on the Fort Apache and San Carlos Indian reservations is largely unknown, and no systematic surveys for the species have been done in the last 20 years, so the status of those narrow-headed garter snake populations is also unknown. Nonetheless, narrow-headed garter snakes persisting downstream of the Black River stocking complex may be exposed if fish disperse downstream.

Roundtail Chub

Voeltz (2007) documented roundtail chub in the Black River at Wildcat Crossing. AGFD (M. Lopez, pers. comm.) documented roundtail chub in the same area at Wildcat Crossing as recently as 2009. There are historical records or roundtails being present at Three Forks and the East Fork Black River (Voeltz 2002), though no recent records. One roundtail chub was collected in the very lower West Fork of Black River in 2002.

Roundtail chub are not present in Crescent or Big lakes or immediately downstream, nor are they present in the East Fork of the Black River. The nearest occurrence of roundtail chub is in the Black River just downstream of the confluence with the East and West Forks of the Black (M. Lopez, pers. comm.), at least 25.9 miles downstream of Big Lake, and approximately 2.7 miles downstream of the East Fork stocking reach. McKell (2005a) documented roundtail chub in the Black River near the confluence with Bear Creek. Voeltz (2007) documented roundtail chub in the Black River at Wildcat Crossing. AGFD (M. Lopez, pers. comm.) documented roundtail chub in the same area at Wildcat Crossing as recently as 2009. One roundtail chub was collected in the very lower reach of the West Fork Black River in 2002 (Table 23); however, this is the first record of roundtail in the West Fork, it was collected about 100 meters upstream of the

Black River, and was likely an isolated fish swimming into the West Fork during an extreme drought year when water temperatures are likely to be higher. Roundtail chub are located in the Black River upstream and downstream of the Fish Creek confluence (McKell 2005a; Voeltz 2007), and are assumed to be at or very near the confluence.

Potential Impacts

It is not likely that a reproducing roundtail chub population exists in the North Fork of the East Fork or the East Fork Black River. Recent surveys in the North Fork in 2007, 2008 and 2009 found no roundtail chub (Table 9), and recent surveys in the East Fork in 2009 also found no roundtail chub (Table 13). Exposure to stocked trout that could escape from Big Lake or Crescent Lake would be to adult chub, and there are no recent records for this area, and extensive surveys have been completed. While there is a possibility that escaped fish from Big Lake or Crescent Lake may reach the Black River where roundtail chub are found, the combination of low risk of the lakes spilling and the distance the fish would have to travel, and the low likelihood of persistence if a trout were to disperse makes any potential impacts to roundtail chub unlikely. There would be a higher likelihood of impacts from Apache or rainbow trout stocked in the East Fork, or Apache trout stocked in the West fork. Detailed information regarding dispersal of trout stocked in from either reach can be found in the East and West fork sections. If stocked trout dispersed into occupied roundtail chub habitat in the Black River, they would compete with roundtail chub for food and space. Stocked trout may also prey on juvenile roundtail chub.

Apache trout and Arctic grayling leaving Ackre Lake and Fish Creek could encounter all age classes of roundtail chub in the Black River, if the escaped fish reach the Black River. While this is possible since the stream to stream connection between these sites is continuous during high flows, it is unlikely. No grayling has ever been documented in the Black River or in the East Fork Black River. The numbers of escaped fish reaching the Black River is expected to be extremely small and rare occurrence, thus any impact directly or indirectly to roundtail chub is expected to be very small. Apache trout in the Black river could be from stocked population in Ackre Lake, the recovery population in Fish Creek, any of the other recovery populations above barriers on tributaries to the Black, or from the stocking reaches on the East or West Forks of the Black River.

Stocked Apache or rainbow trout may prey on small roundtail chub and compete with other age classes for food and space. Arctic grayling may compete for food with very small roundtail chub and with all age classes for space, but this would be expected to be very short term, as grayling do not persist in stream environments in Arizona. The Conservation Team implementing the Arizona conservation agreement for the roundtail chub was comfortable with stocking rainbow trout and Apache trout in drainages containing roundtail chub as long as the stocking was not on top of the roundtail population (SCAS meeting notes, 3/6/08). Dispersal of stocked species to occupied roundtail chub habitats allows for the effects to occur even though the roundtail chub

are not in the stocking site. The main threats to roundtail chub in the Black River are from highly piscivorous brown trout and abundant crayfish. It is expected that stocked Apache trout and Arctic grayling in Ackre Lake will have an extremely low impact to roundtail chub in the Black River.

Three Forks Springsnail

Three Forks springsnails are found at Three Forks Springs, which is an off channel spring located at Three Forks (13.7 miles downstream of Big Lake and 4.6 miles upstream from the East Fork stocking reach), and Boneyard Bog Springs, which is located at the headwaters of Boneyard Creek (18.4 miles downstream of Big Lake and 8.9 miles upstream of the East Fork stocking site via Boneyard Creek). These springsnail sites are 34.1 and 38.4 miles, respectively, from Ackre Lake; a stocked fish would have to travel down Fish creek, and up the Black River, into the East Fork of the Black River, through the stocking reach in order to reach the Three Forks area. Nonnative crayfish (Myers 2001) have adversely affected the Three Forks Springs populations. The population at Three Forks has reduced dramatically in size and surveys since 2004 rarely find more than 2-6 springsnails at a time (pers com. J Sorenson).

Forest fire retardant drops during the Three Forks Fire did not land on any of the springs holding springsnails; but airborne residues may have drifted over the site (which would not require upstream flow). There was one drop that crossed a dry tributary to the North Fork and one that came close to the North Fork.

Potential Impacts

The small spring systems occupied by the Three Forks Springsnail are not accessible to large-bodied fish such as the stocked trout species. Even if the stocked species reached Three Forks or Boneyard Bog, it is unlikely they could reach occupied springsnail habitat. Trout stocking in the East Fork Black River is not expected to impact the Three Forks springsnail at either Three Forks or Boneyard Bog, because the extant springs that still support the snail are too shallow (especially near the springheads where snails are found) for trout to successfully forage (Figure 32, Figure 33, Figure 34). Trout have not been observed anywhere near the springheads that still have snail populations in all the years they have monitored that species since 2004 (pers com J. Sorenson).

The North Fork East Fork Black River is a popular area for public recreation, and recreation has been identified as a threat to the species (G051_I01 *Pyrgulopsis trivialis* species assessment and listing priority review, 2007). The Three Forks area is closed to public access by the Forest, and the Boneyard springs area has cattle fencing around it, and any vehicle access has been blocked by boulders; any recreational anglers would have to hike or 4x4 to the spring. Neither trampling nor habitat destruction from anglers is likely to occur since trout have are not likely to reach the springs because of the shallow, boggy nature of the stream, and have never been observed at

either Three Forks or Boneyard Springs, and as well, these areas are not suitable for angling (no open water areas conducive to angling), anglers are not expected to be present.

The concern related to the stocking program is the transmission of nonnative snails or mussels, particularly New Zealand mud snails (NZMS), via the water in stocking trucks that transport the fish from the hatchery. Nonnative snails can displace native species and with a species of extremely limited distribution, this could result in extirpation or extinction. However, this risk is extremely small. NZMS are not present at any hatcheries within Arizona, plus management plans to control or prevent snails or mussels from occupying hatcheries are in place. Many of the hatcheries use loaders that exclude organisms and water from the raceway, except for catchable size trout. Crescent Lake is stocked by the Canyon Creek, Tonto, and Sterling Springs state hatcheries. Big Lake is stocked by Canyon Creek, Page Springs and Sterling Springs hatcheries. The East Fork Black River is stocked almost exclusively by Silver Creek Hatchery. Canyon Creek Hatchery has a closed spring source that is piped the entire distance to the raceways. Tonto and Sterling Springs water sources are also piped into raceways. The fish loaders pick up fish and water from the water column of the raceway, not from the bottom, then sorts the larger catchable trout into the stocking truck while smaller fish, raceway water and any other organisms go back into the raceway. Water in the hatchery trucks are loaded directly from wells. Page Springs Hatchery has two water sources, one of which is secured (Pond Springs) and the other is partially secured (Cave Spring). It is unlikely that non target organism biota could become established due to the small area of exposed water before coming from the Cave Spring before it enters underground pipes. Moreover, the exposed portion of the Cave Spring is protected by a chain link fence, locked gate, and screened entrance. There are also metal screens that filter debris prior to entering the headbox and subsequent hatchery pipes. Introduction of non target organism biota via more natural means (transmission via mammals or birds) is unlikely due to fast moving water which largely precludes use of Cave Spring by mammals and birds. The Silver Creek Hatchery is scheduled to undergo a complete renovation in 2010, which will completely cover the spring, and pipe the springwater into an indoor facility. It is unlikely that NZMS would become established in these spring sources because of internal HACCP plans and hatchery procedural steps taken during day to day operation and maintenance, the remote locations of the springs, and also since the spring sources are not used by anglers that might transport NZMS on their wading gear.

The greatest threat to springsnails is crayfish. Carpenter and McIvor (1999) reported lower invertebrate diversity in sites at Three Forks that had higher densities of crayfish. Fernandez and Rosen (1996) reported significantly lower numbers and mass of invertebrates at sites with crayfish at Three Forks. The specific organisms that showed significant declines in the presence of crayfish during this study were caddisflies, snails, and a mussel (*Anadonta californiensis*).

Figure 32. Photo of Boneyard Bog Springs, taken in July 2003.

Figure 33. Photo of Boneyard Bog Springs.

Figure 34. Photo of Boneyard Bog Springs.

CANYON CREEK COMPLEX

Canyon Creek

Site Description

Canyon Creek is located approximately 25 km (16 mi) southwest of Heber and encompasses 822 km^2 (318 mi^2) of both Gila and Navajo Counties. The portion of Canyon Creek proposed for stocking is an 8 km (5 mi) reach from the spring source to the White Mountain Apache Reservation boundary (Figure 35). Canyon Creek flows over a substrate of primarily boulder, cobble, and bedrock, with enough gravel present to support the natural reproduction of brown trout. Riffle and run habitats dominate, but there are several pools up to 2 m (6 ft) deep. The creek is at the top of the watershed and lies entirely within the Tonto National Forest.

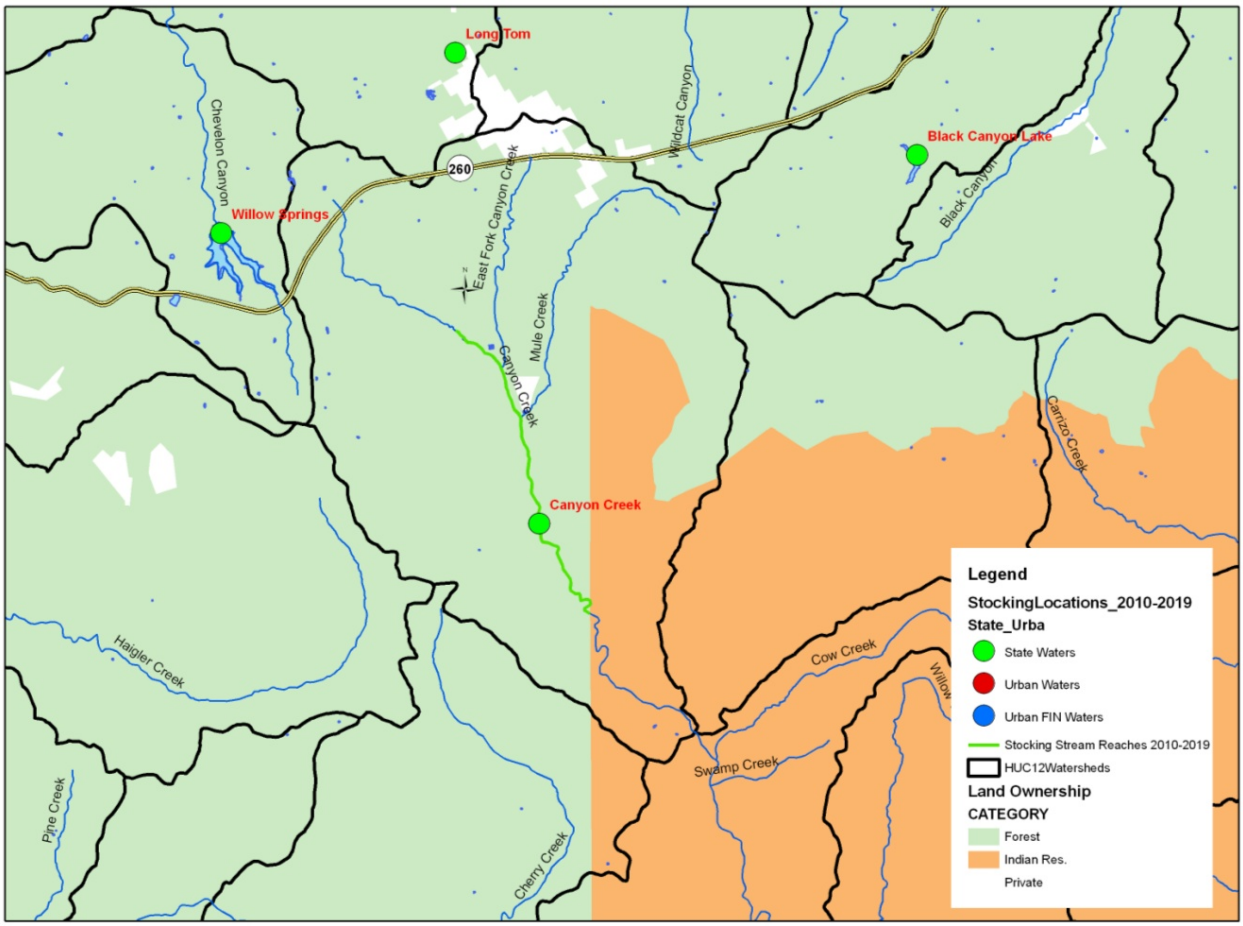

Figure 35. Overview map of the Canyon Creek stocking area.

Canyon Creek is managed by the Tonto National Forest for all types of recreation, including camping, picnicking, fishing, water activities, hunting, birding, and hiking. The upper portion of the creek is accessible from Forest Road 33 year round, except during extreme snow or rainfall. The lower portion of the proposed stocking reach is accessible by vehicle from Forest Road 188, which is closed seasonally from December 31 through March 31, at which time lower Canyon Creek can only be reached by hiking in to it. Canyon Creek Hatchery is located at the upper end of the stocking reach (Figure 36).

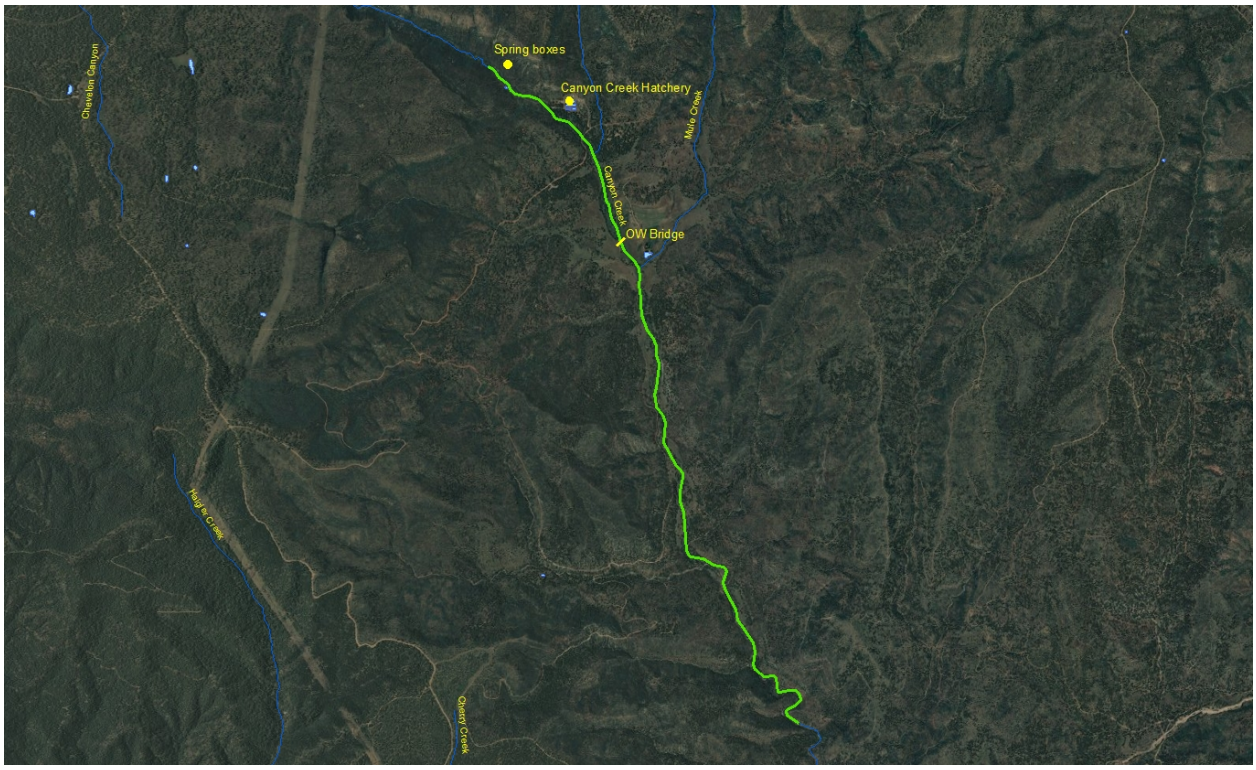

Figure 36. Location of Canyon Creek Hatchery and springs as well as the OW Bridge.

Management of Water Body

The proposed stocking site is broken into two distinct management sections. The section from spring source to OW Bridge is managed as a coldwater intensive use, put-and-take rainbow trout fishery throughout the spring, summer, and fall months. This section of Canyon Creek is stocked weekly from April through September with catchable rainbow trout.

The section of the creek downstream of the OW Bridge to the White Mountain Apache Reservation boundary is managed as a naturally reproducing coldwater rainbow trout and brown trout fishery. Supplemental stocking of this reach of stream has occurred over the years to augment or recover the fishery after events such as the Rodeo-Chediski fire in 2002 (Table 28). Brown trout and rainbow trout may be stocked in this portion of Canyon Creek to augment or recover the populations should a catastrophic event decimate fish populations, or as needed to maintain the fishery. This includes the stocking of sub-catchables and or fry/fingering in the late fall to allow for overwintering.

Mule Creek downstream of OW Bridge is the only tributary within the proposed stocking reach that supports fish. It is currently managed as a coldwater, intensive-use fishery for naturally reproducing rainbow and brown trout. Mule Creek has limited trout habitat; it is intermittent and generally flows less than 1 cfs for most the year. In 1982 it received a one-time stocking of 500 brown trout. Mule Creek is not proposed for future stockings due to its limited trout habitat.

Creel data collected by the Department's Region VI Fisheries Program in 2007 showed Canyon Creek had 3,166 angler use days, with anglers harvesting 4,247 trout. These data were not published nor reported in any technical or other report.

Table 28. Stocking History of Canyon Creek

Species	First Year	Last Year	Num. of years stocked	Num. Stocked
Brook trout	1935	1967	2	1,400
Brown trout	1948	2005	6	34,000
Colorado River pikeminnow	1986	1986	1	5,929
Native trout*	1935	1935	1	26,000
Rainbow trout	1933	2009	60	316,214
Razorback sucker	1987	1989	2	20,968
Total			571	401,043

Proposed Action

The proposed action is to stock rainbow trout and brown trout for the period covered by this consultation.

Catchable, sub-catchable, fry/fingerling rainbow trout would be stocked from April through September in Canyon Creek; numbers of trout stocked would be from 0 - 7,000 fish annually.

Sub-catchable brown trout may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events such as a large flood event; numbers of brown trout would be from 0 – 800 fish annually.

Water Distribution / Connectivity

Canyon Creek originates at springs below the Mogollon Rim and is perennial for 59 km (37 mi) to its confluence with the Salt River. Riffle and run habitats dominate in Canyon Creek but there are several pools up to 2 m (6 ft) deep within the proposed stocking reach.

Mule Creek also originates from a spring below the Mogollon Rim and flows for just over 3km (2 mile) to its confluence with Canyon Creek. The confluence of these two streams is 400 m (1300 ft) downstream of the OW Bridge. Mule Creek has limited trout habitat, it is intermittent, and generally flows less than 1 cfs for most of the year. Other tributaries to Canyon Creek exist on the White Mountain Apache Reservation (Ellison, Oak, and Willow creeks); however, little information on their hydrology is available.

Fish Movement

There is a concrete road crossing roughly 500 m (1600 ft) downstream of the spring source; this road acts as a barrier to the upstream movement of fish. There are no other known barriers to upstream fish movement within the proposed stocking reach. Other barriers to upstream fish movement may exist on the White Mountain Apache Reservation, but no information is available. Rainbow trout are not currently stocked above this crossing. A naturally occurring population of brown trout exists from the spring source to the road crossing and during recent fish surveys only brown trout were collected upstream of the road crossing (C. Gill pers. comm.). This lack of rainbow trout found above the crossing suggests the crossing is a barrier to the upstream movement of stocked rainbow trout. There are no barriers to prevent fish stocked in this reach from moving into Mule Creek.

Connectivity suggests fish could be transported or emigrate downstream from the proposed stocking site to the Salt River. Salmonids could move freely downstream during cooler periods, however, year round survival near the confluence or in the Salt River would not be possible at the high summer temperatures. Survival, occurrence and movement of rainbow trout or brown trout in Canyon Creek on the reservation are not known.

Generally, the highest flows in Canyon Creek occur in the winter months from long duration, low-intensity storms. Smaller and infrequent flow events occur in summer from monsoon storms that result in short duration, high-intensity thunderstorms. Trout could be washed down or actively emigrate downstream in Canyon Creek, into the Salt River and then into Roosevelt Lake during high flood events or anytime during the cooler seasons. This is most likely to occur during the winter months but could also occur during the summer.

Catchable rainbow trout are stocked April through September in Canyon Creek and are at their highest densities in the stream during this time. Within the stocking reach rainbow and brown trout can overwinter and support a naturally reproducing population. Although rainbow trout could be washed downstream from summer floods during the stocking season, high summer temperatures seem to limit their movement and survival downstream to portions of Canyon Creek near the White Mountain Apache Reservation (J. Warnecke pers. com.). Therefore movement downstream on to the White Mountain Apache Reservation during summer months is unlikely. By the time the monsoon floods occur, the water temperature in Canyon Creek has been documented to exceed 29° C (84° F) near the White Mountain Apache Reservation boundary (Gill 2008b). Information needed to further evaluate likelihood of downstream movement and survival of stocked trout from the White Mountain Apache Indian reservation is proprietary information and unable to be included in this document.

Community Description

Canyon Creek maintains naturally occurring populations of native desert sucker and speckled dace. Non-native brown trout are also self-sustaining in the system and are found from the headwater to the reservation boundary. Rainbow trout are also found in Canyon Creek, although

their numbers dwindle at the reach just upstream of the reservation boundary due to warmer water temperatures and less optimal habitat, since the creek becomes shallower with more runs and riffles with fewer pools and substrate shifting to primarily bedrock.

Terrestrial gartersnakes are common along Canyon Creek above the Reservation boundary, as are canyon treefrogs and Arizona toads (Holycross et al. 2006). The complex lies within the historical range of the narrow-headed gartersnake and they may still occupy the system (see complex analysis). Crayfish are absent. The portion of Canyon Creek within the White Mountain Apache Reservation is relatively unknown to non-tribal personnel, but Rosen and Schwalbe (1988), reported narrow-headed gartersnakes, Sonoran mud turtles, canyon treefrogs, and "Colorado River chub" from Canyon Creek about 2.25 miles up from the Salt River in 1986.

The most recent survey conducted at Canyon Creek documented the presence of rainbow trout, brown trout, speckled dace, and desert sucker (Gill 2008a). Both rainbow trout and brown trout are common in the upper portion of the proposed stocking reach and become less common near the White Mountain Apache Reservation boundary. Brown trout successfully reproduce in Canyon Creek and maintain a viable population for recreational angling (Gill 2008a). Natural reproduction of rainbow trout has been noted in Canyon Creek (Gill 2006a, 2007). However, it should be noted that the reproduction of rainbow trout in 2006 was thought to be from a supplemental stocking in the lower portion of the creek in 2005 (Gill 2006a) and that the young of the year rainbow trout collected in 2007 were thought to be hatchery escapees, as all were collected in a short portion of stream at the hatchery outflow (Gill 2007a); however Canyon Creek hatchery raises both rainbow trout and cutthroat trout, and cutthroat trout have not been detected in any of the surveys of Canyon Creek. If fish were frequently escaping from the hatchery, cutthroat trout would likely also be found, but they have not. It is likely that rainbow trout could not maintain a viable population for recreational fishing, due to their low level of natural reproduction, angling pressure, and high summer temperatures without supplemental stocking.

Speckled dace and desert sucker are abundant from the OW Bridge to the White Mountain Apache Reservation boundary; from OW Bridge upstream their densities decline. Both speckled dace and desert sucker densities were more than double what they were prior to the Rodeo-Chediski Fire of 2002, but they have experienced a slight reduction in recent years (Gill 2008a). This may be attributed to predation by non-native brown and rainbow trout, or it may be natural cyclical variation within these populations.

Roundtail chubs have never been reported in the reach of Canyon Creek located on the Tonto National Forest. However, they were sampled from Canyon Creek in 1987 and 1988 on the Fort Apache Indian Reservation, more than 20 miles downstream from the Forest boundary (Voeltz 2002). Razorback suckers have not been found in Canyon Creek since they were stocked in 1989, and were only found for a short period immediately after stocking. The last Colorado

pikeminnow was collected in Canyon Creek in 1987, near the White Mountain Apache Reservation boundary (Warnecke et al. 1990), one year after they were stocked. Neither species is now expected to persist in any stream in the Salt River Watershed above Roosevelt Lake based on 11 surveys conducted from the spring source to the reservation boundary from 1990 to 2008. Information from the reservation is not available. Table 29 provides a summary of surveys and results in Canyon Creek.

A survey was conducted in Mule Creek in 2009 from two sites; one 200 m downstream of the spring at the headwaters, and one roughly half way between the spring and the confluence with Canyon Creek (Gill 2009b). Only brown trout and speckled dace were found. Brown trout were uncommon at both sites; speckled dace were uncommon near the spring and abundant in the middle section of Mule Creek. Rainbow trout, brown trout, and desert sucker have been documented within the creek previously. Table 30 provides a summary of surveys on Mule Creek.

Table 29. Summary of surveys conducted on Canyon Creek between 1965 and 2008.

Year	Collector	Location Description	Survey Type	Source	Species
1965	ASU	1 mi S of Reservation boundary		Son-Fish database	speckled dace
1967	ASU	18 mi NNW of Seneca		Son-Fish database	desert sucker Sonora sucker speckled dace roundtail chub
1987	RBSCSFMON	Confluence with Salt River & up0.5 mi	Backpack electrofishing	AGFD Native Fishes Database	desert sucker Sonora sucker roundtail chub smallmouth bass common carp
1988	RBSCSFMON	Crossing at Indian Rd #12, upstream	Backpack electrofishing	AGFD Native Fishes Database	desert sucker speckled dace roundtail chub
1988	RBSCSFMON	Crossing at Indian Rd #19, upstream	Backpack electrofishing	AGFD Native Fishes Database	brown trout rainbow trout speckled dace desert sucker
1988	RBSCSFMON	“The Pyramids”above road crossing at campground	Backpack electrofishing	AGFD Native Fishes Database	brown trout rainbow trout speckled dace desert sucker
1987 1988 1989	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fish Management Report (Warnecke et al. 1990)	brown trout rainbow trout speckled dace desert sucker

Year	Collector	Location Description	Survey Type	Source	Species
					Colorado pikeminnow
1990 1992 1993 1994	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fish Management Report (Warnecke et al. 1996)	brown trout rainbow trout speckled dace desert sucker
1998	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Spot Check Survey (McMahon and Warnecke 1998)	brown trout rainbow trout speckled dace desert sucker
2003	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fisheries Survey (Warnecke and Weedman 2003)	brown trout rainbow trout speckled dace desert sucker
2004	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fisheries Survey (Warnecke and Wiggins 2004)	brown trout rainbow trout speckled dace desert sucker
2005	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fisheries Survey (Warnecke and Wiggins 2005)	brown trout rainbow trout speckled dace desert sucker
2006	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fisheries Survey (Gill 2006a)	brown trout rainbow trout speckled dace desert sucker
2007	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fisheries Survey (Gill 2007a)	brown trout rainbow trout speckled dace desert sucker
2008	AGFD	From spring source to Reservation boundary	Backpack electrofishing	Fisheries Survey (Gill 2008a)	brown trout rainbow trout speckled dace desert sucker

Table 30. Summary of surveys conducted on Mule Creek between 1967 and 2009.

Year	Collector	Location Description	Survey Type	Source	Species
1967	AGFD	~3/4 mi downstream of spring source	Backpack electrofishing	AGFD Native Fishes Database	brown trout rainbow trout
1968	AGFD	~1/4 mi upstream of spring source	Backpack electrofishing	AGFD Native Fishes Database	brown trout rainbow trout

1984	AGFD	Just downstream of spring source ~200yd	Backpack electrofishing	AGFD Native Fishes Database	brown trout rainbow trout
1984	AGFD	At old road crossing about ½ mi downstream of spring	Backpack electrofishing	AGFD Native Fishes Database	brown trout rainbow trout speckled dace desert sucker
1984	AGFD	Just upstream from Canyon Creek confluence ~400yd	Backpack electrofishing	AGFD Native Fishes Database	speckled dace desert sucker
2009	AGFD	Just downstream of spring source ~200yd	Backpack electrofishing	Fisheries Survey (Gill 2009b)	brown trout speckled dace
2009	AGFD	~ Halfway between spring and Canyon Creek confluence	Backpack electrofishing	Fisheries Survey (Gill 2009b)	brown trout speckled dace

Consultation Species or Critical Habitat
Potential impacts to bald eagle, Chiricahua and northern leopard frogs, northern Mexican and narrow-headed gartersnakes, roundtail chub and Mexican spotted owl are addressed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Narrow-headed gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Bald Eagle
Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally

move between available sites so the reduction in use of a particular stocking site may not be significant.

Chiricahua Leopard Frog

Local Analysis: Although the Canyon Creek buffered stocking reach is within the historical range of the Chiricahua leopard frog, the likelihood that fish stocked in Canyon Creek would have an impact on Chiricahua leopard frogs is low. There are no historical records for Chiricahua leopard frogs within the buffered stocking reach (Figure 37, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 57 surveys at 34 sites within the buffered stocking complex between 1984 and 2007 and no Chiricahua leopard frogs were observed (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 12 sites between 2003 and 2007 and did not observe any Chiricahua leopard frogs (dated provided by Black Mesa Ranger District, Tonto National Forest). It is likely that Chiricahua leopard frogs do not occupy the Canyon Creek buffered stocking complex.

Broad Scale Analysis: The likelihood that dispersing sport fish would have an impact on Chiricahua leopard frogs downstream is low. The Chiricahua leopard frog Gentry Creek Management Area (GCMA), an actively managed Chiricahua leopard frog recovery area, is located to the west of Canyon Creek approximately 8.5 miles downstream from the stocking reach and 5 miles overland. There are numerous recent records for Chiricahua leopard frogs in the GCMA (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The closest occupied Chiricahua leopard frog site in the GCMA is West Prong Gentry Creek, which is approximately 6.5 miles up the intermittent tributary of Gentry Creek. Another route that dispersing leopard frogs could access the stocked reach of Canyon Creek would be to travel approximately 7 miles up the intermittent Cherry Creek drainage (Arizona Game and Fish Riparian Herpetofauna Database, M.J. Sredl pers.comm.). It is not likely that stocked fish would travel that far up an intermittent tributary and it is not probable that Chiricahua leopard frogs would travel that far down an intermittent tributary.

Northern Leopard Frog

Local Analysis: Although Canyon Creek and the buffered stocking reach are within the historical range of the northern leopard frog, the likelihood that frogs will be exposed to fish stocked in Canyon Creek is low. There are 3 records for northern leopard frogs from 2 sites: Twin Lakes (1984, 1985) and Willow Springs Canyon (1996) (Figure 37, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 57 surveys at 34 sites within the buffered stocking reach between 1984 and 2007 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed at any site, including Twin Lakes (1999) or at Willow Springs Canyon (1997, 1998) (Figure 37, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the Black Mesa Ranger District, Tonto National Forest, surveyed 12 sites within the buffered stocking complex between

2003 and 2007 and did not observe any northern leopard frogs (Dated provided by Black Mesa Ranger District, Tonto National Forest). It is likely that northern leopard frogs no longer occupy Willow Springs Canyon; if they are the existing presence of sport fish in Willow Springs Lake and at the headwaters of Canyon Creek make it difficult for northern leopard frogs to disperse into Canyon Creek from Willow Creek Canyon.

Broad Scale Analysis: The likelihood that northern leopard frogs outside of the buffered stocking complex would be exposed to dispersing sport fish is low. Downstream of the Canyon Creek buffered stocking reach elevation drops below the minimum for the northern leopard frog in the Salt River watershed (approximately 4,800 ft) (Sredl 1997) and there are no historical records for northern leopard frogs in these drainages or in tributaries of Canyon Creek that fish could disperse into (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). It is likely that northern leopard frogs do not occupy the drainages into which stocked fish are able to disperse to.

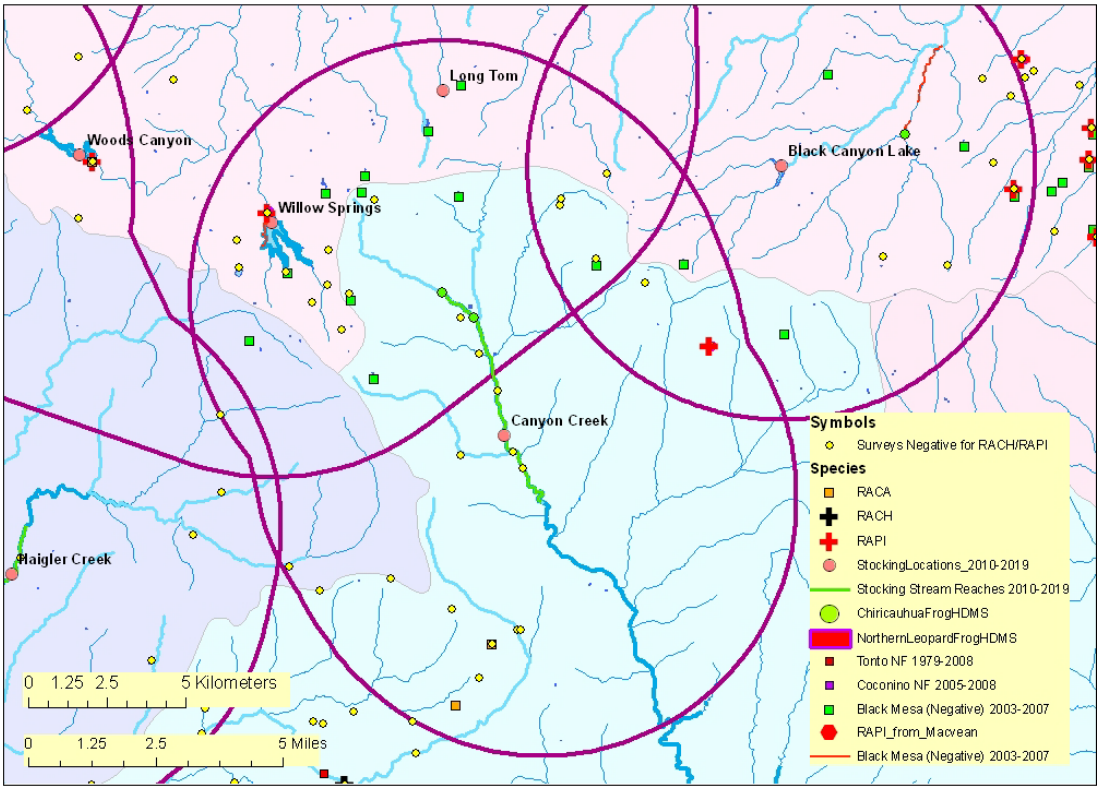

Figure 37. Map of Canyon Creek buffered stocking site:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the

legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Narrow-headed Gartersnake

Stocking complex analysis: Canyon Creek lies within the historical range of narrow-headed gartersnakes; given the presence of suitable habitat, the species may still occupy the complex in low numbers. There are recent (1986, 1990) narrow-headed gartersnake records within the Canyon Creek stocking reach; however no narrow-headed gartersnakes were detected during species-specific surveys in 2004 and 2005 or subsequent surveys by the Department and other personnel (Holycross et al. 2006, B. Burger pers. comm.). Because narrow-headed gartersnakes may be present in the Canyon Creek stocking reach, gartersnakes could be exposed to stocked sport fish. Additionally, potential exists for future narrow-headed gartersnake recovery actions in this area because crayfish are absent (Holycross et al. 2006).

Downstream analysis: Although the data on narrow-headed gartersnakes are limited, this species may still occupy Canyon Creek and the surrounding tributaries within the White Mountain Apache Reservation (Rosen and Schwalbe 1988, HDMS, T. Jones pers. comm.). Stocked brown and rainbow trout could disperse downstream from the stocking reach in Canyon Creek, into the Salt River, as far as Roosevelt Lake; however, rainbow trout downstream of the stocking reach would likely die in the summer due to high water temperatures. The areas downstream of the sub-watershed have not been systematically surveyed for gartersnakes and there is a lack of available information on any gartersnake populations on the White Mountain Apache Reservation. If narrow-headed gartersnakes occupy areas downstream of the stocking complex, there is likelihood they could be exposed if stocked fish disperse downstream.

Roundtail Chub

Roundtail chub are not present in the stocking area. It is unknown if chub maintain a population in Canyon Creek on the Fort Apache Indian Reservation and in the Salt River near the confluence with Canyon Creek as results from surveys on the Fort Apache Indian Reservation are proprietary to the tribe and not available for consideration. The most recent records, in 1988, for roundtail chub are from the lower end of the creek near the confluence with the Salt River, but the current status of the population is unknown (Voeltz 2002). In the documentation for the recent July 7, 2009, 12-month finding designating the roundtail chub as a candidate, the status of the Canyon Creek population was determined to be unknown due to the lack of survey data. The population of roundtail chub in the Salt River near the confluence with Canyon Creek has been heavily impacted by the spread of channel catfish and flathead catfish (Voeltz 2002) and may be extirpated (Creef and Clarkson 1993, Jahrke and Clark 1999). The population of roundtail chub in the lower portion of Canyon Creek may also have been adversely impacted by this increase in predators. Three roundtail chub were collected in 2009 at the upper end of Gleason Flat in a connected backwater of the Salt River (Evans 2009a). These individuals possibly came from dispersal out of Canyon Creek or Ash Creek, which supports a re-established population of

roundtail chub. Canyon Creek confluence is about 2 miles upstream of Gleason Flat and Ash Creek is about 1 mile upstream. One rainbow trout was documented 1 mile upstream of the Canyon Creek confluence and one was also documented 2 miles downstream of the Canyon Creek confluence with the Salt River from early May 1986 survey (AGFD native fish database); however, it is unknown if these trout originated in Canyon Creek or elsewhere as rainbow trout are propagated in two Federal fish hatcheries and stocked within numerous lakes and tributaries on the White Mountain and San Carlos Apache Indian Reservations within the Salt River Drainage, which is upstream of Canyon Creek.

Potential impacts

Rainbow trout are competitors for food and space with roundtail chub, and may also prey on young chub (Propst et al. 1998). Brown trout are potential predators and competitors with roundtail chub. Canyon Creek is perennial throughout its length. Flow status is not known with certainty on the reservation. During spring floods or monsoon runoff, connectivity between the stocking sites and the lower part of the creek most likely exists. Both brown and rainbow trout can be displaced downstream during these events. During the winter or early spring, temperatures in the lower part of Canyon Creek may provide for survival of displaced trout until the water temperatures rise in the early summer. During that period, there is a potential for competition for space and food in pools where all three species live. Roundtail chub also breed during this time, so larval fish are at risk of predation.

Rainbow trout are stocked weekly from April through September. Typically the spring floods occur prior to the first stocking of rainbow trout. Warnecke et al. (1996) noted that stocked rainbow trout rarely overwinter in Canyon Creek due to fishing pressure and high summer water temperatures (J. Warnecke pers. comm.). By the time the monsoon floods occur the water temperature in Canyon Creek has been documented to exceed 29° C (84° F) near the White Mountain Apache Reservation boundary (Gill 2008b). The young of year rainbow trout collected in 2006 were likely a result of a supplemental stocking of rainbows into lower Canyon Creek in summer 2005 to provide angling opportunity within this reach. No young of year rainbows have been collected in these reaches since. The 45% young of year rainbow trout collected in 2007 were thought to all be hatchery escapees as they were all collected from the vicinity of the hatchery outflow as stated in the 2007 report. However, if fish were frequently escaping from the hatchery, cutthroat trout which are also produced at the hatchery would likely also be found, but they have not. This would not be an indication of natural reproduction. For these reasons, while possible in winter and spring, any exposure of roundtail chub to stocked rainbow trout in lower Canyon Creek would likely be of short duration. Brown trout do reproduce and overwinter in Canyon Creek. There is a higher likelihood of exposure to brown trout than rainbow trout because brown trout are more successful in reproducing and overwintering in Canyon Creek.

The last record of roundtail chub in Canyon Creek was found in September 1988, near the confluence with the Salt River. This survey documented non-native smallmouth bass and common carp, but no trout. Resident non-native species present year-round independent of the proposed stocking action, such as smallmouth bass, red shiner or common carp are thought to be having significant effects on roundtail chub through direct predation on eggs, larvae or young of year or competition for food and space in lower Canyon Creek. While potential exists for additional predation or competition pressures from seasonally present stocked trout, it would not be anticipated stocked trout would persist through the warmer months and numbers would be extremely low.

Mexican Spotted Owl and Critical Habitat

The stocking stream reach is within Mexican spotted owl (MSO) critical habitat (CH), occurs within 4 buffers, and is also in three individual PACs. There appears to be the opportunity for angler access based on topographic and world imagery maps.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within boundary of at least one MSO PACs in the general vicinity of the site. There may be some disturbance of MSOs at the nest site, roosting or foraging areas within the PAC during the breeding season.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring

restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

WORKMAN CREEK COMPLEX

Workman Creek

Site Description

Workman Creek is a tributary of Salome Creek which flows directly into Roosevelt Lake (Figure 38). The Workman Creek stocking location is a 3 mile stream reach located upstream of Hwy 288 and ending at Workman Falls, a 200ft waterfall. Workman Creek is located in Gila County on the Tonto National Forest, 45 miles north of Globe; 15 miles on AZ 88, 26 miles on AZ 288, and 3 miles on Forest Route 487. There are three primitive campgrounds along Workman Creek and a hiking trail paralleling the creek that is used by all recreationists, including anglers. Only the campground at the falls is open to overnight camping. The other two are day use only. There is also a large group campground and individual campsites located approximately a half mile from Workman Creek at Reynolds Creek. This area is highly used by campers, hikers, and ATV users as well. All four of these campground sites are open seasonally from May 15 through October 15.

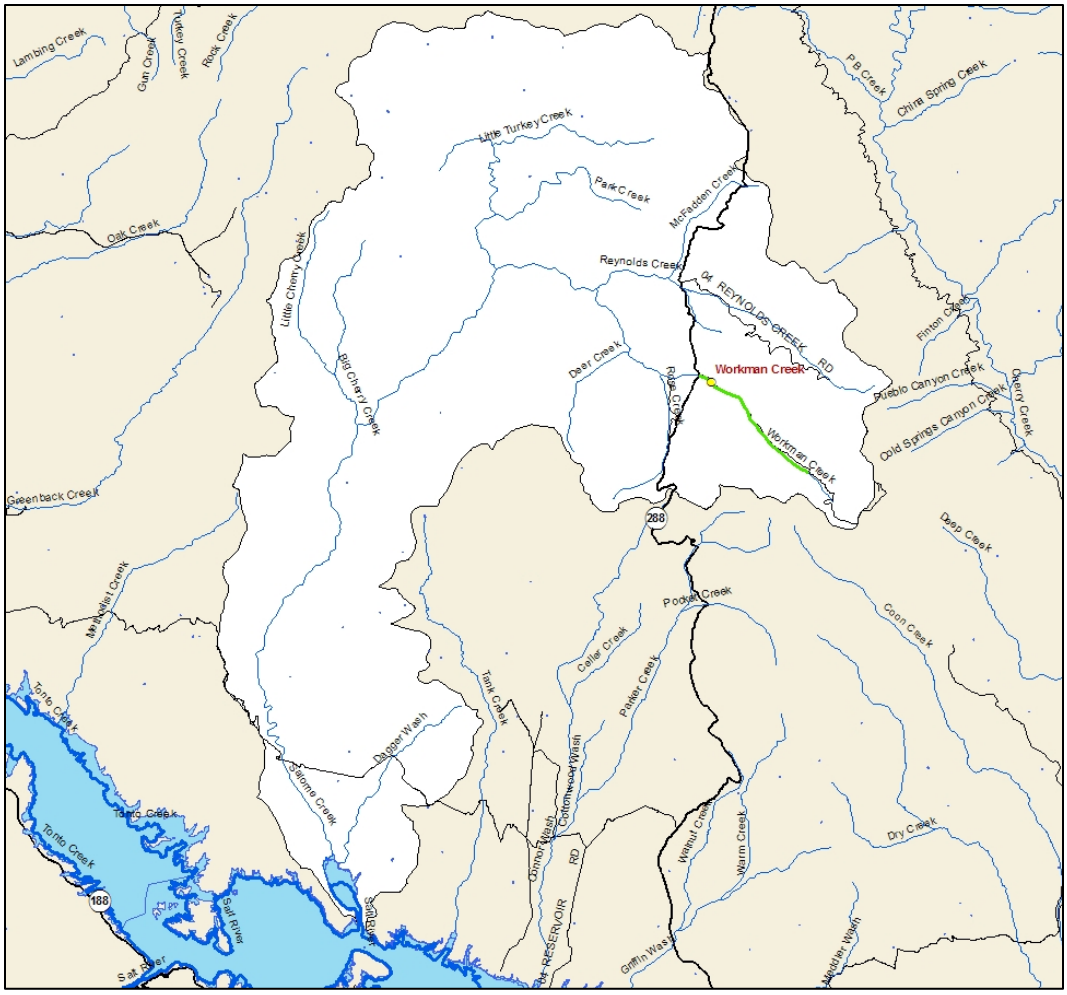

Figure 38. Map of Workman Creek stocking reach located in the Salome Creek drainage which flows into Roosevelt Lake.

Workman and Salome creeks are managed by the Tonto National Forest for all types of recreation, including camping, picnicking, fishing, water activities, hunting, birding, and hiking. The creek is accessible by road year round, except during extreme snow or rainfall. Land ownership along Workman Creek is almost entirely Tonto National Forest with the exception of private land inholdings at the Armer Ranch and the Dreamcatcher Ranch, located just west of Highway 288. Salome Creek is comprised of Tonto National Forest and 1% private lands.

Angling primarily occurs between Highway 288 and upstream to Workman Creek Falls during April through August (Figure 39). The creek is accessible by road east of Highway 288. West of Highway 288 it is accessed by a private road that is locked to the public. Lower Workman Creek is also accessible by the #288 hiking trail that joins Workman Creek below Armer Ranch, and again at Hells Hole, which is approximately one mile east of the Salome and Workman Creek confluence. Lower Workman Creek and Salome Creeks are extremely rugged and difficult to

access. Salome Creek is accessed at the lower end by the #61 Trail. This trail is used primarily by recreationists and not anglers.

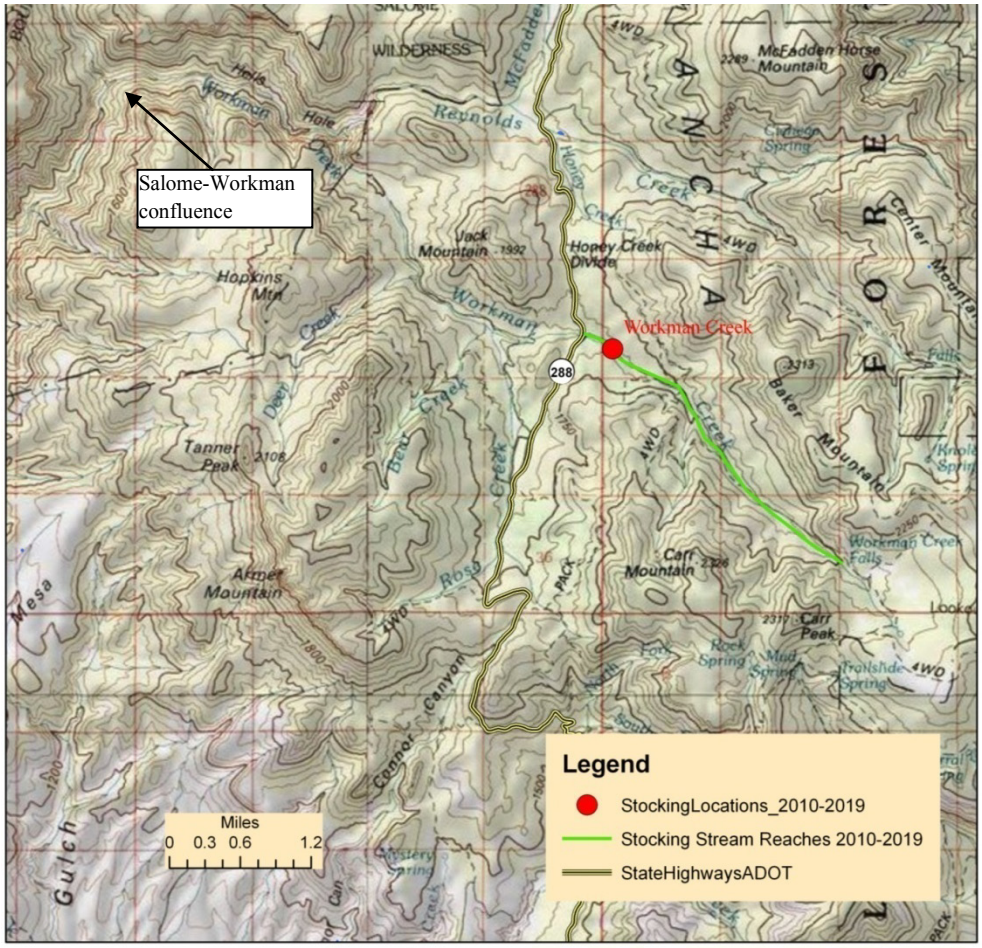

Figure 39. Map of Workman Creek, Hwy. 288 and Salome Creek area.

Management of Water Body

Workman Creek is managed as cold water intensive use, put-and-take rainbow trout fishery in the spring and summer months. It is typically stocked in April and May with approximately 400 trout stocked monthly (Table 31). Salome Creek and Reynolds Creek were stocked historically, but are not proposed for future stocking actions. Based on a 2001 survey of anglers conducted by the Department, Workman Creek provides 808 angler user days (an average of 2.2 anglers per day) for trout, which are supported primarily through the proposed stocking action, because reproduction is not sufficient to maintain a fishable population (Pringle 2004).

Table 31. Stocking history for Workman, Salome and Reynolds creeks.

Creek	Species	First Year	Last Year	Num Years Stocked	Num. Stocked
Workman Creek	Brook trout	1946	1947	2	1,575

	Brown trout	1974	1982	2	6,500
	Native trout*	1938	1938	1	9,000
	Rainbow trout	1939	2009	90	65,512
	Total				82,587
Salome Creek	Brown trout	1973	1974	2	6700
Reynolds Creek	Rainbow trout	1941	1946	5	14,101

Proposed Action

The proposed action is to stock rainbow trout (catchable and sub-catchable) in the spring and summer each year; numbers of trout may be from 0 to 1500 fish annually for the period covered under this consultation.

Water Distribution/Connectivity

Workman Creek begins at a spring east of Hwy 288 at 7000 feet in elevation and flows northwest approximately nine miles to the confluence of Salome Creek at 4000 feet elevation. Rose Creek and Deer Creek enter Workman Creek from the south downstream of Highway 288. Reynolds Creek flows into Workman Creek from the north, downstream of Rose and Deer Creeks and before Workman Creek joins Salome Creek. The water distribution and connectivity is unknown in Deer Creek and Rose Creek.

Reynolds Creek begins at 6800 feet elevation and is intermittent from its headwater downstream 5.2 miles to Hwy. 288. This stretch has abundant small pools and some larger pools. There is a 150 ft waterfall 4.7 miles upstream of Hwy. 288 in Reynolds Creek. Downstream of Hwy. 288, Reynolds Creek becomes perennial, resulting from several springs that appear as seeps. At 2.7 miles below the Young Road, the Reynolds Creek forms a bedrock canyon that flows into Hells Hole and into Workman Creek at 4700 feet in elevation. There are several waterfall/plunge pools that are fish barriers in this area of Reynolds Creek that preclude stocked trout in Workman Creek from accessing upper Reynolds Creek.

Salome Creek flows 14 miles to Roosevelt Lake from the Workman Creek confluence. Salome Creek begins at the confluence of JR Canyon and Little Turkey Creek at an elevation of 4200 feet, to Roosevelt Lake at an elevation of 2500 feet. Little Turkey Creek and Park Creek are tributaries to Salome Creek above the Workman Creek confluence. Big Cherry Creek and Little Cherry Creek are tributaries to Salome Creek below the Workman Creek confluence. It is unknown if these tributaries are perennial or intermittent, but these streams would flow into Salome Creek in a flood event.

Workman Creek is mostly perennial with intermittent and ephemeral reaches. The stream is generally well shaded by Douglas fir, ponderosa pine, oaks, large sycamores, alders, and willows

(Figure 2). Upstream from the stocking reach, above Workman Falls, the stream is ephemeral/intermittent. The stocking reach is perennial year round. Workman Creek below the stocked reach (downstream of Hwy 288) is ephemeral/intermittent and canyon bound; some stretches are waterless during dry years and in the summer months but may maintain some perennial pools during these years. The stream changes from a relatively flat forested riparian habitat with primarily boulder and cobble stream substrate above Hwy 288 to a bedrock canyon with a higher flow gradient with several deep, greater than 3 meter, pools. Patches of gravel that rainbow trout could use for spawning have been observed in Workman Creek but are sparse.

Salome Creek flows through a steep desert rocky canyon containing pools up to 30 feet deep, with swiftly flowing, shallow rocky areas. The surface flow in the lower reaches of Salome Creek is intermittent or entirely dry in the spring and summer. Salome Creek is frequently dry beginning at least 1 mile upstream of where the A-Cross Road intersects the creek, downstream to its confluence with Roosevelt Lake. Surveyors found very little water in Salome and Little Turkey Creek above their confluence in August 1994 (AGFD Salome Spot Check Report, August 1994).

Figure 2. Photo of Workman Creek.

Fish Movement

There are a number of falls on Workman Creek upstream and downstream of the stocked reach. These falls are barriers to upstream movement of fish out of the stocked reach, and barriers to fish movement into the stocked reach from downstream. One waterfall greater than 16 feet is located just upstream from the Salome confluence. Stocked rainbow trout and other existing fish can move downstream from the stocked reach of Workman Creek into Salome Creek, although in dry years and during the warmer months, the movements are restricted due to intermittent reaches below the stocking reach; however fish may persist in perennial pools that may be present. Downstream of the confluence of Workman Creek and Salome Creek, there is a large waterfall approximately 3 miles north of Salome's confluence with Roosevelt Lake (The Jug area) that restricts upstream movement of fish found between Roosevelt Lake and 'the Jug' approximately 3 miles north of Roosevelt Lake.

The highest surface water flows occur primarily in the winter months from long duration, low intensity storms, and secondarily from more infrequent flood events in summer-storm events from short-duration, high intensity thunderstorms (Figure 40). There is no stream discharge gauge for Workmen Creek, but USDA Surface-Water data from nearby Cherry Creek shows flood events are highest in January through March, and then surface flows are the lowest May through July, lessening the possibility of trout movement upstream and downstream of the stocked reach of Workman Creek (Figure 40). Trout could be pushed or actively migrate downstream from Workman Creek, into Salome Creek, and then into Roosevelt Lake by flood events. Rainbow trout are stocked in April and May when surface water is at or near base flow and peak flood events are the most infrequent. Overwintering trout may be available to move downstream during winter/spring flow events as well.

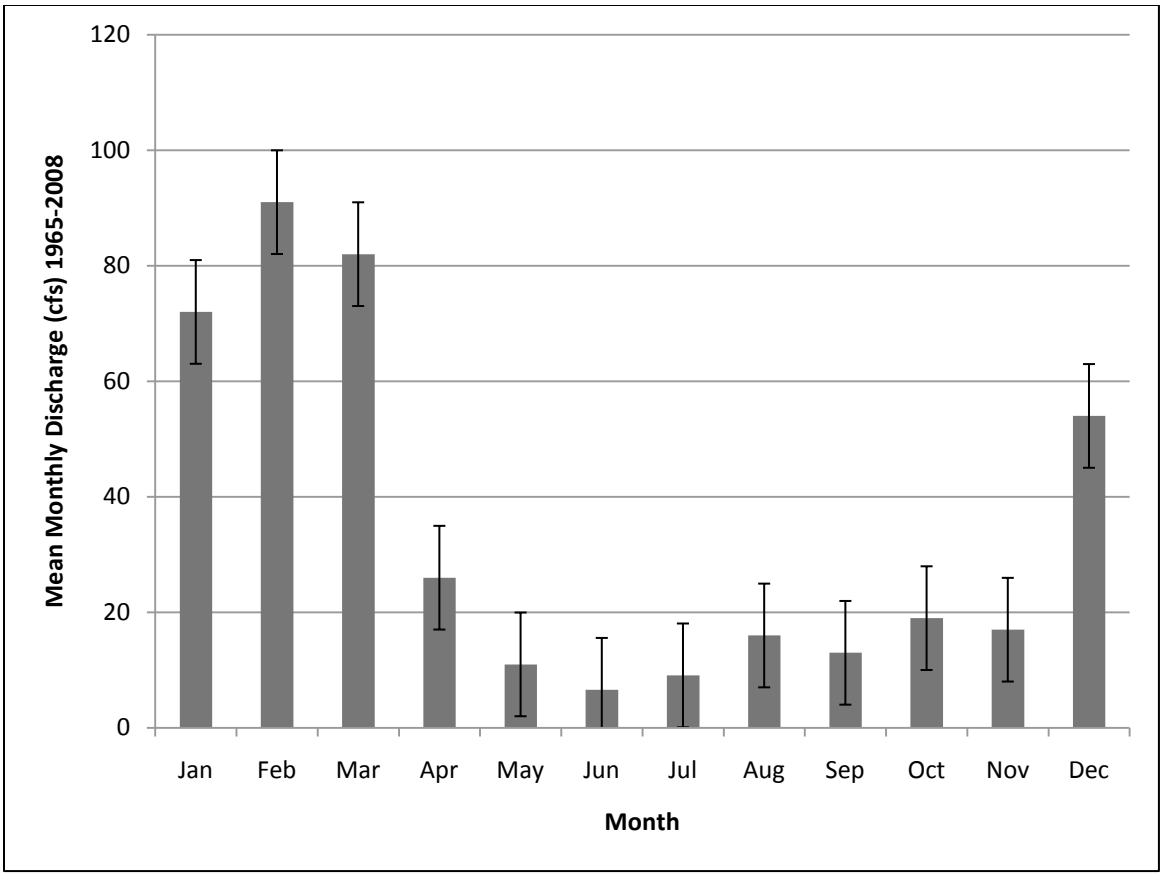

Figure 40. USGS Stream gage 00060 at Cherry Creek near Globe; mean (1 SE) monthly discharge (cfs) for 44 years of record (1965-06-01 to 2008-09-30).

Community Description

Fish surveys of various reaches in the Salome sub-watershed have reported rainbow trout, brown trout, brook trout, longfin dace, yellow bullhead, fathead minnows, green sunfish, roundtail chub, speckled dace, red shiners, and suckers of an unknown species (Table 32). The headwaters of Salome were surveyed in 1973 and only brown trout were reported. Fingerling brown trout were reported, indicating a self-sustaining population. The upper portion of Workman Creek above Highway 288 contains rainbow trout. Brook trout were found there in 1967 but have not been found since. From Highway 288 downstream to the confluence of Salome, rainbow trout, speckled dace, and longfin dace have been collected. In 2006, a visual survey was conducted from the Hells Hole Trailhead to the confluence of Salome Creek. Rainbow trout young were detected, indicating the occurrence of natural reproduction in the lower end of Workman Creek (Gill 2006b). Roundtail chub have never been reported in Workman Creek.

The most recent visual encounter/dip-net survey in 2006, covering Workman Creek from Highway 288 to Salome Creek found Longfin dace and Rainbow trout in Workman above its confluence with Salome Creek (Gill 2006d). Canyon treefrogs were also common; a black-

necked garter snake was caught. No crayfish were seen in either Workman or Salome in 2006 (Gill 2006d).

Surveys in 1994 of Reynolds Creek near Hwy 288 crossing found rainbow trout (11 fish ranging from 85-197 mm) and longfin dace (n = 15)(AGFD 1994). Speckled dace were found in a survey at the Ranger Station in 1967 (McDonald and Todd 1967). No roundtail chub have been reported in Reynolds Creek. Rainbow trout have not been stocked in Reynolds Creek since 1947, so the rainbow trout are self sustaining because pool/fall complexes preclude upstream movement of rainbow trout. No surveys have been conducted in Rose Creek and Deer Creek, which are tributaries to Workman Creek, and fish and other aquatic species assemblages are unknown.

Upstream of the Workman Creek confluence in Salome Creek, only green sunfish were collected in 1994 and 2000 surveys (Voeltz 2002). In 2007, downstream of the confluence of Workman Creek and Salome Creek, Burger found green sunfish to be the dominate species, along with "several" rainbow trout (Gill 2006d). In this stretch, roundtail chub, yellow bullhead, green sunfish, and rainbow trout were collected in 2000 (Voeltz 2002). Roundtail chub were only found in the lower reach (Voeltz 2002) at an area below a 32 foot waterfall just above "the Jug". At approximately 3 miles north of the Roosevelt Lake confluence, downstream from "the Jug" to the A-Cross road crossing, rainbow trout, roundtail chub, desert sucker, green sunfish, red shiners, and fathead minnows were reported in 1988 (ASU 1988) and 1997 (Voeltz 2002). The 1997 collection of rainbow trout occurred June 30, thus rainbow trout are assumed to persist year-round in this area.

Surveys of Little Turkey Creek (a tributary to Salome Creek) in 1994 found only green sunfish. Anglers consistently report catching brown trout in Little Turkey Creek (N. Robb and C. Gill pers. comm.)

No recent fisheries survey data exists for Little Turkey Creek and Park Creek, which are tributaries to Salome Creek above the Workman Creek confluence, and Big Cherry Creek and Little Cherry Creek, which are tributaries to Salome Creek below the Workman Creek confluence.

Table 32. Summary of fish surveys in Salome Watershed.

Date	Collector*	Location	Survey Type	Source	Species
May 24, 1967	AGFD McDonald, Todd	Workman Crk, from Hwy 288 upstream 2.1 miles	Electro shocking	Data Sheets	brook trout rainbow trout
				Num. and Size of Rainbow Trout (if Known)	9 (80-119mm) 7 (120-160 mm)
Sep 6, 1994	AGFD Carrothers, 640, 695	Workman Crk – at Confluence of Reynolds Crk	Electro shocking	Data Sheets	rainbow trout

Date	Collector*	Location	Survey Type	Source	Species
				Num. and Size of Rainbow Trout (if Known)	4 (60-99 mm) 6 (100-159 mm) 13 (160-239 mm)
1980	ASU	Workman Crk-Hwy 288 to above falls	Unknown	Kansas Gap	rainbow trout
				Num. and Size of Rainbow Trout (if Known)	1 rainbow trout
June 13, 1986	AGFD 604	Workman Crk-at YMCA Camp	Electro shocking	NFDB	rainbow trout brown trout
				Num. and Size of Rainbow Trout (if Known)	9 (00-59 mm) 13 (120-139 mm) 15 (220-259 mm)
Nov 6, 2006	AGFD Gill	Workman Crk, Trail 284 to confluence of Salome Creek	Visual	Trip Report	Longfin Dace rainbow trout
				Num. and Size of Rainbow Trout (if Known)	Stocked size Smaller than stocked size
May 29-30, 2007	AGFD Burger	Workman Crk, Hwy 288 to Salome Confluence	Visual Dipnet	Trip Report	Longfin Dace rainbow trout
				Num. and Size of Rainbow Trout (if Known)	“Several “ rainbow trout Size unknown
May 14, 1973	AGFD	Salome Creek, Headwaters	Electro shocking	AGFD Memo	Brown trout
				Num. and Size of Rainbow Trout (if Known)	15 adult, 2 fingerling brown trout
1988	SonFish-ASU	Salome Creek between A-Cross Road upstream to “the Jug”	Unknown	Kansas Gap	Yellow Bullhead Longfin Dace Green Sunfish Fathead Minnow Red Shiner
June 30, 1979	AGFD Cooper	Salome Crk, below falls, 3 miles N of Roosevelt Lake	Unknown	Trip Report	Roundtail Chub Sonoran Sucker Longfin dace Rainbow trout
				Num. and Size of Rainbow Trout (if Known)	1 (3 inches) 3 (8 to 9 inches) 1 (15 inches)
Aug 22-24, 1994	AGFD 694,695	Salome Crk upstream from Reynolds Creek to above confluence with Little Turkey Creek	Electro shocking	Spot Check Survey	Green Sunfish Brown trout Specked Dace
June 30, 1997	AGFD Duncan,	Salome Creek at “The Jug”	Angling Visual	Trip Report	Green sunfish Roundtail chub

Date	Collector*	Location	Survey Type	Source	Species
	Carlson				Rainbow trout Unidentified sucker
Num. and Size of Rainbow Trout (if Known)					Approx 24 rainbow trout Size unknown
June 7-8, 2000	AGFD Timmons	Salome Creek, at Tinajas west of Dutchwoman Butte above "the Jug"	Gillnets, seines, angling	Timmons 2000	Yellow bullhead Green Sunfish Roundtail Chub
Aug 22-24, 1994	AGFD 694,695	Little Turkey Creek upstream from confluence of Salome Creek	Electro shocking	Spot Check Survey	Green Sunfish
May 29-30, 2007	AGFD Burger	Salome Crk, from Workman confluence downstream to just above "the Jug"	Visual Dipnet	Trip Report	Green Sunfish rainbow trout
Num. and Size of Rainbow Trout (if Known)					1 Rainbow Trout, size unknown
May 26, 1967	AGFD McDonald, Todd	Reynolds Creek at Ranger Station	Electro shocking	NFDB	Speckled Dace
Sep 7, 1994	AGFD 694,697, AC	Reynolds Creek below Group Site	Electro shocking	Trip Report	longfin dace rainbow trout
Num. and Size of Rainbow Trout (if Known)					5 (80-99)mm) 1 (160-179 mm) 5 (180-199 mm)
Sep 6, 1994	AGFD 640,694, 695	Reynolds/Workman Confluence	Electro shocking	Trip Report	Longfin Dace Rainbow Trout
Num. and Size of Rainbow Trout (if Known)					5 (80-99 mm) 1 (160-179 mm) 5 (180-199 mm)

**three digit numbers in the collector column are AGFD numbers assigned to employees by position*

Consultation Species or Critical Habitat
Potential impacts to the Mexican spotted owl and critical habitat, and roundtail chub are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed

action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Mexican Spotted Owl and Critical Habitat

The stocking stream reach is within Mexican Spotted Owl (MSO) critical habitat (CH), occurs within a buffer, and also occurs within a PAC. There appears to be the opportunity for angler access on the upstream part of the stocking reach with access becoming limited further downstream.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within boundary of at least one MSO PACs in the general vicinity of the site. There may be some disturbance of MSOs at the nest site, roosting or foraging areas within the PAC during the breeding season.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Roundtail Chub

Roundtail chub are found in Salome Creek; however, the extent of the creek occupied by the species is unknown, because much of the creek is in steep canyons that limit access for surveys. Surveys in the lower reach near Roosevelt Lake in June 1979 found roundtail chub, rainbow trout, and suckers below a set of waterfalls (Cooper 1979). Above these waterfalls, green sunfish dominate the fish population along the entire stretch upstream to the confluence of Workman and Salome Creek. Roundtail chub have also been documented in the reach known as "The Jug" that extends from about 4 miles to 7 miles above A-Cross Road. (Duncan 1997; Timmons 2000). The Salome Creek roundtail chub population is designated as unstable-threatened (Voeltz 2002).

Reynolds Creek currently contains rainbow trout, upper Salome has brown trout, and the entire stretch of Workman Creek and Salome Creek contain rainbow trout (the latter apparently year-round). Workman Creek has been stocked with rainbow trout since 1939. Brook trout have not been stocked since 1947 but were sampled in a survey in 1974, suggesting that they were self reproducing in the system for over twenty years. Brown trout were stocked historically in both Workman Creek and Salome Creek. Brown trout were found in the headwaters of Salome in 1979 and 1994, although they have not been stocked in Salome since 1974.

Surveys have found not only the stocked size trout (either stocked or recruited) but also young of the year (YOY) rainbow trout in Workman Creek, Reynolds Creek, and Salome Creek (Table 32). The presence of trout smaller than the size that is consistently stocked is indicative of natural reproduction and a self-sustaining population of rainbow trout. Surveys in 1967 found two YOY rainbow trout; 1994 found 3 YOYs rainbow trout; there were 9 YOY rainbow trout in 1986; and in 2006 one YOY was observed. In 1994, 10 YOY rainbow trout were also been observed in Reynolds Creek. In 1979, a fingerling brown trout was also found in the upper reach of Salome.

The rainbow trout stocked in Workman Creek can move down the creek five and a half miles toward Salome Creek during flood events and winter months. The stream is intermittent with perennial pools during the summer so movement is less likely since summer flood events are less likely than winter storm events. A total of 800 rainbow trout are stocked in April and May, the beginning of the dry season, which limits trout movement in normal years until higher flows typically occur in December, January, February, and March. Angler catch and harvest rates are not known for Workman Creek; however, the creek does support approximately 800 angler use days per year (Pringle 2004). Rainbow trout are reported from lower Salome Creek (Duncan 1997) in habitat shared (presumably year round) with roundtail chub. It is not known how many of the stocked rainbow trout are moving into Salome Creek and how many trout in this area are wild trout that have recruited from the naturally reproducing population in the stream. The rainbow trout at “The Jug” were upstream of waterfall barriers and they may have come from Workman Creek as it is the only site in the Salome Creek drainage currently stocked with rainbow trout. The large number of angler use days and observed catch rates suggest that most of the stocked fish are harvested soon after being stocked. It is more likely that the trout in Salome Creek have long been established and are self sustaining.

Surveys of Salome Creek suggest the fish community is primarily dominated by green sunfish and yellow bullheads to a lesser extent. Given the community composition, these other nonnative fish species as well as brown trout (if present in this reach) likely contribute a larger piece to the overall impacts to roundtail chub via predation and competition than stocked trout. However, this analysis considers the incremental impacts by stocked species.

Potential Impacts

Roundtail chub are not present in Workman Creek based on surveys; however, exposure of roundtail chub to stocked trout could occur downstream in lower Salome Creek where stocked fish would join the self-sustaining populations of other fish. Roundtail chubs would not be able to access the stocked reach of Workman Creek due to the presence of barriers that restrict upstream movement. It is possible that stocked trout could be supplementing the self-sustaining populations, although the extent to which this may be occurring and the magnitude of any associated potential impacts is unknown since the impacts cannot be separated between them. Small trout size classes can compete with small roundtail chub size classes for habitat and food, but small trout can also serve as a prey source for larger roundtail. Adult stocked trout may compete with adult roundtail chub for habitat and food, and may also prey on small size classes of chub if present post chub spawning.

TONTO CREEK COMPLEX

Physical Geographic Description

Tonto Creek forms the longest continuous perennial stream within the Salt River watershed and flows southward for more than 55 miles from the Mogollon Rim to the Salt River at Roosevelt Lake (Figure 41 and Figure 42). The Tonto Creek watershed drains an area of 1042 square miles. The watershed elevation ranges from about 6500 ft at the headwaters to 2130 ft at the confluence with Roosevelt Lake.

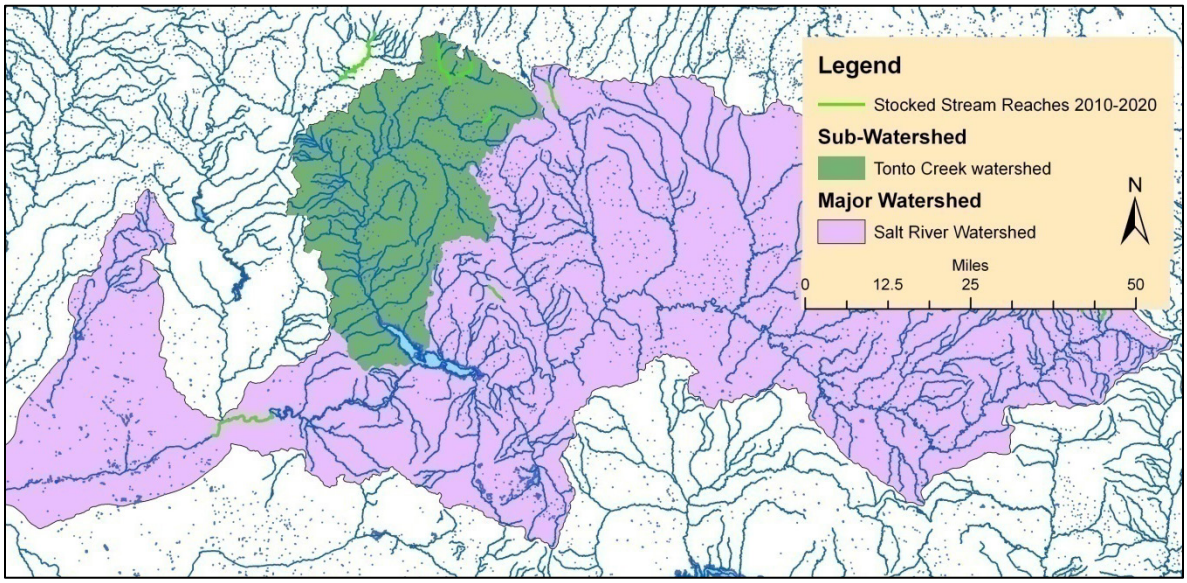

Figure 41. Overview map of the Tonto Creek drainage located within the Salt River watershed.

The Tonto Creek complex contains three proposed stocking locations: Tonto, Christopher, and Haigler Creeks (Figure 42). Christopher Creek is a tributary to Tonto Creek about 1.8 miles downstream of Hwy 260. Haigler Creek enters Tonto Creek another 9 miles downstream of Christopher Creek. The Christopher Creek confluence is within the proposed stocking reach on

Tonto Creek while the Haigler Creek confluence is 10 km (6 mi) downstream of the lowest most stocking site on Tonto Creek.

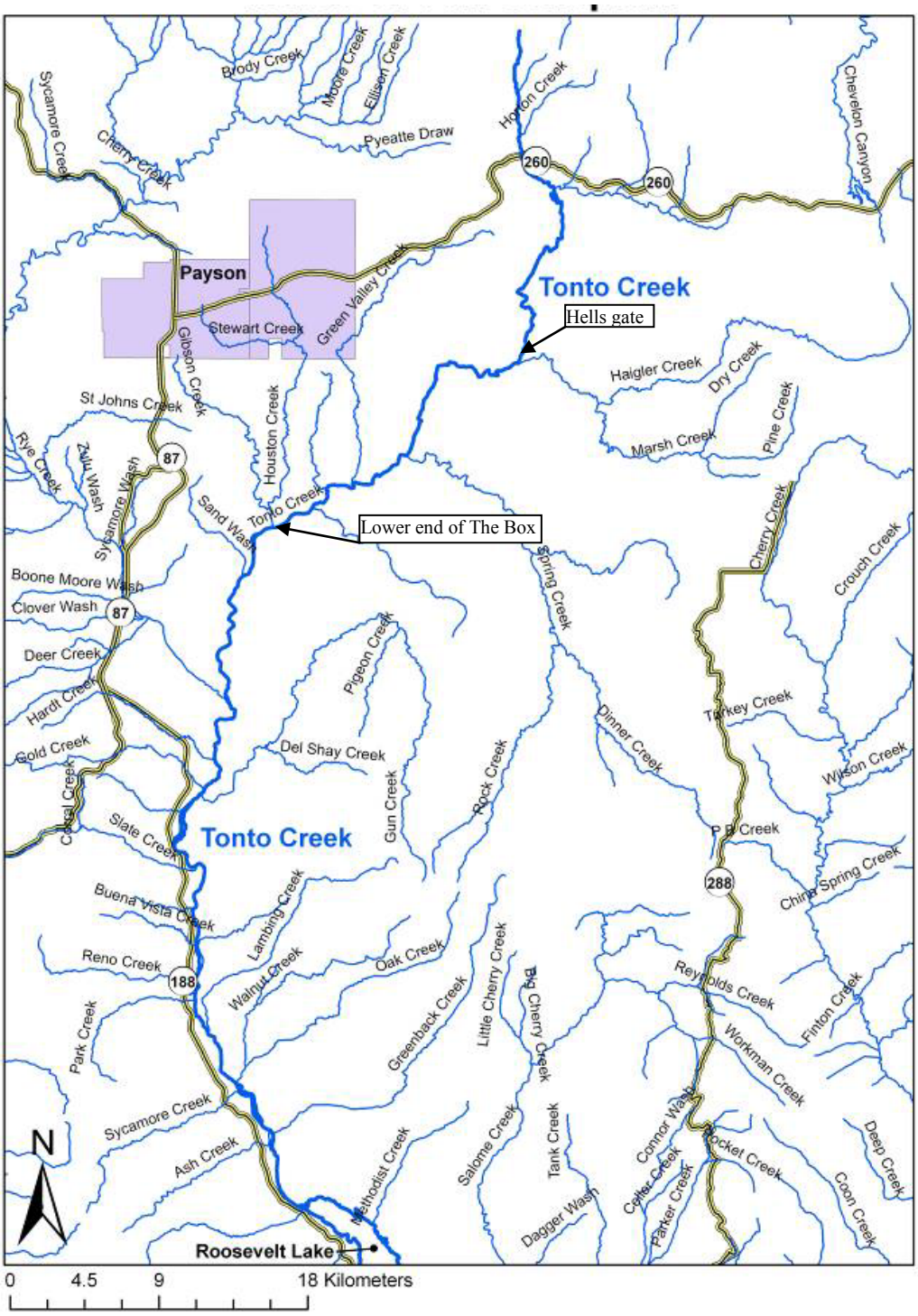

Figure 42. Overview map of the Tonto Creek Watershed.

Tonto Creek

Site Description

The watershed of Tonto Creek lies immediately below the Mogollon Rim. The stocked reach is located in the headwaters of Tonto Creek in Gila County and is roughly 7 miles long (Figure 42Figure 43). The stocked area begins just upstream of the confluence with Dick Williams Creek and ends at the Bear Flat Campground, downstream of the Highway 260 bridge crossing. It is approximately 16 miles east of Payson and is totally within the boundaries of the Tonto National Forest, although there are portions of stream with private cabins and in-holdings. The area ranges from 6400 ft to 5350 ft elevation and the stream gradient averages 93 ft/mi until the confluence with Gunn Creek, where it averages only 23 ft/mi.

Tonto Creek is managed by the Tonto National Forest for recreation, including camping, picnicking, hiking, bird watching, fishing, hunting, and water activities. The area includes the Horton day use area and the Upper Tonto Creek Campgrounds. These areas include picnic units and vault toilets. Tonto Creek is accessible by road from the Highway 260 turn-off to the fish hatchery and to recreation sites at the Bear Flat Campground from the Ponderosa Flat turn-off from Highway 260. Where access is not available from the road, short, steep hikes from Forest Road 289 can access much of the stream in the stocking reach. Below Bear Flat, Tonto Creek flows into the Hellsgate Wilderness and is only accessible by extremely rugged hiking until it approaches Gisela at “The Box”.

Tonto Creek originates in mixed conifer forest, dominated by Ponderosa pine and then transitions to a pinyon pine, juniper, oak, grass, and agave about 4 miles south of Bear Flat Campground. Tonto Creek again transitions from pinyon pine and juniper woodland into Sonoran desert below Hells Gate. Riparian trees include willow, Fremont cottonwood, Arizona Sycamore, net-leaf hackberry, Arizona Ash, and Arizona Alder. Much of the drainage was burned severely by the 1990 Dude Fire and is currently vegetated with grass and shrubs.

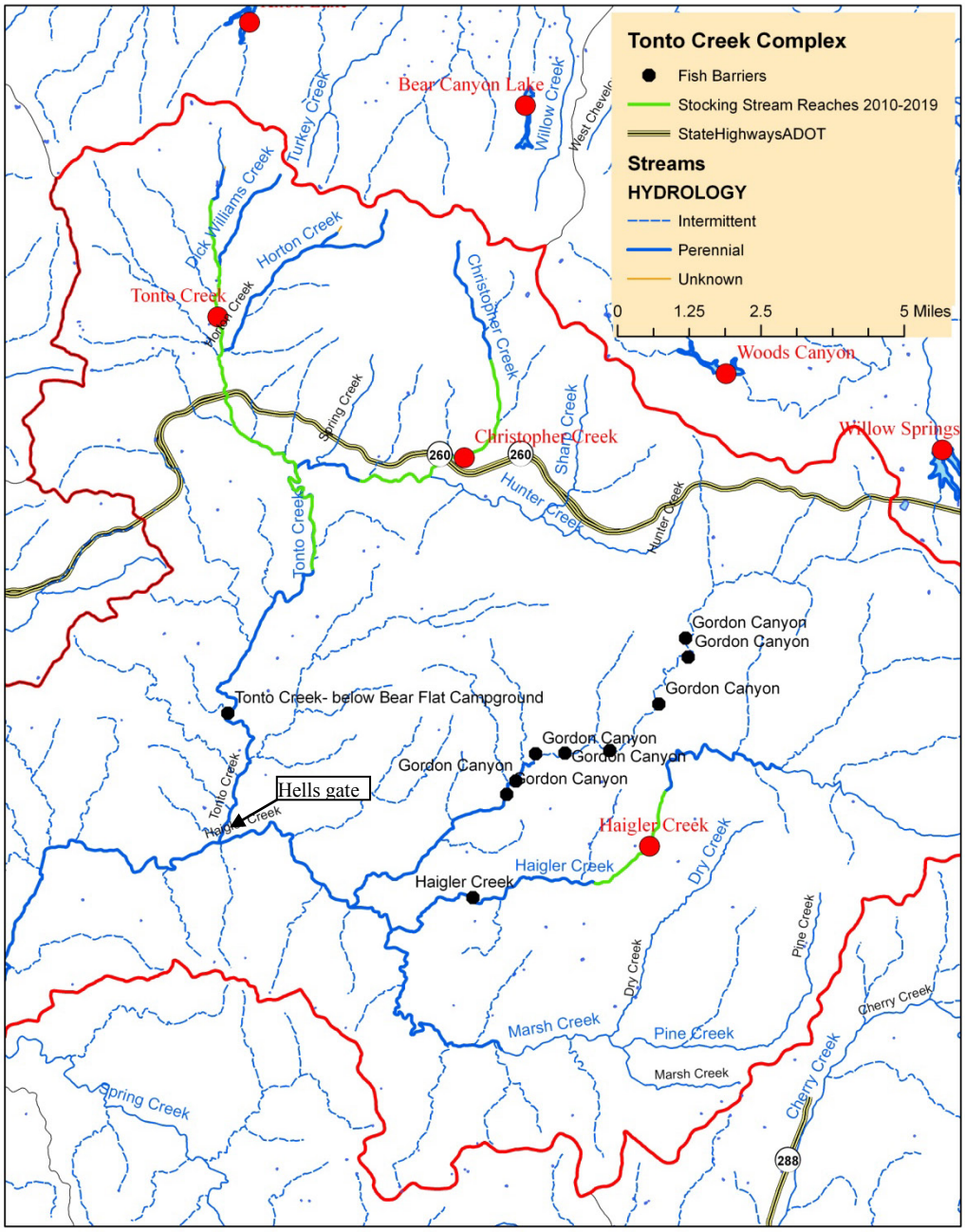

Figure 43. Stream reaches proposed for stocking in the Tonto Creek watershed.

Management of Water Body

Upper Tonto Creek is managed as a coldwater intensive use, put-and-take rainbow trout fishery throughout the spring, summer, and fall months. The rainbow trout fishery has been operating as a put-and-take cold water trout fishery for over 30 years. Trout are generally stocked at 14 sites along a 7 mile reach of stream below the hatchery. The majority of stocking sites (9) are concentrated along approximately 1.25 mi of stream between the 'Baptist Camp Bridge' and the FSR 289 bridge close to the confluence of Horton Creek. Three stocking sites are downstream of

the SR 260 bridge. Fish are stocked at a rate of approximately 1,300 to 3,000 fish per month between April 1 and October 1 annually. Peak rates of stocking are approximately 800 fish each week in mid-season.

As early as 1917, fish stocking was initiated by the Department in the upper Tonto Creek watershed (upper Tonto Creek goes from Tonto Spring down to the Bear Flat Campground). More than 2 million trout have been stocked into Upper Tonto Creek since 1933 (Table 33). Tonto Creek has received stockings of smallmouth bass and brook, brown, rainbow, and native trout of an undetermined species. Tonto Creek was also stocked with juvenile razorback sucker as part of a research program in 1987-1988. Except for brown trout, those fish no longer exist in the stocking reach. The middle (Bear Flat to Gisela) and lower reach (from Gisela to Roosevelt Lake) of Tonto Creek are managed as a basic yield fishery for warm water species.

A 1986 postal questionnaire identified 39,743 angler-use days spent at Tonto Creek during annual high use periods from April through September. Angler creel surveys from 1987 indicate high success rates (52%). There were 1.06 trout per angler caught, 0.86 fish per angler taken home and a 16% release rate (Warnecke 1988b). Based on a 2001 survey of anglers conducted by the Department, Tonto Creek provides 10,100 angler user days, which is an average of 27 anglers per day for trout, which are supported primarily through the proposed stocking action. Former Field Supervisor, Craig McMullen, who patrolled the creek, has observed that approximately 90% of the stocked rainbow trout are likely fished out within a week of being stocked (C. McMullen pers. comm.).

Table 33. Stocking history for Tonto Creek, Horton Creek and Spring Creeks.

Tonto Creek, Upper Reach (Tonto Spring to Bear Flat):				
Species	**First Year**	**Last Year**	**Num. of Years Stocked**	**Num. Stocked**
Brook trout	1936	1986	22	32,814
Brown trout	1933	1993	41	160,706
Native trout*	1936	1938	9	34,637
Rainbow trout	1933	2008	76	2,579,841
Razorback sucker	1987	1988	2	37,150
Smallmouth bass	1970	1970	1	121
			Total	2,844,819
Horton Creek:				
Species	**First Year**	**Last Year**	**Num. of Years Stocked**	**Num. Stocked**
Apache trout	1971	1971	1	23
Brook trout	1933	1947	16	44,016

Brown trout	1936	1974	7	15,839
Native trout*	1933	1939	4	19,375
Rainbow trout	1933	1965	179	247,025
			Total	326,278
Spring Creek:				
Species	**First Year**	**Last Year**	**Num. of Years Stocked**	**Num. Stocked**
Brown trout	1948	1991	6	25,300
Rainbow trout	1950	1950	1	300
Native trout*	1938	1938	1	1
			Total	40,600

**Historical record – listed as "Native trout", no species specified.*

Proposed Action

The Department proposes to stock catchable rainbow trout from April through October; number of trout may be from 0 to 16,000 fish each year for the period covered under this consultation.

Water Distribution / Connectivity

Tonto Creek is mostly perennial with seasonally intermittent stretches in its lower reach below Gun Creek, where the stream channel becomes wider and braided as it flows through a broad alluvial basin. A winter/spring peak occurs as a result of precipitation and snowmelt at higher elevations, and the second peak in summer is due to monsoonal rains (Figure 45). Groundwater discharge, evapotranspiration, and pumping from wells have dropped the water level in the alluvium below the level of the streambed during part of the year. The alluvium is the principal aquifer in the lower basin and yields large quantities of water to wells (Schumann and Thomsen 1972). Dick Williams Creek is a small but mostly perennial tributary of upper Tonto Creek. The creek enters a small canyon downstream of the Highline trail which has serveral elevation drops that function as barriers during low flows. Dick Williams Creek was dry in September 2008 from is confluence with Tonto Creek to 0.25 miles upstream (Kern and Burger 2008).

Horton Creek begins below the Mogollon Rim with southwesterly flows for approximately 5 miles where the creek enters upper Tonto Creek near the campgrounds, approximately a mile north of Highway 260. Horton is mostly perennial but is seasonally intermittent approximately 0.75 miles upstream of the Tonto Creek confluence and on the upper east fork above the confluence with Horton Spring. The surface flow averages approximately 8 cubic feet per second and no barriers have been observed.

Bull Tank Canyon flows into Tonto Creek approximately 1.5 miles upstream of Hells Gate. In June 2008, Bull Tank Canyon had no flow with isolated pools in the first 100 yards from its confluence with Tonto Creek (Burger 2008).

Spring Creek is a perennial stream with no known barriers that flows northwesterly into Tonto Creek (Figure 44). The stream receives heavy impacts from livestock near both the Flying W Ranch and the Spring Creek Ranch causing low woody species regeneration and stream channel widening and degradation. Dinner Creek, Walnut Canyon, and Bryant Canyon are also tributary to Spring Creek. Walnut Creek has two large waterfall barriers found approximately 1.5 miles upstream of its confluence with Spring Creek (Figure 44). Rock Creek forms at the confluence of Turkey Creek and Bearhead Canyon flowing in a northeasterly direction until it reaches Spring Creek and is mostly perennial. Stream flow was estimated to be 1 cubic foot per second (Riley and Clarkson 2006). Buzzard Roost flows into Spring Creek and is mostly perennial but becomes intermittent in its upper reach. Dinner Creek flows into Spring Creek near the Spring Creek Ranch and has no known barriers. Dinner Creek is perennial in its lower two miles.

Houston Creek flows south into Tonto Creek just below "The Narrows" with no known barriers in the Creek or in its tributary, Gibson Creek. Houston Creek's, total stream flow was noted at approximately 0.5 cubic feet per second from its confluence with Tonto Creek to approximately ½ mile upstream (Clarkson and Marsh 2006). Fathead minnow have been found in Gibson Creek above its confluence with Houston Creek in 1995, indicating at least intermittent hydrology Lutch 1995). However, normal water connectivity between Houston and Gibson Creek is unknown in Gibson Creek.

Rye Creek is a tributary to Tonto Creek, draining the northeastern slope of the Matazal Mountains and entering Tonto Creek southeast of Rye. No surface flows were present in Rye Creek above the Forest Road 184 bridge in 2000 (Voeltz 2002). In Deer Creek, about 2.5 miles upstream of Rye Creek intermittent flows are possible, although extent and timing is unknown.

Gun Creek is a tributary to Tonto Creek, flowing off the northern and western slopes of the Sierra Ancha Mountains with lack of perennial flow as found in 2000 with no stream banks. There is a natural fish barrier in lower Gun Creek approximately 4 meters high.

Cottonwood Creek flows east to west and then converges with Tonto Creek below Tonto Creek's confluence with Gun Creek on the Tonto National Forest. No information was found to describe the physical attributes of Cottonwood Creek except that is was classified as a desert stream.

Ash Creek and Greenback Creek are the most downstream tributaries of Tonto Creek.

Fish Movement

There are a number of falls on Tonto Creek upstream and downstream of the stocked reach. These falls are definite barriers to upstream movement of fish out of the stocked reach, and barriers to fish movement into the stocked reach from downstream.

There is a roughly 20 ft waterfall 820 ft upstream of the Horton Creek confluence, within the stocking reach on Tonto Creek, that is a barrier to the upstream movement of fish. Fish that are stocked upstream of the waterfall have the ability to move freely downstream, but fish stocked downstream of the barrier cannot move upstream. Evidence of this is that brown trout have been collected during recent surveys from the Horton Creek confluence downstream, but not upstream of this location (Gill 2005). Also, approximately 3 mi south of Bear Flat Campground is a 12 ft waterfall serving as a fish barrier halting upstream movement of fish in Tonto Creek. Fish from the stocking reach can move downstream over the waterfall. No stocking occurs below this barrier.

Stocked rainbow trout and other existing fish can move downstream from the stocked reach of Tonto Creek and ultimately into Roosevelt Lake. However, few adult rainbow trout have been documented downstream of Bear Flat campground, only one rainbow trout was documented downstream of the confluence with Haigler Creek (Hells Gate) to the town of Gisela and never downstream of Gisela (LCRB Aquatic; Burger 2007; Kern 2008b; and Holycross et. al. 2006). Stocked rainbow trout, after moving downstream of the stocked reach can then swim upstream into Tonto Creek's tributaries, although their movement is restricted due to barriers, warmer temperatures, and dry and intermittent reaches found in the tributaries.

The highest surface water flows in Tonto Creek occur primarily in the winter months from long duration, low intensity storms, and secondarily from more infrequent flood events in summer-storm events from short-duration, high intensity thunderstorms. A stream discharge gauge on lower Tonto Creek at the confluence of Gun Creek shows flood events are highest in January through March, and then surface flows are the lowest May through July. Rainbow trout are stocked April through October when surface water is at or near base flow and peak flood events are the most infrequent, lessening the possibility of trout movement upstream and downstream of the stocked reach of Tonto Creek (Figure 45).

In conclusion, stocked rainbow trout are mostly restricted in the summer from moving downstream of Hells gate most likely due to higher water temperatures and limited, if any, overwintering has been documented to occur within the stocked reach due to poor habitat and angling pressure (Warnecke 1988b, C. Gill pers. comm., LCRB Aquatic GAP, Burger 2007, Kern 2008b, and Holycross et. al. 2006).

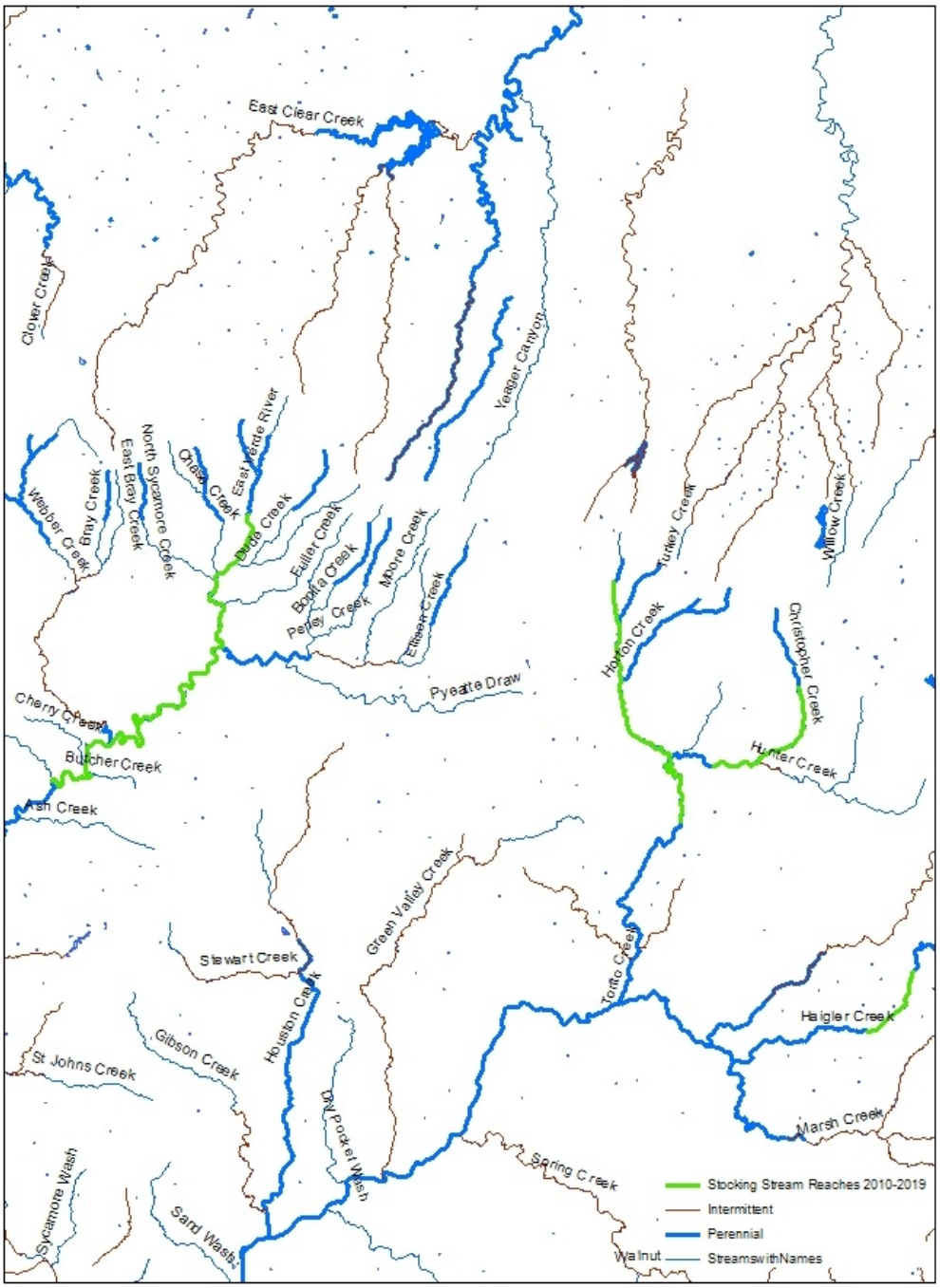

Figure 44. Tonto Creek and connecting tributaries.

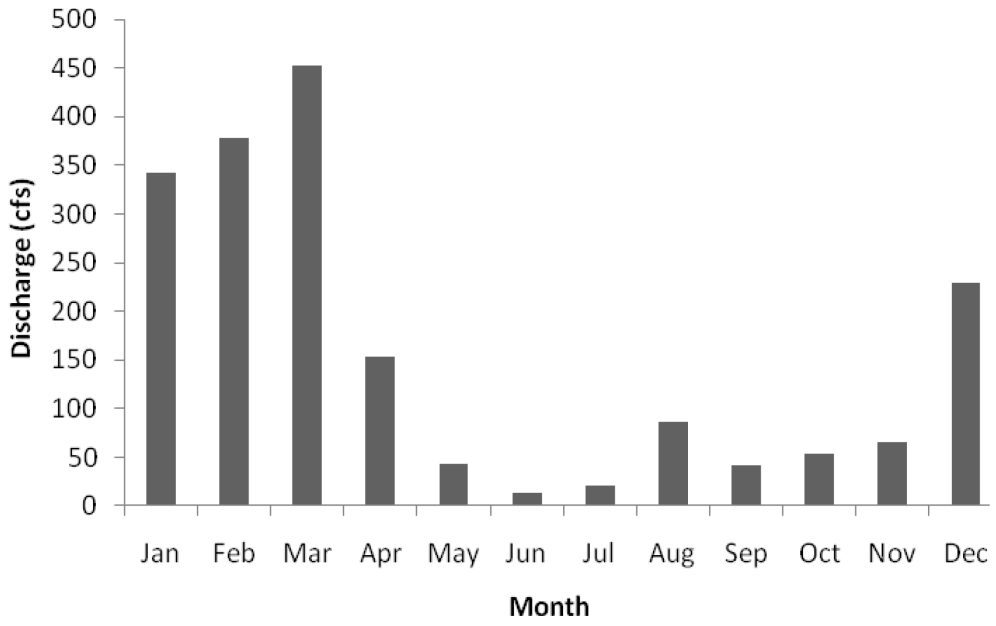

Figure 45. Mean monthly discharge for the period from 1941 to 2008 for Tonto Creek above Gun Creek, near Roosevelt, Arizona.

Community Description

Historically, Upper Tonto Creek supported only native species of fishes, potentially including longfin dace, speckled dace, Sonora sucker, desert sucker, headwater chub, spikedace, and loach minnow (Abarca and Weedman 1993). Headwater chub has been identified as the chub inhabiting the Tonto Creek watershed upstream of Roosevelt Lake (Minckley and Demarais 2000). They are currently known to exist in suitable habitats of the main stem of Tonto Creek and many of its tributaries, including Haigler, Buzzard Roost, Marsh, Rock, Dinner, and Spring Creeks below about 5500 feet in elevation (AGFD HDMS and Carveth 2007). Surveys reporting headwater chub from Tonto Creek are sporadic; efforts in the 1980s and 1990s show chub present from near Punkin Center upstream to the confluence with Haigler Creek at Hells Gate. Surveys in 1992 and 2008 noted headwater chub only above the vicinity of Hells Gate (Burger 2008b and AGFD Native Fish Database 1992).

The most recent surveys in 2005 (Gill 2005) and 2008 (AGFD unpublished data) indicate that the upper portion of Tonto Creek supports brown trout, rainbow trout, desert sucker, and longfin dace. Brown trout is not currently stocked, but represented a substantial portion of the fish community relative abundance in 1988 and 2008 from above the Horton Creek Confluence to just below the Bear Flat Campground within the reach proposed for rainbow trout stocking (Warnecke 1988a, 1988b). Speckled dace have not been documented from Upper Tonto Creek since 1984 when only 2 individuals were collected, despite surveys in 1991/1992 (Abarca and Weedman 1993), 2005 (Gill 2005) and 2008 (Kern 2008, Bear Flat to Hell's Gate). Rainbow

trout, longfin dace and desert suckers comprised a majority of the fish collected in the stocked reach.

Below the stocked reach, downstream of Bear Flat Campground, native headwater chub, longfin dace, desert sucker, Sonora sucker, speckled dace, rainbow trout, brown trout, green sunfish, and yellow bullhead were reported from the most recent survey in 2008 (Kern 2008b). Adult and young of the year rainbow and brown trout were commonly found in this stretch, indicating natural reproduction. In 2008, headwater chub were first seen directly below the 12 ft waterfall barrier about 3 miles downstream from Bear Flat Campground (Kern 2008b).

Downstream from the falls below Bear Flat Campground, rainbow trout and headwater chub were commonly observed in the same stream sections, although the trout numbers seemed to decrease the further downstream. A snorkel survey and a gill net set were completed in Tonto Creek downstream of Hells Gate (confluence of Haigler) with no rainbow trout sampled during June (Kern 2008b). Additionally, Burger (2007) did not report observing any rainbow trout on a survey of Tonto Creek between Hells Gate and Gisela, although Holycross et al. (2006) reported adults of both rainbow and brown trout between Bear Flat and Hells Gate in 2004. This indicates the lower most extent of trout is approximately around the Hells gate area.

Limited evidence is seen indicating successful reproduction of rainbow trout and brown trout in the stocked reach of Tonto Creek. However, more evidence is available below the stocked reach. Persistence of brown trout over time and the collection of small fish indicate that some successful reproduction occurs; reproduction of brown trout is also known to occur in Horton Creek (Warnecke 1988a). A majority of the rainbow and brown trout surveyed in upper Tonto Creek, from above the Horton Creek confluence to the Bear Flat Campground, during 1988 were less than 150 mm, which indicates that some reproduction but limited winter carry-over from the previous year (Warnecke 1988b). In 1993, the size of most captured rainbow trout indicate they were stocked fish, although there were some small rainbow trout that could have been the result of natural recruitment or escape from the hatchery (Abarca and Weedman 1993). Young of the year rainbow and brown trout have been captured at locations downstream of the stocked area, including between Bear Flat and Hells Gate (Gill 2005 and Kern 2008b).

Only one trout has ever been documented downstream of Hells Gate. This trout was found in the Gisela reach in 1970 (LCRB Aquatic GAP). Trout were not found during multiple surveys further downstream between Houston and Gun creeks in 2004 and 2005; mosquitofish, green sunfish, red shiner, carp, and catfish were found in those summer surveys (Holycross et al. 2006). Green sunfish and headwater chub were reported as common in Tonto Creek between Hells Gate and Gisela in a May 2007 survey (Burger 2007). Only smallmouth bass and green sunfish were sampled in October 2009 just above Gisela; however, carp were also observed (M. Dahlberg pers. comm.). Surveys in 1991 and 1992 (Abarca and Weedman 1993) found headwater chub from the confluence of Tonto Creek and Gun Creek upstream to the confluence

with Jones Canyon, which is approximately 3 miles downstream of the "The Box" which is downstream of Gisela.

Also noted in 1991 and 1992, downstream of the Gunn Creek and Tonto Creek confluence to Tonto Creek's terminus at Roosevelt Lake, green sunfish, red shiner, mosquito fish, common carp, smallmouth bass, largemouth bass, yellow bullhead, fathead minnow, speckled dace, desert sucker, and longfin dace were found (Table 34). No headwater chub or trout were found from Gunn Creek downstream to its confluence with Roosevelt Lake.

No survey records exist for Dick Williams Creek until 2008. No fish were observed along its entire length despite excellent viewing conditions. The relative abundance of aquatic invertebrates, adequate flow and habitat diversity are indicative of a stream capable of supporting a fish community. It is plausible that a large flood event or severe drought conditions eliminated the fish community at some point in the past, and that lack of navigable water in the lower potions of the creek have prevented Tonto Creek resident fish from re-populating Dick Williams Creek (Kern 2008b).

Horton Creek has had a self-sustaining brown trout fishery throughout the creek for the past 25 years. Brook, rainbow and brown trout have been stocked in the creek since the 1930's. The last stocking was of approximately 2,000 brown trout fingerlings in 1974. Brown trout is the only fish species recorded in Horton Creek since 1965, the last year rainbow trout were stocked (Table 35). Anglers currently report catching brown trout in Horton Creek. Twenty three Apache trout were stocked in 1971 (Table 33) with three Apache trout sampled in 1972. In 1935 "bonytail" chub were reported, which were likely headwater chub. Other than this record, no survey records or collections reporting chubs in Horton Creek are found and headwater chub are considered extirpated from the stream (Voeltz 2002).

Spring Creek was stocked historically (Table 33) with brown trout, rainbow trout, and native trout of an unknown species. Brown trout were stocked until 1991. The earliest collections of chub from Spring Creek were made in 1934 in the lower and upper portions of the creek. Surveys of Spring Creek since 1990 have recorded headwater chub, speckled dace, desert sucker, brown trout, yellow bullhead and green sunfish. In 2001**,** Spring Creek was found to have abundant headwater chub in the uppermost reaches. Speckled dace were also abundant; brown trout common, desert sucker uncommon, and mosquito fish and fathead minnow rare. Chubs were common in the middle reach (Bear Flat to Gisela); green sunfish and yellow bullhead abundant, and brown trout rare (LCRB Aquatic GAP).The latest spot survey in 2002 showed headwater chub, green sunfish, yellow bullhead and mosquito fish. No frogs or turtles were noted (Burger et al 2002). Anglers currently report catching brown trout in Spring Creek. Rainbow trout have never been sampled in Spring Creek since they were stocked historically.

Walnut Canyon is a tributary to Spring Creek. The only record of fish collected is of green sunfish in 2002. An unnamed tributary to Walnut Canyon contained green sunfish, Sonoran mud turtles, and bullfrogs (Burger et al. 2002). Rock Creek and Buzzard Roost, both tributaries to Spring Creek, are known to have desert sucker, headwater chub, brown trout, and speckled dace. Surveys were conducted in 1993 and 2001. It is unlikely that a sustainable chub population exists above the Buzzard Roost Ranch due to intermittent flows (Voeltz 2002).

Dinner Creek is a tributary to Spring Creek. The only documented survey was in 2007. Surveyors found green sunfish near its confluence with Spring Creek, and desert sucker and headwater chub upstream for approximately two miles.

Houston Creek contains longfin dace, green sunfish, and smallmouth bass (Burger 2005). Smallmouth bass, bullfrogs, and crayfish were observed by Marsh and Clarkson in 2006 just above its confluence with Tonto Creek (Clarkson and Marsh 2006).

Only fathead minnows have been found in Gibson Creek by a spot survey in 1995. No other survey records are known.

Many species of native and non-native fishes (but no rainbow trout) have been found in Rye Creek historically, mostly within one mile of its confluence with Tonto Creek. The most recent spot check survey in Rye Creek was October 2005, and only red shiners and an unidentified catfish were sampled. In past surveys in 1979, 1995 and 2000, smallmouth bass, green sunfish, yellow bullhead, channel catfish, desert sucker, sonoran sucker, speckled dace, and longfin dace were sampled. Headwater chub were last sampled in 1995 (LCRB Aquatic GAP). The headwater chub population in Rye Creek is likely extirpated due to lack of suitable habitat and the presence of nonnative fish and crayfish (Voeltz 2002). Deer Creek is a tributary to Rye Creek where desert sucker, green sunfish, and longfin dace were found in the only known survey (Lutch 1995).

Headwater chub were collected from lower Gun Creek during surveys in 2000 (LCRB Aquatic GAP). All chubs were found in the only water left, a few bedrock pools, and displayed signs of stress. A survey in the middle reach of Gun Creek during the summer of 2000 and one performed in 2002 (Burger et al. 2002) found only speckled dace. Green sunfish were also found in the lower reach. Black-necked garter snakes, canyon tree frogs, and Sonoran mud turtles were seen in this reach as well.

Historical records for Chiricahua leopard frogs exist in the vicinity. Recent surveys have found narrow-headed gartersnakes in the Tonto Creek within the complex, but not northern Mexican gartersnakes, although both are found within Tonto Creek downstream of the stocking complex.

Crayfish are common to abundant in lower portions of Tonto Creek, including upstream of Highway 260, but they decrease substantially in the uppermost reaches.

Table 34. Fish survey summary for Tonto Creek.

Date	Collector	Location	Survey Type	Source	Species	Num. and Size of Rainbow Trout (if known)
March, 1984	AGFD Warnecke	Upper Tonto Creek – Stocked Reach	Electro shocking	Management Report	brook trout rainbow trout brown trout desert sucker	1 (80-99 mm) 12 (100-119 mm) 6 (120-139 mm) 1 (180 mm) 1 (260 mm)
Oct, 2003	AGFD, Weedman	Upper Tonto Creek – Stocked Reach	Electro shocking	Trip report	rainbow trout longfin dace green sunfish desert sucker brown trout	17(84-310mm) Average 230 mm
Oct, 2005	AGFD Gill	Upper Tonto Creek – Stocked Reach	Electro shocking	Trip report	longfin dace rainbow trout green sunfish brown trout desert sucker	63 (70-295 mm) 60% <130 mm -all at Bear Flat Campground 33% >200 mm
June 16-19, 2008	AGFD Kern, Hanna, Burger	Tonto Creek – Bear Flat to Hells Gate	Visual and Net	Trip Report	rainbow trout brown trout longfin dace specked dace unknown Sucker Green sunfish	Adult and YOY rainbow and brown trout
Aug 28, 1991 and June 1992	AGFD Abarca and Weedman	Upper and Lower Tonto Creek	Seines and electro shocking	Trip Report	Longfin Dace Mosquitofish Common Carp Smallmouth bass	Juveniles < 100 mm not collected for survey

Date	Collector	Location	Survey Type	Source	Species	Num. and Size of Rainbow Trout (if known)
					Largemouth bass Yellow bullhead Red shiner Fathead minnow Speckled dace Desert sucker Green sunfish Headwater chub Sonoran sucker Rainbow trout	

Table 35. Fish survey summary for Horton Creek.

Date	Collector	Location	Survey Type	Source	Species	Num. and Size of Rainbow Trout (if Known)
1965	AGFD	Horton Creek	Unknown	HDMS	Rainbow trout	Approx 24 rainbow trout, Size unknown
May 2, 1968 May 10, 1967 May 9, 1966	AGFD McDonald & Peterson	Horton Creek	Electro shocking	Trip Report	Brown trout	
March 1984	AGFD Warnecke	Horton Creek	Electro shocking	Fish Management Report	Brown Trout	

Consultation Species or Critical Habitat
Potential impacts to bald eagle, Chiricahua and northern leopard frogs and headwater chub are addressed below. Potential impacts from stocked fish movement downstream on northern Mexican and narrow-headed gartersnakes are discussed in the Tonto Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local and broad scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Bald Eagle
Woods Canyon Breeding Area is located approximately 8.4 miles from Tonto Creek. The Tonto Creek stocking reach is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2008 and were last observed in 2009. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 98.5%, mammals for 0.7% and unknown for 0.7%. Of the prey items further identified to species, rainbow trout accounted for 99.3% and ground squirrels for 0.7%. Woods Canyon Breeding Area productivity data shows that the nest failed in 2008 when an intense late spring snow storms occurred a few days before the confirmed failure. In 2009 the nest was successful (McCarty and Jacobson 2008, 2009). Tonto Creek does not currently have monofilament bins present.

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Chiricahua Leopard Frog
Local Analysis: Although Tonto Creek and the Tonto Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to stocked fish in the 5-mile buffered stocking complex that includes Tonto Creek is low. There are no historical records for Chiricahua leopard frogs from Tonto Creek; however, there are historical records for Chiricahua leopard frogs from 2 sites in the

buffered stocking complex, one of which includes current observations: Ellison Creek (= Highline Trail) (1995) and Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (1997). Chiricahua leopard frogs were observed during subsequent surveys at Ellison Creek (= Highline Trail) (1997, 1998 and 2006) however, not reported during additional surveys at Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (2005 and 2007). There have been 108 surveys at 55 sites within the buffered stocking complex between 1937and 2007 with most surveys conducted between 1968 and 2007. (Figure 46, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District, Tonto National Forest, surveyed 6 additional sites within the buffered stocking complex in 2004 and did not observe any Chiricahua leopard frogs (Dated provided by Black Mesa Ranger District, Tonto National Forest). Although current records show that Chiricahua leopard frogs occupy Ellison Creek (= Highline Trail) (1995), the likelihood that fish stocked in Tonto Creek would encounter frogs is low because the stocked fish and the occupied frog sites are in 2 different drainages flowing into 2 different major rivers. In addition, the area between Ellison Creek and Tonto Creek is not indicative of suitable habitat for leopard frogs and exceeds the 5 miles overland distance a Chiricahua leopard frog would likely disperse overland.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in Tonto Creek is low. There are no historical records for frogs in Tonto Creek or its tributaries where fish may disperse outside the buffered complex (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, it is unlikely that Chiricahua leopard frogs that occupy Ellison Creek would disperse into Tonto Creek because the area between Ellison and Tonto Creeks does not contain suitable habitat for leopard frogs and the overland dispersal distance exceeds that which a Chiricahua leopard from would be expected to disperse.

Northern Leopard Frog

Local Analysis: Although Tonto Creek and the Tonto Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in the buffered stocking complex that includes Tonto Creek is low. There have been 108 surveys at 55 sites within the buffered stocking complex between 1937and 2007 with most surveys conducted between 1968 and 2007 (Figure 46, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). There are no historical records for northern leopard frogs from Tonto Creek; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex; Unmarked Pond (= Cindy's Pond) (1984) and Woods Canyon Lake (= Spillway Recreation Site) (1968). Northern leopard frogs were not observed during subsequent surveys at Unmarked Pond (= Cindy's Pond) (1997 and 1998) and Woods Canyon Lake (= Spillway Recreation Site) (1992 and 1995) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Given that the area within the Tonto Stocking Complex has been well surveyed and subsequent surveys have reported negative

observations, it is likely that northern leopard frogs no longer occupy Unnamed Pond (=Cindy's Pond) or Woods Canyon Lake (= Spillway Recreation Site) (1968). In addition, salamanders have been documented at (= Cindy's Pond) (1984) and bullfrogs at Woods Canyon Lake (= Spillway Recreation Site) (1968), making this area less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in the Tonto Creek stocking site is low, because there are no historical records for frogs in Tonto Creek or its tributaries where fish may disperse, and these drainages are below the elevational range of the northern leopard frog (approximately 5300 ft) (Ranid Frog Conservation And Management, Technical Report 121) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.).

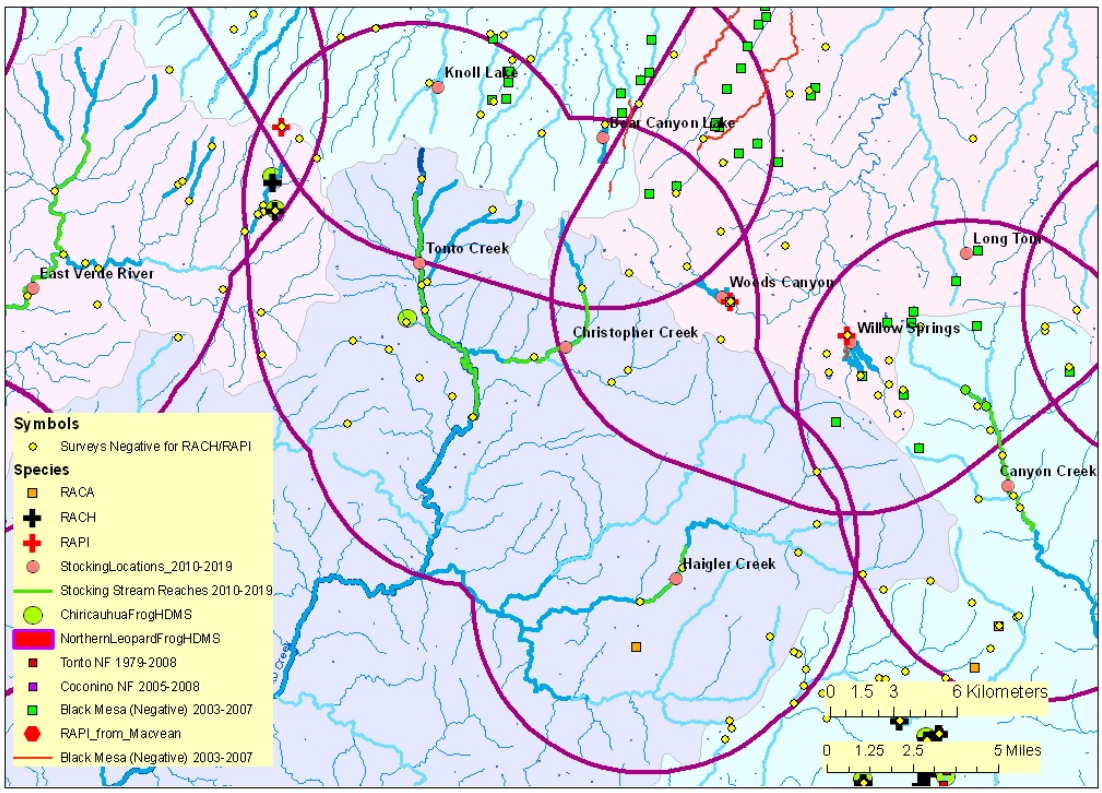

Figure 46.Map of Tonto Creek buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Headwater Chub

Headwater chub are found in the main stem of Tonto Creek below the waterfall located below Bear Flat Campground, at least to Hells Gate (Kern 2008b). Kern (2008b) reported multiple age classes of headwater chub in the portion of Tonto Creek below Bull Tank Canyon, but not in the portion upstream to Bear Flat. Kern (2008b) also noted that headwater chub could be present in low numbers in this upper area, which is functionally isolated from upstream fish movement by a series of slides and waterfalls. Headwater chub were also found downstream in Tonto Creek to at least Spring Creek in May 2007 (Burger 2007). Historically, chub were found above Bear Flat Campground in Tonto Creek, Horton Creek, and Christopher Creek, although these populations are considered extirpated (Voeltz 2002). The population in Rye Creek is thought to be extirpated due to limited water and habitat (Voeltz 2002).

Potential Impacts

Rainbow trout are proposed to be and have historically been stocked in Tonto, Christopher, and Haigler Creeks from April through October. In addition to stocked rainbow trout, wild self-sustaining rainbow trout and/or brown trout are found throughout Tonto Creek's watershed. They are found in Christopher Creek and its tributaries, Horton Creek, Haigler Creek and its tributaries, and Spring Creek and its tributaries. Surveys have found not only the stocked-size rainbow trout but also young of the year rainbow trout throughout the watershed (Table 34). The presence of trout smaller than the size that is consistently stocked, which is 8 inches, is indicative of natural reproduction and a self-sustaining population of rainbow trout.

The proposed action is stocking trout from April through October which is typically the driest months of the year. This reduces trout movement in normal years until higher flows typically occur in December, January, February, and March. Rainbow trout movement is further limited by high harvest rates during the warmer dry months. The duration that stocked rainbow trout would potentially have effects on headwater chub in Tonto Creek would likely be in the winter and early spring. Flows that could wash fish into the section of Tonto Creek occupied by headwater chub typically occur from December through March (Figure 3). This is also the period when stream temperatures are likely to be suitable for rainbow trout.

The rainbow trout stocked in the upstream stocking reach of Tonto Creek, as well as the rainbow trout stocked into Christopher and Haigler Creeks, can move down the creek and ultimately into Roosevelt Lake during flood events and winter months, however it has been well documented and stated above within fish movement and fish community that the extent of the rainbow trout lessens from Bear flat campground to becoming for the most part nonexistent downstream of Haigler Creek and absolute downstream of Gisela

Rainbow trout do share habitat with headwater chub in Tonto Creek, below Bear Flat Campground and north of Gisela. It is not known how many of the stocked rainbow trout are moving into lower Tonto Creek and how many trout in this area are wild trout from the naturally

reproducing population in the stream. The large number of angler-use days and observed catch rates suggest that most of the stocked fish are harvested soon after being stocked, and it is more likely that the trout below Bear Flat Campground in Tonto Creek have long been established and are self-sustaining.

It is possible for stocked rainbow trout to move downstream from the stocked reaches and then upstream into Tonto Creeks tributaries. However, this is limited due to intermittent and dry stretches in the tributaries, as well as natural barriers. The only creek where it is possible for stocked rainbow trout from Tonto Creek to move into occupied headwater chub populations is Spring Creek. Rainbow trout have not been sampled in Spring Creek since they were stocked in 1950, which suggests some unknown barrier to their movement into Spring Creek. Haigler Creek has barriers in its lower reach, and the remaining tributaries do not have existing populations of headwater chub.

During a June survey, Kern (2008b) did not detect rainbow trout downstream of the Haigler Creek confluence, but did collect yellow bullhead and green sunfish. This suggests that by June, Tonto Creek below Hells Gate is not suitable for rainbow trout survival, and begins to transition into more of a warm water stream at this point. Only one trout has been observed south of Hells Gate. The time of year of this record is unknown. Further, Burger (2007) did not detect any rainbow trout during a survey from Hells Gate to Gisela, again suggesting that below Hells Gate, Tonto Creek becomes unsuitable for rainbow trout, at least by late spring when both of these surveys occurred. Trout have not been found in Rye Creek, Gun Creek, or Tonto's tributaries below Hells Gate that have contained headwater chub in the past, but are currently thought to be extirpated (Voeltz 2002).

Rainbow trout are competitors for food and space with roundtail and headwater chub, and may also prey on young chub (Propst et al. 1998). Exposure of headwater chub to stocked trout could occur in Tonto Creek, below the stocked reach in occupied habitats by headwater chub, but not in the stocked reach of Tonto Creek, due to the presence of barriers that restrict upstream movement of headwater chub; however, the impacts cannot be separated from those of trout that appear to be self-sustaining in the system. It is possible that stocked trout could be supplementing those self-sustaining populations, although the extent to which this may be occurring is unknown. Small trout can compete with small headwater chub, but can also serve as a prey source for larger headwater chub. Surveys of both upper and lower Tonto Creek show a large part of the fish populations to be exotic species such as brown trout, common carp, yellow bullhead, green sunfish, red shiner, channel catfish, and large and small mouth bass (Table 34). Given the community composition, these other nonnative fish species, as well as brown trout, if present in this reach, likely contribute a larger piece the overall impacts to headwater chub via predation and competition than do stocked rainbow trout. Green sunfish and small mouth bass would have much larger impacts to headwater populations via predation.

Suitable spawning temperatures for headwater chub are likely to occur in the occupied headwater chub habitat during the stocking season. This creates an additional risk of predation on larval or post-larval individuals by resident and stocked rainbow trout. Although specifics on when headwater chub spawn in Tonto Creek are lacking, temperatures of 64 to 76° F are reported for spawning headwater chub in the upper Verde (Brouder et al. 2000) and upper Gila Rivers (Bestgen 1985). Little data on stream temperature has been collected; however, random temperatures collected during 1987 indicate that maximum temperatures near the Highway 260 Bridge were greater than 73° F. Stream temperature near the hatchery averaged 56° F during this time period and mean temperatures increased nearly 36° F in the short reach between the Baptist Bridge and Horton Creek.

Christopher Creek

Site Description

Christopher Creek is a tributary to Tonto Creek (Figure 47), flowing off of the Mogollon Rim on the Tonto National Forest south to just downstream of Highway 260, before turning west and paralleling Highway 260 to its confluence with Tonto Creek east of Payson. The perennial portion of Christopher Creek is approximately 8 miles long and the stream drains an area of 29 square miles.

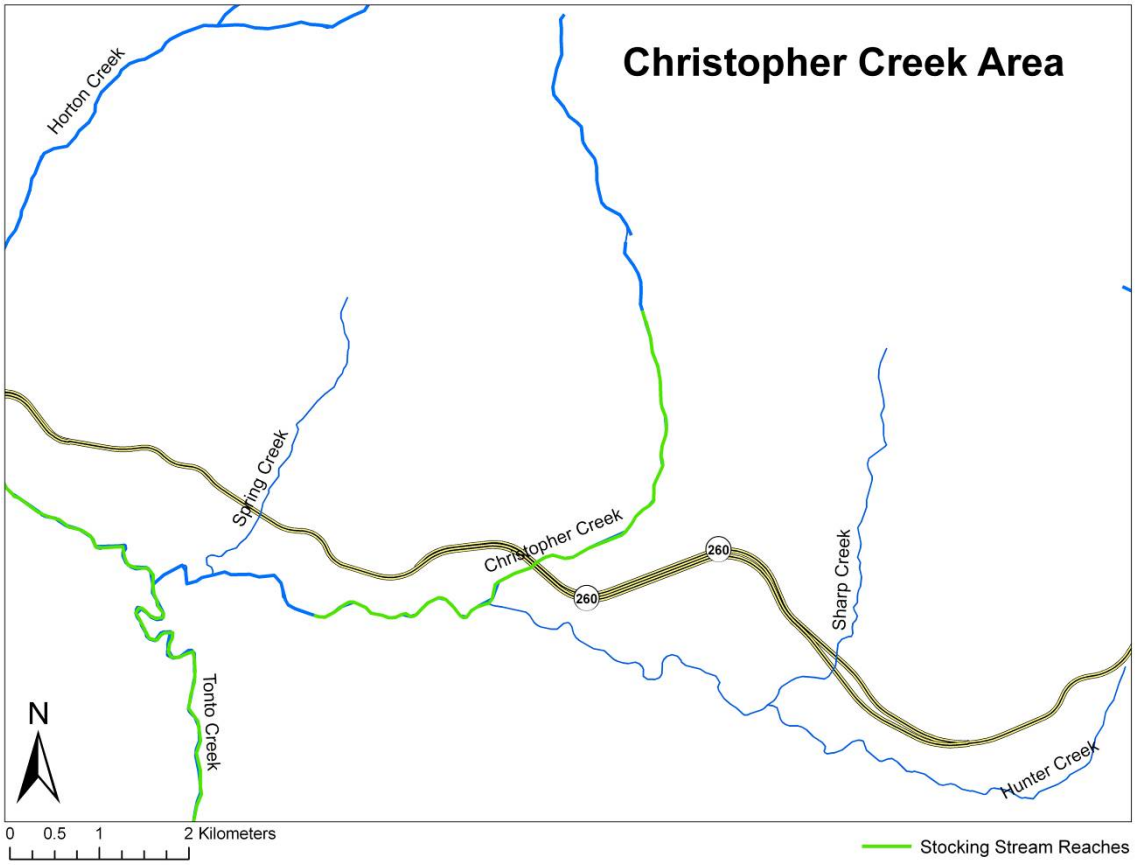

Figure 47. Overview map of Christopher Creek Stocking Area.

Christopher Creek is managed by the Tonto National Forest for recreation, including camping, picnicking, fishing, and water activities. The designated campground provides picnic tables, camp units, and a vault toilet. Christopher Creek is accessible by road to the campground off Highway 260 or just past the campground to FR 284. Downstream of the stocking reach the creek flows an additional 1.5 miles to the confluence with Tonto Creek. Land ownership is comprised of 78% Tonto National Forest, 17% Apache-Sitgreaves National Forest, and 6% private lands.

Hunter Creek is an interrupted perennial tributary to Christopher Creek 1000 ft upstream of Christopher Creek Campground (Figure 47) that begins near the base of the Mogollon Rim at 6500 ft in elevation near Hwy 260 and is roughly 5 miles long. The mouth of Hunter Creek is at an elevation of 5640 ft. Sharp Creek is a tributary to Hunter Creek.

Management of Water Body
Christopher Creek is managed as cold water intensive use, put-and-take rainbow trout fishery in the spring and summer months (Table 36). Christopher Creek supported about 10,865 angler user days in 2001 (Pringle 2004). From a 1986 postal questionnaire, there were 17,561 angler-use days spent at Christopher Creek during annual high-use periods from April through September.

Table 36. Stocking history for Christopher Creek.

Species	First Year	Last Year	Num. of Years Stocked	Num. Stocked
Brook trout	1933	1980	14	23,874
Brown trout	1936	1992	11	28,193
Native trout*	1933	1939	7	31,675
Rainbow trout	1933	2008	923	708,667
			Total	792,409

**Historical record – listed as "Native trout", no species specified.*

Proposed Action
The Department proposes to stock catchable rainbow trout from April through October. Number of trout may be from 0 to 10,000 fish annually for the period covered under this consultation.

Water Distribution / Connectivity
Christopher Creek is perennial from just below the Mogollon Rim to its confluence with Tonto Creek downstream of Hwy 260. Much of the base flow originates from springs at the head of See Canyon. In the upper portion of Christopher Creek boulders and cobble make up the primary bed material and cascade drop/pool habitats are the dominant type. Riffle and run habitats dominate from Hwy 206 downstream to shortly below the R-C Scout Camp. Below this Christopher Creek

enters a canyon-bound section, with frequent deep pools and substrate dominated by bedrock. There is a concrete stream crossing for vehicles at the Christopher Creek campground. Hunter Creek is an interrupted perennial tributary to Christopher Creek 1000 ft upstream of Christopher Creek Campground. Hunter Creek and Sharp creek are seasonally intermittent and are typically dry from the confluence with Christopher Creek to approximately a half mile north of Highway 260 (Evans 2009b, C. Gill pers. comm.). No fish barriers have been identified in Hunter or Sharp creeks.

Fish Movement

There are at least two barriers greater than 10 feet on Christopher Creek just downstream of the R-C Scout Camp that prevents upstream movement of fish. These are located in the canyon-bound section of Christopher Creek. It is likely that other barriers exist in this section. There is a concrete stream crossing at the Christopher Creek campground that could be a barrier to some fish species, but it is likely not a barrier to salmonids. A pool exists below the road crossing and the drop to the pool is not sufficient to prevent trout stocked below the crossing from moving upstream. Therefore, fish from the lowermost stocking site at Christopher Creek campground would have the ability to freely move upstream to the uppermost stocking locations near the See Canyon trailhead and beyond. Stocked fish would also have the ability to move up Hunter Creek and Sharp Creek. This crossing is scheduled to be replaced in 2010 by the Tonto National Forest, which may allow more fish passage in the future with the use of culverts.

Fish also have the ability to freely move downstream from the stocking locations to Tonto Creek and beyond. Once fish reach Tonto Creek they would be subject to the same controls limiting their long-term survival as discussed in the Tonto Creek section.

Community Description

Surveys of Christopher Creek in 1966, 1967, 1968, 1983, 1986,1987 (Warnecke 1986; Warnecke 1987) from See Canyon to just downstream of Christopher Creek Campground have found rainbow trout, brown trout, longfin dace, desert sucker, brook trout, and green sunfish. The most recent survey (Gill 2008c) reported rainbow trout, brown trout, longfin dace, green sunfish, and largemouth bass. In both 1987 and 2008, young of year rainbow trout were collected, indicating self-sustaining populations of rainbow trout and brown trout (Table 5). Madsen (1935) reported "bonytails" throughout Christopher Creek and some were also found in Sharp Creek. No other records for chubs from Christopher, Hunter, or Sharp Creek have been found, and the chub population is considered extirpated (Voeltz 2002).

Hunter Creek was most recently surveyed in 2009 (Evans 2009b). This survey documented green sunfish, rainbow trout, and longfin dace, with the dominant species being green sunfish. The survey also noted a high density of crayfish. The only other survey of Hunter Creek was in 1983, which found longfin dace, rainbow trout and desert sucker. Young of year rainbow trout were

found indicating natural reproduction (Table 37). Sharp Creek was surveyed in 1983 and only longfin dace were found.

Table 37. Fish survey summary for Christopher Creek, Hunter Creek and Sharp Creek.

Date	Collector	Location	Survey Type	Source	Species	Num. and Size of Rainbow Trout (if Known)
July 9-10, 2008	AGFD Gill	Stocked Reach of Christopher Creek	Electro shocking	Trip Report	Rainbow trout Brown trout Longfin dace Green sunfish	Approx 85% <70 mm 113 total rainbow trout collected
Oct 1987	AGFD Warnecke	Stocked Reach of Christopher Creek	Electro shocking	Trip Report	Rainbow trout Brown trout Longfin dace Green sunfish	70 mm to 230 mm Avg length = 125 mm 192 total rainbow trout
Sept, 1983	AGFD Reg 6	Hunter Creek	Electro shocking	Trip report	Longfin Dace Rainbow trout Desert sucker	
July 2009	AGFD Evans	Hunter Creek	Visual	Trip Report	Green sunfish Rainbow trout Longfin dace	1 (50-60 mm) 3 (60-70 mm) 2 (70-80 mm) 1 (130-140 mm) 1 (140-150 mm) 1 (170-180 mm)
Sept, 1983	AGFD Reg 6	Sharp Creek	Electro shocking	Trip Report	Longfin dace	

Historical records for Chiricahua leopard frogs exist in the vicinity. Both narrow-headed and northern Mexican gartersnakes are known from connected waters downstream in Tonto Creek. Crayfish are also known from the area of Christopher Creek near the confluence of Hunter Creek.

Consultation Species or Critical Habitat

Potential impacts to bald eagle, Chiricahua and northern leopard frogs, headwater chub and Mexican spotted owl are addressed below. Potential impacts from stocked fish movement downstream on northern Mexican and narrow-headed gartersnakes are discussed in the Tonto Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Bald Eagle

Woods Canyon Breeding Area is located approximately 4.5 miles from Christopher Creek. The Christopher Creek stocking reach is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2008 and were last observed in 2009. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 98.5%, mammals for 0.7% and unknown for 0.7%. Of the prey items further identified to species, rainbow trout accounted for 99.3% and ground squirrels for 0.7%. Woods Canyon Breeding Area productivity data shows that the nest failed in 2008 when an intense late spring snow storms occurred a few days before the confirmed failure. In 2009 the nest was successful (McCarty and Jacobson 2008, 2009). Christopher Creek does not currently have monofilament bins present.

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Chiricahua Leopard Frog

Local Analysis: Although Christopher Creek and the Tonto Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that fish stocked in Christopher Creek would have an impact on Chiricahua leopard frogs is low. There are no historical records for Chiricahua leopard frogs from Christopher Creek. There are historical records for Chiricahua leopard frogs from 2 of these sites; one of which includes current observations at Ellison Creek (= Highline Trail) (1995), and Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (1997). Chiricahua leopard frogs were observed during subsequent surveys at Ellison Creek (= Highline Trail) (1997, 1998 and 2006) but not reported during additional surveys at Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (2005 and 2007). There have been 108 surveys at 55 sites within the buffered stocking complex between 1937and 2007, with most surveys conducted between 1968 and 2007 (Figure 46, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District of the Tonto National Forest surveyed 6 additional sites within the buffered stocking complex in 2004 and did not observe any Chiricahua leopard frogs (Dated provided by Black Mesa Ranger District, Tonto National Forest). Although current records show that Chiricahua leopard frogs occupy Ellison Creek (= Highline Trail) (1995), the likelihood that fish stocked in Christopher Creek would encounter frogs is low because fish and occupied frog sites are in 2 different drainages flowing into 2 different major rivers. In addition, the habitat between the Ellison and Tonto creek drainages is not suitable habitat and exceeds the five mile overland distance a Chiricahua leopard frog would likely disperse overland.

Broad Scale Analysis: If fish were to disperse from Christopher Creek, the likelihood that they would impact Chiricahua leopard frogs is low. There are no historical records for frogs in Christopher Creek or its tributaries where fish may disperse outside the buffered complex. (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, it is unlikely Chiricahua leopard frogs that occupy Ellison Creek would disperse into Christopher Creek because the area between Ellison and Tonto Creeks does not contain suitable habitat for leopard frogs and the five mile overland dispersal distance exceeds that from which a Chiricahua leopard would be expected to disperse.

Northern Leopard Frog

Local Analysis: Although Christopher Creek and the Tonto Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that fish stocked in Christopher Creek would encounter northern leopard frogs is low. There are no historical records for northern leopard frogs from Christopher Creek; however, there are historical records for northern leopard frogs from 2 sites in the buffered stocking complex at Unmarked Pond (= Cindy's Pond) (1984) and Woods Canyon Lake (= Spillway Recreation Site) (1968). There have been 108 surveys and site visits at 55 sites within the buffered stocking complex between 1937and 2007, with most surveys conducted between 1968 and 2007 (Figure 5, Arizona Game

and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Unmarked Pond (= Cindy's Pond) (1997 and 1998) and Woods Canyon Lake (= Spillway Recreation Site) (1992 and 1995) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Given that the area within the buffered stocking complex has been well surveyed and subsequent surveys have reported negative observations, it is likely that northern leopard frogs no longer occupy the complex.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in Christopher Creek is low, because there are no historical records for frogs in Christopher Creek or its tributaries where fish may disperse outside the buffered complex. (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the habitat in these drainages is less suitable for northern leopard frogs due to the presence of non-native fish, crayfish and bullfrogs than in areas free of these non native species.

Headwater Chub

No headwater chub have been collected or identified in Christopher Creek or its tributaries since 1935. These species are reported as extirpated in these streams (Voeltz 2002). The closest recent record for headwater chub is over 7 miles downstream from the proposed stocking locality in Tonto Creek (Kern 2008b).

Potential Impacts

There are no potential impacts on headwater chub within the Christopher Creek drainage since headwater chub are considered extirpated from this stream (Voeltz 2002). It is possible that stocked rainbow trout could move out of Christopher Creek and into Tonto Creek. See discussion for Tonto Creek regarding potential impacts in this section of stream.

Mexican Spotted Owl and Critical Habitat

The stocking stream reach is within Mexican spotted owl (MSO) critical habitat (CH), and also occurs in a buffer. At the northern end of the stocking stream reach, 0.26 miles is within critical habitat and 0.55 miles is in the buffer with the rest of the stocking stream reach outside of critical habitat. There appears to be angler access along the whole stocking stream reach based on topographic and world imagery maps.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around MSO PACs in the general vicinity of the site. No physical effects to MSO habitat in the PAC are anticipated, since anglers are not expected to be present in the PAC. There may be some disturbance to MSOs from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs These actions may include trampling of vegetation, soil compaction, removal of woody debris, or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities including angling, were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Haigler Creek

Site Description

Haigler Creek is located 10 miles north of Young, near FR200 within the Tonto National Forest; it is a tributary to Tonto Creek in the area known as Hells Gate (Figure 48). The headwaters are located between the Naegelin Rim and the Mogollon Rim in the vicinity of Colcord Mountain. Haigler Creek begins at the confluence of Naegelin and Lost Salt Canyons at 7000 ft in elevation. The stream is perennial from the Colcord Canyon confluence to its confluence with Tonto Creek at 4500 ft elevation, a distance of roughly 15 miles. The watershed drains an area of approximately 114 square miles.

Land ownership is primarily Tonto National Forest land, but there is a private inholding between Haigler Canyon Campground and Fisherman's Point, and several other inholdings between Haigler Canyon Campground and Alderwood Campground. Land ownership within a 1 mile buffer along Haigler Creek is comprised of Tonto National Forest (98%) and private lands (2%) (Voeltz 2002). Haigler Creek enters the Hellsgate Wilderness about 1 mile downstream of Alderwood Campground.

Haigler Creek is managed by the Tonto National Forest for recreation, including camping, picnicking, hiking, bird watching, fishing, hunting, and water activities. The Haigler Canyon Campground and Alderwood Campground provide camping opportunities. Haigler Creek is accessible by a road seasonally during the months of April through November. There are four points of access to the creek: Haigler Canyon Campground, Alderwood Campground, Hells Gate, and Fisherman's Point. Fisherman's Point is only accessible by hiking.

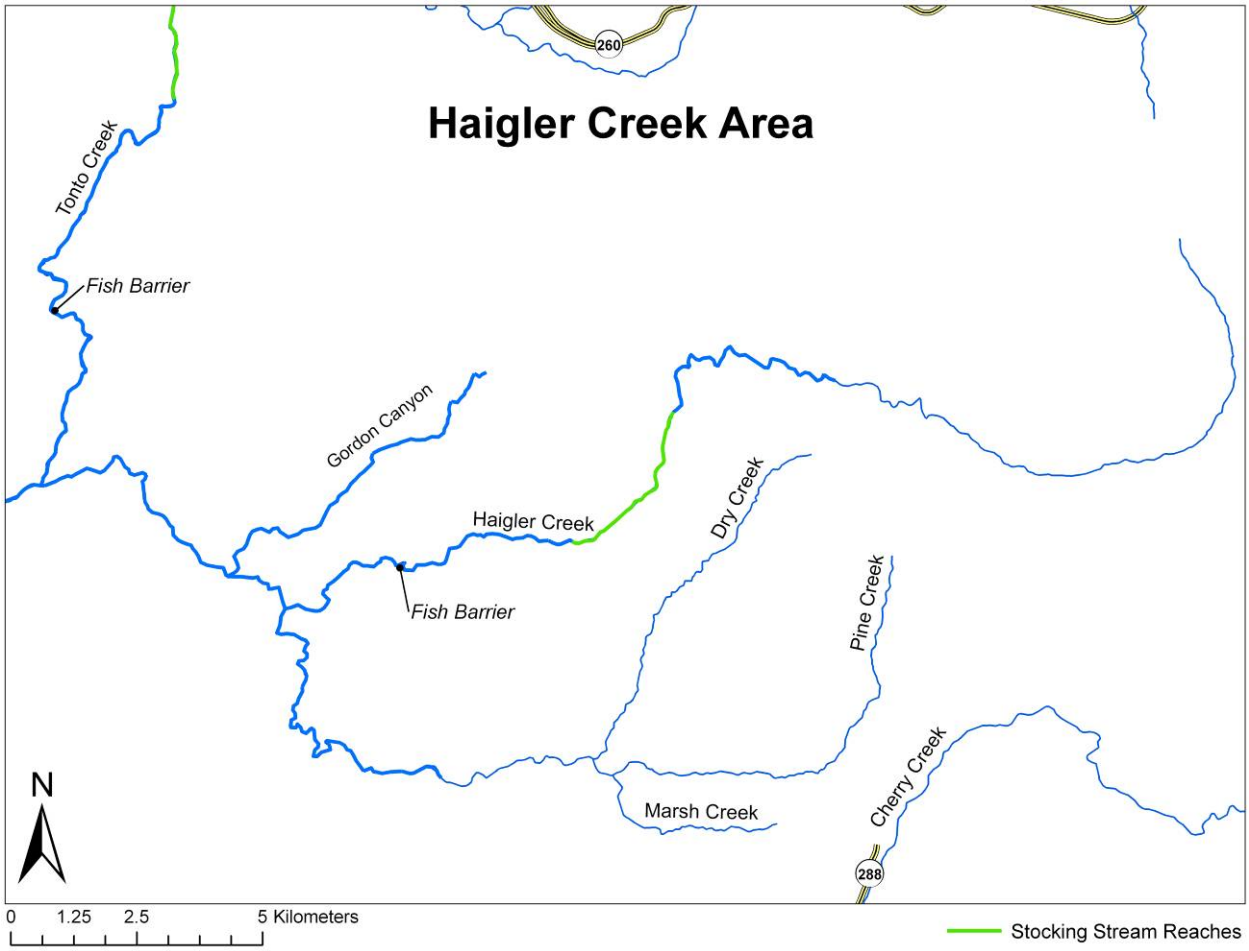

Figure 48. Overview map of Haigler Creek Stocking area.

Marsh Creek is also a tributary to Haigler Creek. Its headwaters originate along the southwestern slopes of the Naegelin Rim, north of Young (Figure 44). It flows from its headwaters at an elevation of roughly 6790 ft to its confluence with Haigler Creek at an elevation of approximately 4500 ft. Marsh Creek enters Haigler Creek roughly one mile upstream from Gordon Canyon. Land ownership of Marsh Creek is 98% Tonto National Forest and 2% private lands. Pine Creek and Dry Creek are intermittent streams that are tributaries to Marsh Creek (Figure 3).

Gordon Canyon is a tributary to Haigler Creek that flows in a southwesterly direction through the Tonto National Forest, before its confluence less than a mile downstream of the Marsh/Haigler confluence (Figure 3). Land ownership within a 1 mile buffer along Gordon Creek is comprised of 98% Tonto National Forest and 2% private lands (Voeltz 2002). Its headwaters are located between Turkey Peak and the Mogollon Rim, and the stream follows a generally southwesterly course towards Haigler Creek. Gordon Canyon was historically stocked with trout (Table 38) but is no longer proposed for future stocking.

Management of Water Body

Haigler Creek is managed as cold water intensive use, put-and-take rainbow trout fishery in the spring and summer months (Table 39). Upper Haigler Creek (above the stocking reach) and Gordon Canyon are managed as hike-in wild rainbow and brown trout fisheries. A creel survey was done in 1990. The creel census summary shows a 32% success rate for all anglers with a harvest rate of 0.34 fish per hour. A statewide survey of 2001 anglers showed 1,777 angler use days for Haigler Creek (Pringle 2004).

Table 38. Stocking History for Gordon Canyon.

Species	First Year	Last Year	Num. of Years stocked	Num. Stocked
Brook trout	1947	1947	1	1,000
Rainbow trout	1942	1975	123	34,924
			Total	35,924

Table 39. Stocking History for Haigler Creek.

Species	First Year	Last Year	Num. of Years stocked	Num. Stocked
Bluegill	1995	1995	1	13
Brook trout	1979	1986	3	1,200
Brown trout	1948	1991	9	38,600
Native trout*	1938	1938	1	7,000
Rainbow trout	1933	2008	75	600,718
Razorback sucker	1987	1987	1	10,000
			Total	657,531

**Historical record – listed as "Native trout", no species specified.*

Proposed Action

The Department proposes to stock catchable rainbow trout in Haigler Creek from April through August each year; numbers of trout may be from 0 to 16,000 fish annually for the period covered under this consultation.

Water Distribution / Connectivity

Haigler Creek is a perennial stream to its confluence with Tonto Creek. A number of natural barriers and one man-made barrier exist on this creek (Figure 3). Marsh Creek, a tributary of Haigler Creek, is perennial with certain sections going dry during the warmer months. In June 2009, approximately a mile of Marsh Creek was dry from 1 mile east of Marsh Creek Ranch to ¼ mile from its headwaters. No barriers were noted on Marsh Creek (Duffy 2005). Pine Creek and Dry Creek are intermittent streams which are tributaries of Marsh Creek (D. Daniels pers. comm.). More specific information regarding the water distribution of Pine and Dry Creeks are unknown, but these streams would likely flow into Tonto Creek in a flood event. Gordon Canyon

is perennial with sections located outside of the canyon stretches going dry in the warmer months of dry years. A number of smaller natural barriers exist between the Gordon Canyon confluence and the confluence with Tonto Creek.

Fish Movement

Several barriers exist on Haigler Creek that would prevent the upstream migration of fish. The first known natural barrier is downstream of Fisherman's Point just before the stream enters a private parcel of land (C. Gill pers. comm.). This is a definite barrier to the upstream movement of all fish species, substantiated up by the fact that a recent survey did not collect any stocked trout above this point (Gill 2009a). The second barrier is located on the parcel of private land between Fisherman's Point and the Haigler Canyon Campground. This barrier is created by a diversion dam that has been reinforced by travertine over time. It is a barrier to most fish species but may allow the passage of some fish that might overcome the water velocities at high flows. The next barrier, a natural waterfall over 30 feet high in a canyon-bound section of stream (Figure 5), is downstream of Alderwood Campground (Kern 2008c), and is a clear-cut barrier to all fish species at all flow levels.

There are several barriers to upstream fish movement on Gordon Canyon, the first of which is a waterfall approximately 3 miles upstream of the confluence with Haigler Creek. Other smaller natural barriers exist between the Gordon Canyon Confluence and the confluence with Tonto Creek. However, stocked fish have the ability to move freely downstream to the confluence of Tonto Creek. The fact that a naturally reproducing populations of rainbow trout exists downstream of the first waterfall below Alderwood Campground (Kern 2008c) suggest that stocked fish have in fact moved downstream at some point in the past. Rainbow trout have not been sampled downstream of Hells Gate at the confluence of Tonto Creek and Haigler Creek since 1970.

Additionally, Kern (2008d) documented a young of year rainbow trout in lower Gordon Canyon Creek, suggesting the ability of stocked fish to move at least part way up the stream but seem to be limited by the intermediacy of the creek, warmer temperatures, and by the natural barrier (C. Gill pers. comm. and C. Cantrell pers. comm.). A survey of upper Marsh Creek in 2005 did not detect either rainbow or brown trout (Duffy 2005), but both rainbow and brown trout have been documented in Marsh Creek in the past (LCRB Aquatic GAP). Whether these fish originated from stock ponds in the watershed or moved up from Haigler Creek is unknown, but suggests stocked fish from Haigler Creek, Tonto Creek, or Christopher Creek may be able to move up Marsh Creek and into Pine and Dry Creeks during the cooler months or during flood events.

Fish have the ability to freely move downstream from the stocking locations to Tonto Creek and beyond. Once fish reach Tonto Creek they would be subject to the same controls limiting their long-term survival as discussed in the Tonto Creek section.

Community Description
Haigler Creek contains a population of headwater chub (Minckley and DeMarais 2000; Voeltz 2002). Surveys reporting headwater chub from Haigler Creek were done in the 1980's and 1990's, and report headwater chub present from the vicinity of the Marsh Creek confluence and below (Voeltz 2002).

The historic fish assemblage of Haigler Creek is very similar to that previously described for Tonto and Christopher Creek. Data since 1980 from Haigler Creek indicate that the fish assemblage is comprised of both native and non-native species (Table 40). Fish collection data are available from the following years at locations that varied by year: 1984, 1990, 1992, 1993, 2000, and 2008 (Kern 2008c). Headwater chub collections in the last 20 years are from lower portions of Haigler Creek, the nearest of which is 1.4 miles downstream from the trout stocking area.

Holycross et al. (2006) reported rainbow trout, desert suckers, and longfin dace from Haigler Creek near Alderwood recreation area. Surveys conducted in August 2009 found the same three species plus brown trout at Alderwood. Desert suckers and longfin dace dropped out in surveys further upstream (Gill 2009a).

The most recent survey of lower Haigler Creek in 2008 resulted in observations of natural reproducing rainbow and brown trout below Alderwood Campground (Kern 2008c). From Alderwood Campground downstream to a large barrier waterfall, stocked rainbow trout, wild brown trout, and wild rainbow trout comprised the majority of the fish community. Headwater chub were first observed downstream of the waterfall barrier and were present down to the confluence of Marsh Creek. Multiple age classes of headwater chub, rainbow trout, and brown trout were observed in this stretch. Wild rainbow trout were observed all the way downstream to the confluence with Tonto Creek and rainbow and brown trout were observed just upstream of the Haigler Creek and Tonto Creek confluence in 1993. Suitable habitat for headwater chub exists upstream of the large waterfall barrier, although habitats generally become smaller and shallower closer to Alderwood campground, and if once historically present in these reaches, headwater chub would be considered extirpated from them today with limited potential for successful reintroduction due recreational pressure (C. Cantrell pers. comm.).

Table 40. AGFD Fish Collection History from Haigler Creek. An "X" indicates that species was collected or observed from the stream in that year.

Species	**1984**	**1990**	**1992**	**1993**	**2000**	**2008**	**2009**
Rainbow trout	X	X	X	X	X	X	X
Juvenile rainbow trout	X	X	X	X	X	X	X

Species	1984	1990	1992	1993	2000	2008	2009
Brown trout	X		X	X	X	X	X
Longfin dace	X		X	X		X	X
Headwater chub	X			X		X	
Speckled dace		X		X	X	X	
Desert sucker		X	X	X		X	X

A spot survey of Upper Marsh Creek in 2005 reported headwater chub, longfin dace, and green sunfish (Duffy 2005). Headwater Chub were also abundant during surveys in 2000 (Timmons and Weedman 2000). Green sunfish were abundant, rainbow trout were common, and brown trout were rare but observed. No crayfish were found in Marsh Creek. Pine Creek and Dry Creek are tributaries to Marsh Creek and no records are found regarding their aquatic assemblages.

Gordon Canyon also supports headwater chub (Minckley and DeMarais 2000; Voeltz 2002; Kern 2008d). A fairly recent (2000) fisheries survey of Gordon Canyon identified headwater chub and longfin dace from a point approximately 1 stream mile upstream of the Ellinwood Ranch. A 1993 survey identifies desert sucker, longfin dace, and headwater chub at approximately 1 mile downstream of Ellinwood Ranch near the Haigler Creek confluence (Voeltz 2002; AZGFD Statewide Fish Distribution Database). The most recent survey in 2008 identified desert sucker, headwater chub, and longfin dace in Gordon Canyon (Kern 2008d). Headwater chub were first seen approximately 2 miles north of the confluence of Haigler Creek and Gordon Canyon. A wild young of year rainbow trout was also seen in this stretch. In 1993, young rainbow trout were also sampled below the barriers; 5 trout ranging from 140 mm to 219 mm. Both the headwater chub and the wild young of year rainbow trout were found below the series of barriers. Rainbow trout were stocked below the barriers in the creek until 1975.

Historical records for Chiricahua leopard frogs exist in the vicinity. Narrow-headed garter snakes are known from Haigler Creek, with the most recent record in 2008. Northern Mexican garter snakes are known from Tonto Creek near Gisela. Crayfish are common throughout much of Haigler Creek and Gordon Canyon. Adult and tadpole canyon treefrogs were seen in lower Haigler Creek and Gordon Canyon (Kern and Burger 2008).

Consultation Species or Critical Habitat

Potential impacts to northern and Chiricahua leopard frogs, roundtail and headwater chub, bald eagle and Mexican spotted owl are addressed below. Potential impacts from stocked fish

movement downstream and into northern Mexican and narrow-headed gartersnakes are discussed in the Tonto Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a local and broad scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Bald Eagle

Woods Canyon Breeding Area is located approximately 8.5 miles from Haigler Creek. The Haigler Creek stocking reach is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2008 and were last observed in 2009. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 98.5%, mammals for 0.7% and unknown for 0.7%. Of the prey items further identified to species, rainbow trout accounted for 99.3% and ground squirrels for 0.7%. Woods Canyon Breeding Area productivity data shows that the nest failed in 2008 when an intense late spring snow storms occurred a few days before the confirmed failure. In 2009 the nest was successful (McCarty and Jacobson 2008, 2009). Haigler Creek does not currently have monofilament bins present.

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Chiricahua Leopard Frog

Local Analysis: Although Haigler Creek and the Tonto Creek buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be

exposed to stocked fish in the buffered stocking complex that includes Haigler Creek is low. There are no historical records for Chiricahua leopard frogs from the Haigler Creek stocking reach; however, there are historical records for Chiricahua leopard frogs from 2 sites in the buffered complex, one of which includes current observations at Ellison Creek (=Highline Trail) (1995), and Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (1997). There have been 108 surveys at 55 sites within the buffered stocking complex between 1937and 2007, with most surveys conducted between 1968 and 2007 (Figure 5, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were observed during surveys at Ellison Creek (=Highline Trail) (1997, 1998 and 2006). Chiricahua leopard frogs were not observed during subsequent surveys at Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (2005 and 2007) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). The Black Mesa Ranger District of Tonto National Forest surveyed 6 additional sites within the buffered stocking complex in 2004 and did not observe any Chiricahua leopard frogs (Dated provided by Black Mesa Ranger District, Tonto National Forest). Although there are current records of Chiricahua leopard frogs at Ellison Creek (= Highline Trail) (1995), the likelihood that fish stocked in Haigler Creek would have an impact on Chiricahua leopard frogs is low because fish and frogs are in 2 different drainages flowing into 2 different major rivers. In addition, the five mile overland distance between Ellison Creek and Haigler Creek exceeds that which Chiricahua leopard frogs would likely disperse overland.

Broad Scale Analysis: If fish were to disperse from Haigler Creek, the likelihood that they would impact Chiricahua leopard frogs is low. There are no historical records for frogs in Haigler Creek or its tributaries where fish may disperse outside the buffered stocking complex (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, it is unlikely Chiricahua leopard frogs that occupy Ellison Creek would disperse into Haigler Creek because the area between Ellison and Tonto Creeks does not contain suitable habitat for leopard frogs and the five mile overland dispersal distance exceeds that from which a Chiricahua leopard would be expected to disperse.

Northern Leopard Frog

Local Analysis: Although Haigler Creek and the Tonto Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to stocked fish in the buffered stocking complex that includes Haigler Creek is low. There are no historical records for northern leopard frogs from Haigler Creek; however, there are historical records for northern leopard frogs from 2 sites in the buffered complex at Unmarked Pond (= Cindy's Pond) (1984) and Woods Canyon Lake (= Spillway Recreation Site) (1968). There have been 108 surveys at 55 sites within the buffered stocking complex between 1937and 2007 (Figure 5, Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.), with most surveys conducted between 1968 and 2007. Northern leopard frogs were not observed during subsequent surveys at Unmarked Pond (= Cindy's Pond) (1997 and

1998) and Woods Canyon Lake (= Spillway Recreation Site) (1992 and 1995) (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). Given that the area within the Tonto Stocking Complex has been well surveyed and subsequent surveys have reported negative observations, it is likely that northern leopard frogs no longer occupy Unnamed Pond (=Cindy's Pond) or Woods Canyon Lake (= Spillway Recreation Site) (1968).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in Haigler Creek is low, because there are no historical records for frogs in Haigler Creek or its tributaries where fish may disperse outside the buffered complex. (Arizona Game and Fish Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, the habitat in these drainages is less suitable for northern leopard frogs due to the presence of non-native fish, crayfish, and bullfrogs.

Headwater Chub

Haigler Creek contains a population of headwater chub (Minckley and DeMarais 2000; Voeltz 2002). Surveys reporting headwater chub from Haigler Creek were done in the 1980's and 1990's and report headwater chub present from the vicinity of the Marsh Creek confluence and below (Voeltz 2002). Headwater chub collections in the last 20 years are from lower portions of Haigler Creek, the nearest of which is 1.4 miles downstream from the trout stocking area. In 2008, Headwater chub were not found above the waterfall located below Alderwood Campground, but became increasingly abundant below the waterfall with several age classes observed (Kern 2008c). In the lower reaches of Haigler Creek, headwater chub were the most common fish observed. Voeltz (2002) described this population as stable-threatened.

Potential Impacts

Rainbow trout are a potential predator on headwater chub larvae and small juveniles (Propst et al. 1998). The majority of the rainbow trout observed in the reach shared with headwater chub were wild (Kern 2008c), although some stocked fish are also likely in the area. In many instances across headwater chub occupied sites, headwater chub seem to coexist with trout species where low human use (i.e. development, recreational pressure (camping, hiking, angling, etc…), livestock pressure, roads, etc…) occurs. While the precise distribution of headwater chub is not known for many of these sites, it is possible that intensively used recreational sites have resulted in fewer chub occurring there; however it is equally possible that chub were not common in these areas historically (C. Cantrell pers. comm.). There may also be competition for food and space in pools through the habitat area, and both adult rainbow trout and headwater chub were observed preying on small crayfish (Kern 2008c).

Rainbow trout dominated the upper reach between the waterfall and its confluence with Marsh Creek. Headwater chub were a smaller component of the community. Below Marsh Creek rainbow trout became rarer and headwater chub dominated the community to the confluence with Tonto Creek. Multiple age classes of headwater chub were found in all sections of Haigler

Creek below the waterfall, so the determination of a stable population is appropriate (Kern 2008c). However, there may still be some predation and competition between stocked and wild rainbow trout and headwater chub, particularly in the reach above the confluence with Marsh Creek. Propst et al. (1998) documented that newly stocked rainbow trout quickly began to feed on the same items as wild rainbow trout, including eating small fish.

Any stocked trout that exit the stocking area over the waterfall augment the existing rainbow trout population in the creek below, and may exert additional pressure on the headwater chub. It is unclear what difference exists between the upper and lower reaches of the occupied habitat that results in the observed distribution. It may be that there are significant changes to the habitat downstream that favor headwater chub over rainbow trout that are not immediately apparent.

Young of the year rainbow trout were found in lower Gordon Canyon in 2008 (Burger 2008). Headwater chub were found both upstream and downstream of where the trout were found. The best chub habitat was found in the canyon stretches of Gordon Canyon. The sections that were not in canyon habitat showed evidence of seasonal drying and had less flow.

If stocked fish were to move out of Haigler Creek into Tonto Creek, their potential effects would be the same as described in the Tonto Creek section.

Mexican Spotted Owl and Critical Habitat

The northern 1.4 miles of the stocking stream reach is within Mexican spotted owl (MSO) critical habitat (CH) while the southern 2.8 miles of the stocking stream reach is outside of the critical habitat.

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling, were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

TONTO CREEK COMPLEX ANALYSIS

This complex analysis focuses on the segment of Tonto Creek below the stocked reaches, Hells Gate to Roosevelt Lake (Figure 42) with respect to water distribution/connectivity, fish movement, and the associated potential impacts. As discussed in the narrative above, the potential for trout movement downstream into the lower section of Tonto Creek may occur.

Water Distribution / Connectivity
Tonto Creek transitions approximately one mile below Bear Flat Campground at the Hellsgate Wilderness, into a deep canyon-bound perennial stream with limited access. Tonto Creek is seasonally intermittent below Gun Creek, where the stream channel becomes wider and braided as it flows through a broad alluvial basin. There are two peak flow periods, one occurring in the winter/spring as a result of precipitation and snowmelt at higher elevations, and the second in the summer is due to monsoonal rains (Figure 45). The creek water level in the lower basin falls below the level of the streambed, creating dry sections above Roosevelt Lake during part of the year. Refer to the Tonto Creek water distribution/connectivity section for the detailed discussion of the tributaries for this stream section.

Fish Movement
Upstream fish movement is restricted due to barriers in the upper reach of Tonto and Haigler Creeks (Figure 42).

Fish have the ability to freely move downstream from the stocking locations to Tonto Creek and beyond. Once fish reach Tonto Creek they would be subject to the same controls limiting their long-term survival as discussed in the Tonto Creek section.

Rainbow trout typically are stocked in greater numbers in April and May when surface water is at or near base flow, peak flood events are the most infrequent, and water temperatures in the lower basin become lethal to salmonids.

Consultation Species or Critical Habitat
Chiricahua and Northern leopard frogs were analyzed at a local and broad scale level (Figure 5) as addressed previously in the site consultation species analysis.

Potential downstream impacts from the proposed stocking locations in the Tonto Creek Complex on headwater chub, northern Mexican and narrow-headed gartersnakes are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen

or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Chiricahua Leopard Frog
See **Local** and **Broad Scale** analyses under each stocking location.

Northern Leopard Frog
See **Local** and **Broad Scale** analyses under each stocking location.

Headwater Chub
Headwater chub are found in the main stem of Tonto Creek below the waterfall located below Bear Flat Campground and at least to Hells Gate (Kern 2008b). Headwater chub were also found downstream in Tonto Creek to at least Spring Creek in May 2007 (Burger 2007). The population in Rye Creek is thought to be extirpated due to limited water and habitat (Voeltz 2002).

Potential Impacts
As stated above, rainbow trout are proposed for stocking into Christopher Creek, Tonto Creek, and Haigler Creek from April through October. In addition to stocked rainbow trout, wild self-sustaining rainbow trout and/or brown trout are found throughout the Tonto Creek's watershed. They are found in Christopher Creek and its tributaries, Haigler Creek and its tributaries, Horton Creek, and Spring Creek and its tributaries. Surveys have found not only the stocked size rainbow trout but also young of year rainbow trout throughout the watershed (Table 34). The presence of trout smaller than the size that is consistently stocked, which is 8 inches, is indicative of natural reproduction and a self-sustaining population of rainbow trout.

Although the proposed action is stocking trout from April through October, the highest stocking numbers usually occur in April and May, which is typically the driest months of the year. This reduces trout movement in normal years until higher flows typically occur in December, January, February, and March. Rainbow trout movement is further limited by high harvest rates during the warmer dry months. The time period that stocked rainbow trout potentially would have greater effects on headwater chub in Tonto Creek would likely be in the winter and early spring. Flows that could wash fish into the section of Tonto Creek occupied by headwater chub typically occur from December through March (Figure 3). This is also the period when stream temperatures are likely to be suitable for rainbow trout.

The rainbow trout stocked in the upstream stocking reach of Tonto Creek, as well as the rainbow trout stocked into Christopher and Haigler Creeks, can move down the creek and ultimately into

Roosevelt Lake during flood events and winter months, however it has been well documented and stated above within fish movement and fish community that the extent of the rainbow trout lessens from Bear flat campground to nearly nonexistent downstream of Haigler Creek and absolute downstream of the town of Gisela.

Rainbow trout do share habitat with headwater chub in Tonto Creek, below Bear Flat Campground and north of Gisela as well as in downstream portions of Haigler creek and its tributaries. It is not known how many of the stocked rainbow trout are moving into these areas and how many trout in this area are wild trout from the naturally reproducing population in the stream. The large number of angler-use days and observed catch rates suggest that most of the stocked fish are harvested soon after being stocked, and it is more likely that the trout below Bear Flat Campground in Tonto Creek have long been established and are self-sustaining.

It is possible for stocked rainbow trout to move downstream from the stocked reaches and then upstream into Tonto Creeks tributaries. However, this is limited due to intermittent and dry stretches in the tributaries, as well as natural barriers. The only creek where it is possible for stocked rainbow trout from Tonto Creek to move into occupied headwater chub populations is Spring Creek. Rainbow trout have not been sampled in Spring Creek since they were stocked in 1950, which suggests some unknown barrier to their movement into Spring Creek. Haigler Creek has barriers in its lower reach, and the remaining tributaries do not have existing populations of headwater chub.

During a June survey, Kern (2008b) did not detect rainbow trout downstream of the Haigler Creek confluence, but did collect yellow bullhead and green sunfish. This suggests that by June, Tonto Creek below Hells Gate is not suitable for rainbow trout survival, and begins to transition into more of a warm water stream at this point. Only one trout has been observed south of Hells Gate. The time of year of this record is unknown. Further, Burger (2007) did not detect any rainbow trout during a survey from Hells Gate to Gisela, again suggesting that below Hells Gate, Tonto Creek becomes unsuitable for rainbow trout, at least by late spring when both of these surveys occurred. Trout have not been found in Rye Creek, Gun Creek, or Tonto's tributaries below Hells Gate that have contained headwater chub in the past, but are currently thought to be extirpated (Voeltz 2002).

Rainbow trout are competitors for food and space with roundtail and headwater chub, and may also prey on young chub (Propst et al. 1998). Exposure of headwater chub to stocked trout could occur in lower Tonto Creek, but not in the stocked reach of Tonto Creek due to the presence of barriers that restrict upstream movement of headwater chub; however, the impacts cannot be separated from those of trout that appear to be self-sustaining in the system. It is possible that stocked trout could be supplementing those self-sustaining populations, although the extent to which this may be occurring is unknown. Small trout can compete with small headwater chub, but can also serve as a prey source for larger headwater chub. Surveys of both upper and lower

Tonto Creek show a large part of the fish populations to be exotic species such as brown trout, common carp, yellow bullhead, green sunfish, red shiner, channel catfish, and largemouth and smallmouth bass. Given the community composition, these other nonnative fish species as well as brown trout, if present in this reach, likely contribute a larger piece the overall impacts to headwater chub via predation and competition than stocked trout.

Suitable spawning temperatures for headwater chub are likely to occur in the occupied headwater chub habitat during the stocking season. This creates an additional risk of predation on larval or post-larval individuals by resident and stocked rainbow trout. Although specifics on when headwater chub spawn in Tonto Creek are lacking, temperatures of 64° to 76° F are reported for spawning headwater chub in the upper Verde (Brouder et al. 2000) and upper Gila Rivers (Bestgen 1985). Little data on stream temperature has been collected for the lower basin.

Northern Mexican Gartersnake

Stocking complex analysis: The distribution of northern Mexican gartersnakes within the Tonto Creek complex is incompletely known, but habitats adjacent to the stocking complex are generally not considered suitable for this species. Holycross et al. (2006) surveyed the Tonto Creek watershed extensively for gartersnakes, but found no northern Mexican gartersnakes. Within the 20 km (12.4 mi) buffer established for this stocking complex, there is one questionable northern Mexican gartersnake record from Hart Canyon, a tributary of Willow Creek (approx 8.7 air miles north of Woods Canyon Lake and approx. 8.7 air miles southwest of Chevelon Canyon Lake), for which Holycross et al. (2006) provides this analysis: "Wright and Wright (1957) discuss a *T. eques* from Hart Canyon....and provide both a physical description and photographs (p. 802). Unfortunately, it is difficult to tell from the photographs or description whether or not this specimen is a *T. eques*, so the specimen is not mapped…Whether [this record is valid] is a question that needs to be resolved, if possible." Regardless of the credibility of this record, there have been no systematic surveys for northern Mexican gartersnakes in that area. From the upper reaches of Christopher Creek, it is approximately 8.7 air miles to the Hart Canyon locality. If northern Mexican gartersnakes did occur at the Hart Canyon site, the Mogollon Rim at the headwaters of Christopher Creek at Promontory Point and unsuitable habitat (i.e., relatively dense, mixed coniferous forest) would likely preclude dispersal into the Tonto Creek complex. Surveys for gartersnakes in Tonto Creek between Bear Flat and Haigler Creek in 2004 found none (Holycross et al. 2006). Bullfrogs, crayfish, and non-native fish occupy the complex, making the habitat less suitable for northern Mexican gartersnakes. Steep, rocky canyon habitat in Tonto Creek upstream of the confluence with Haigler Creek probably never supported northern Mexican gartersnakes (Holycross et al. 2006). Therefore, it is unlikely that they occur in the complex. However, there are localities of northern Mexican gartersnakes in Tonto Creek downstream of the complex (see downstream analysis below), and individuals might be able to disperse upstream into the complex. Nonetheless, there is low likelihood that northern Mexican gartersnakes would be exposed to fish stocked in the complex.

Downstream analysis: Tonto Creek downstream of the complex is occupied by northern Mexican gartersnakes. Approximately 16 river miles downstream of Hells Gate, 15 northern Mexican gartersnakes were observed during surveys for the species in 2004, (HDMS, Holycross et al. 2006). Northern Mexican gartersnakes were also observed on Tonto Creek approximately 31 miles downstream of Hells Gate in 1995 (HDMS). Bullfrogs, crayfish, and non-native fish occupy Tonto Creek downstream of the complex, making the area downstream less suitable as habitat for northern Mexican gartersnakes than in areas free of these non native species. But, those conditions also exist where northern Mexican gartersnakes have been documented downstream; thus, there is likelihood that northern Mexican gartersnakes downstream of the complex would be exposed to rainbow trout if they disperse downstream and survive.

Narrow-headed Gartersnake

Stocking complex analysis: Narrow-headed gartersnakes occupy the Tonto Creek complex, which lies within the current and historical range of the species, and are likely found throughout. Holycross et al. (2006) surveyed the Tonto Creek watershed extensively for gartersnakes. Narrow-headed gartersnakes have been found within the Tonto Creek stocking reach in 1988 (HDMS), the Haigler Creek stocking reach in 1992 and 2008 (HDMS), and approx. 0.75 miles downstream of the Christopher Creek stocking reach in 1993 (HDMS). Although the presence of bullfrogs, crayfish, and several non-native fish including common carp, green sunfish, smallmouth bass, and yellow bullhead (Holycross et al. 2006) decreases the suitability of habitat for narrow-headed gartersnakes, recent records, good physical habitat, and connectivity of the habitats make it likely that narrow-headed gartersnakes are present in the complex, and there is likelihood of exposure to stocked rainbow trout within the Tonto Creek complex.

Downstream analysis: Tonto Creek downstream of the stocking complex is occupied by narrow-headed gartersnakes, and was surveyed extensively in 2004 and 2005 (Holycross et al. 2006). From Hells Gate at the Tonto Creek and Haigler Creek confluence, narrow-headed gartersnakes have been observed approximately 7,12, and 18 river miles downstream in 1990, 1999 and 2002, and from 1988-2005, respectively (HDMS, Holycross et al. 2006). Although crayfish and non-native fish species present downstream of the complex (Holycross et al. 2006) make the habitat less suitable for gartersnakes than in areas free of these non native species: however, there is likelihood that narrow-headed gartersnakes downstream of the complex would be exposed to rainbow trout if the trout disperse and survive.

LOWER SALT RIVER SUB-WATERSHED

Drainage Area and Elevations

The Lower Salt River Sub-Watershed includes the waters and drainage basins of the Salt River from Theodore Roosevelt Dam (upper Apache Lake) downstream to the confluence with the Gila River (Figure 49). This watershed includes: the lower Verde River below Bartlett Lake to the confluence with the Salt River, all of the connected tributaries, and the canal systems throughout the metropolitan Phoenix area. This complex drains a surface area of roughly 13,000 square miles. Elevations range from a high of over 2000 ft near Theodore Roosevelt Dam and a low of less than 1000 feet at the confluence of the Salt and Gila Rivers.

The Lower Salt River Sub-Watershed is divided into two complexes: 1) the Lower Salt River Complex, and 2) the Phoenix Metro Complex (Figure 50). The Lower Salt River Complex includes four proposed stocking locations: Apache, Canyon, and Saguaro Lakes, and the lower Salt River reach between Stewart Mountain Dam (Saguaro Lake) and the Granite Reef Diversion Dam. The Phoenix Metro Complex includes 31 proposed stocking locations: Tempe Town Lake, six Open System Urban Fishing Program (UFP) and Fishing in the Neighborhood (FIN) lakes, and 24 Closed System UFP and FIN lakes. The complex analysis includes the lower Verde River below Bartlett Dam because of hydraulic connectivity, although there are no proposed stocking sites in the Verde River drainage in or below Bartlett Dam.

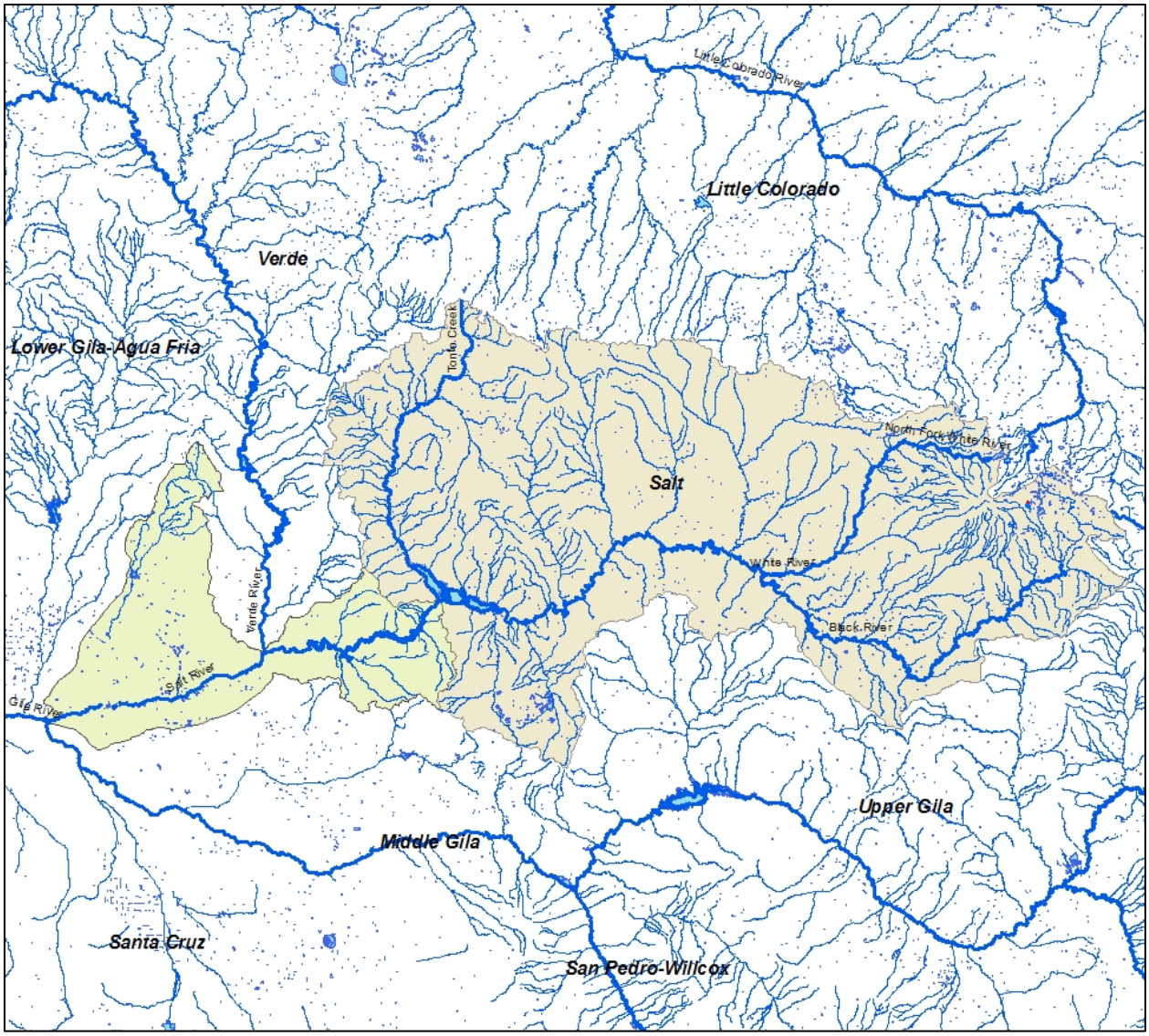

Figure 49. Map of the Salt River watershed with the lower Salt River drainage identified in green.

LOWER SALT RIVER LAKE COMPLEX

Apache Lake

Site Description

Apache Lake is second in a chain of four large reservoirs on the Salt River northeast of Phoenix and is the second largest in surface area. The lake is impounded by the 305 ft Horse Mesa Dam built in 1927. The 2,500 acre lake has a self-sustaining warm water fishery, which in recent years has been negatively impacted by fish kills attributed to blooms of golden alga, an invasive, toxin-producing alga. Apache Lake is actively maintained below its spillway elevation of 1,891 ft. The lake is owned by the Salt River Project (SRP) with the associated recreation areas and

surrounding lands under ownership and management of the Tonto National Forest (TNF). As the second of a series of four sequential lakes along the Salt River, SRP operates Apache Lake and Horse Mesa Dam to optimize water supply deliveries to Phoenix. Horse Mesa Dam is a hydro-electric generating dam providing additional power. The Dam has three conventional hydroelectric generating units rated at a total of 32,000 kW and one pumped storage hydroelectric unit added in 1972 and rated at 97,000 kW (SRP online). Recreation sites at the lake are managed by the TNF for: boating, camping, picnicking and hiking. The Burnt Corral recreation area includes a marina, restaurant, resort hotel, and camping areas.

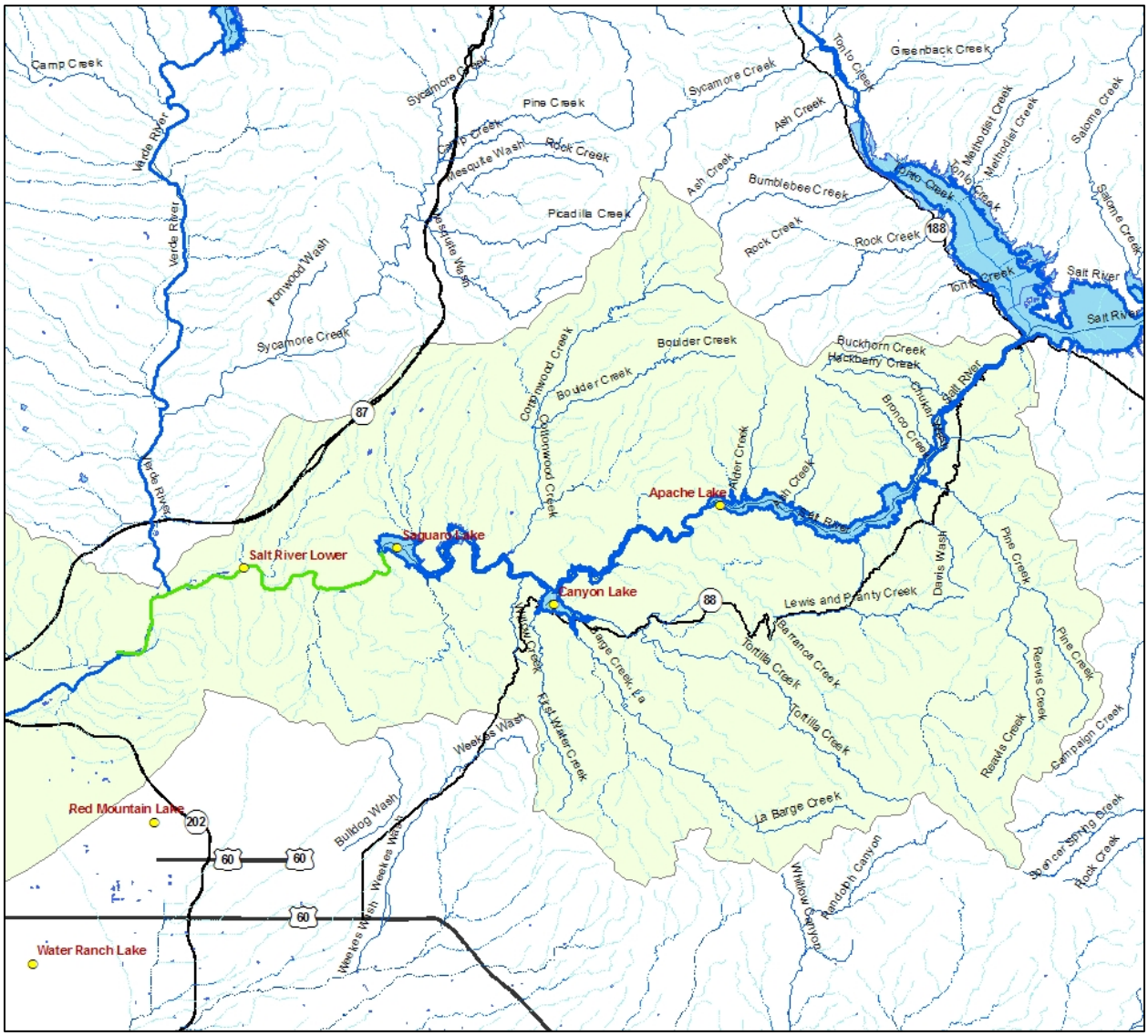

Figure 50. Lower Salt River Sub-Watershed overview with stocking locations.

Management of Water Body

The primary fishery is a warm water self-sustaining fishery. Apache Lake was first stocked by the Department in 1935. Largemouth and smallmouth bass, walleye, bluegill, redear sunfish, yellow perch, and black crappie were stocked over the years to establish a self-sustaining warm water sport fishery for angling recreation by the public (Table 41). Since the discovery of the fish-killing golden alga at Apache Lake in 2005, the main management focus has been to replace and reestablish the popular largemouth bass, smallmouth bass, and walleye fisheries through supplemental stockings. A research project was begun by the Department in 2007 to evaluate the effectiveness of restocking Saguaro, Apache, and Canyon lakes with largemouth and smallmouth bass to recover the warm water fish populations after the fish kills.

The secondary fishery is a coldwater intensive-use, put-and-take rainbow trout fishery throughout the winter months. Apache Lake is typically stocked every 2-3 weeks from early November through February with catchable rainbow trout. Numbers, timing, and size of trout stocked are usually adjusted depending on hatchery fish availability, stocking conditions, variations in angler demand levels, or due to changes in management strategy.

This fishery of Apache Lake has been negatively impacted by alga induced fish kills. Fish kills in lakes of this size are typically not complete kills. The surviving adult and juvenile fish remain to re-populate the fishery beginning with the next spawning season. The impacts from the 2005 algal fish kill on largemouth bass populations were severe at Apache Lake. Very few adults remained, but enough remained and a good spawn of largemouth bass was documented in 2008. The effects of the 2005 golden alga bloom were even more devastating on the smallmouth bass population. A fall 2005 post-kill fishery survey did not document any smallmouth bass (Warnecke et al. 2005a). Small mouth bass were subsequently stocked in 2007 and 2008.

In the fall of 2007 (two years after the initial fish kill), approximately 6,300 juvenile size largemouth bass between 150 and 210 mm were stocked into Apache Lake. Given the size of the lake, it is believed that these supplemental stockings represent a small contribution to the remaining bass population. Six months post stocking 18% of the largemouth bass population was comprised of stocked fish (Stewart 2008), however, 12 months post stocking the stocked bass made up slightly over 1% of the population (Stewart 2009a). The juvenile largemouth bass stocked were just reaching the minimum spawning size (180 - 210 mm) and may have contributed to spawning events in the spring of 2008. How much more successful those spawning events were because of the introduction is difficult to determine. The speed with which the largemouth bass populations rebounded may have been influenced by the stocking, or, the high reproductive successes of the remaining fish could have been sufficient to repopulate the lake. Stocking of adults or sub-adult fish to restore a bass population may be effective or may simply address angler and public concerns about the length of time needed to restore the fishery. It may take up to four years to reestablish a fishery and largemouth bass were stocked in 2009.

Based on a 2001 angler survey conducted by the Department, this lake provides a significant level of recreation: 10,600 angler user days (AUD) for trout (totally supported by the proposed stocking activity) and 147,400 AUD for other species (supported by naturally occurring and self-sustaining populations of warm water fish, with the exception of stocked walleye) (Pringle 2004).

Table 41. Summary of historic Department fish stockings at Apache Lake.

Species	First Year	Last Year	Num. of Years Stocked	Number Stocked
Black crappie	1935	1935	1	300
Bluegill	1935	1954	6	321,050
Coho salmon *	1972	1972	1	25,000
Largemouth bass	1935	2009	29	394,998
Rainbow trout	1972	2009	93	969,744
Redear sunfish	1947	1953	2	36,900
Smallmouth bass	2007	2008	4	8,726
Threadfin shad	1957	1957	1	3,000
Walleye	1972	2009	24	5,842,931
Yellow perch	1953	1953	1	5,824
Total				7,608,473

** No longer found in the system.*

Proposed action

The Department proposes to stock rainbow trout, largemouth bass, smallmouth bass, walleye, channel catfish, and black crappie for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked multiple times from October through March each year; the numbers of trout stocked would range from 0 to 80,000 fish annually.

Sac fry and fingerling walleye would be stocked anytime annually; numbers of walleye stocked would be from 0 – 2.6 million sac fry annually and from 0 - 52,000 fingerling walleye annually.

Largemouth (fry/fingerling, sub-catchable, catchable), smallmouth bass (fry/fingerling, sub-catchable), channel catfish (sub-catchable, catchable), and black crappie (sub-catchable, catchable), may be stocked as needed at any time during the period covered by this consultation to augment the fishery or to recover the fishery following catastrophic events such as a golden alga kill. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Apache Lake is a 17-mile long lake with 41 miles of shoreline, confined between two dams, Horse Mesa Dam (lower end) and Theodore Roosevelt Dam (upper end). Apache Lake has a surface area of 2,568 acres at maximum level and a maximum depth of 255 ft (www.srpnet.com). The lake is operated with the other three interconnected Salt River lakes as one unit for hydroelectric power generation. Roosevelt Lake, upstream of Apache Lake, is the largest lake and the main storage reservoir for the system. Roosevelt Lake receives its water from two large watersheds, the Salt River and Tonto Creek drainages (Figure 51 and Figure 52). Water is released from Roosevelt Lake and travels through the chain lakes (Apache, then Canyon, then Saguaro) and is ultimately released from Stewart Mountain Dam (Saguaro Lake) into the lower Salt River (Figure 53). Water releases from Stewart Mountain Dam into the lower Salt River are seasonally variable, but average approximately 279 cfs daily. Two small ephemeral drainages feed Apache Lake from the north: Alder Creek and Long Canyon.

Apache Lake is operated to maintain a constant balanced level through input from the storage at Roosevelt and pump back from Canyon Lake (downstream). The pumps that transfer water are located at approximately 90 ft depths. In addition to the pumps, the reservoir also contains a bypass valve. Both the pumps and bypass valve can only handle up to 3,000 cfs. If incoming water flow increases above 3,000 cfs and the lake is at full capacity, the water will spill over Horse Mesa Dam and into Canyon Lake (C. Paradzick-SRP- pers. com.). These large runoff events occur on SRP reservoirs an average of once every 10 years.

Please see the following sections for downstream water distribution and connectivity discussion that includes Apache Lake, Canyon Lake, Saguaro Lake and the Lower Salt River as one interconnected complex. Also, the Lower Salt River Complex section discusses the overall water distribution and connectivity throughout this entire complex.

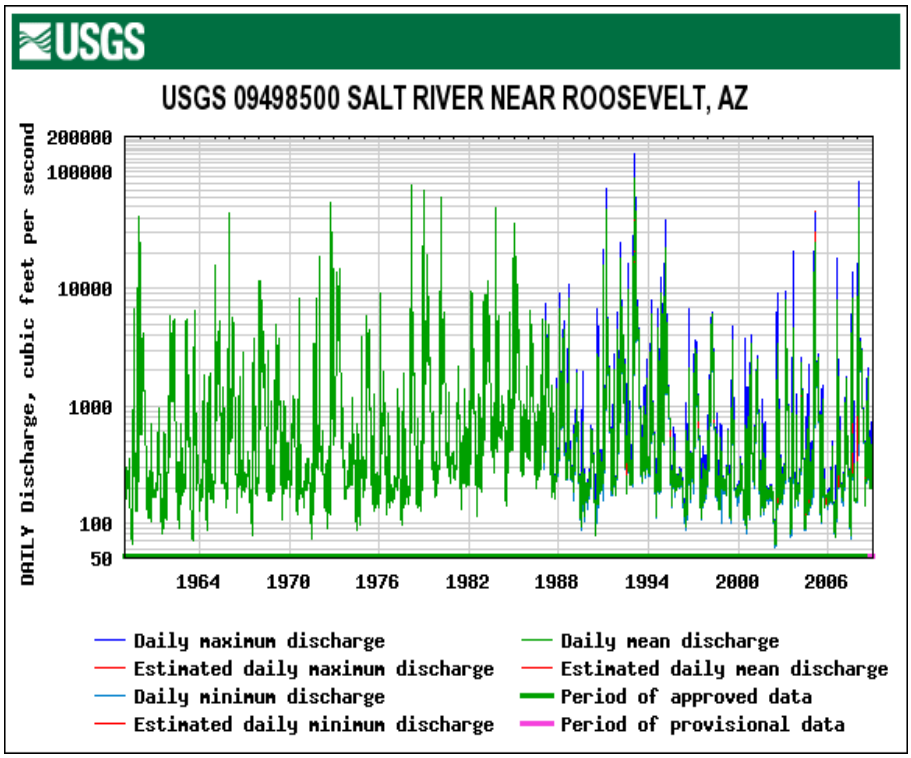

Figure 51. USGS Daily gage discharge at Salt River near Roosevelt, Arizona 1959 – 2009.

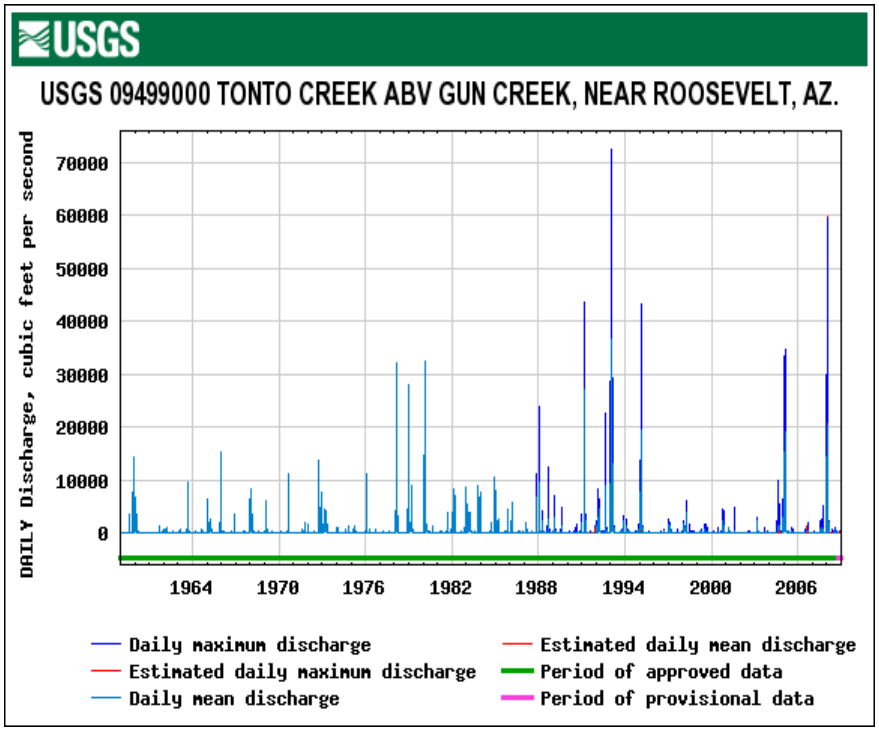

Figure 52. USGS Daily gage discharge at Tonto Creek near Roosevelt, Arizona 1959 – 2009.

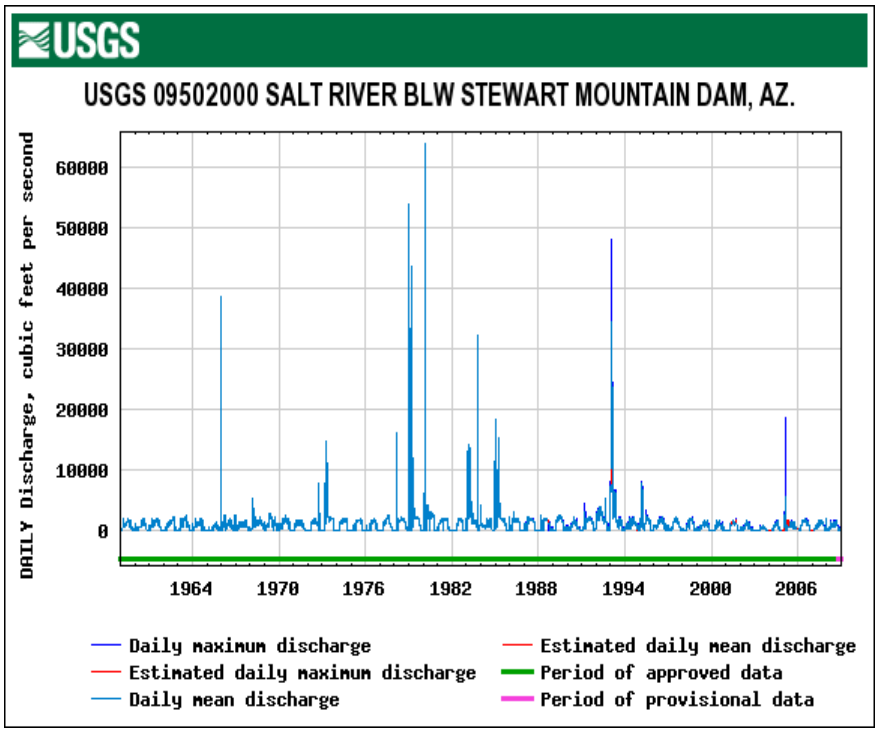

Figure 53. USGS Daily gage discharge at Salt River below Stewart Mountain Dam, Arizona 1959 – 2009.

Fish Movement

Fish within Apache Lake are impeded from upstream movement by the Theodore Roosevelt Dam. Horse Mesa Dam on the lower end confines fish through the penstock releases. As hydroelectric pumps and bypass valves move water through Horse Mesa Dam daily, there is a potential for fish to be displaced downstream into Canyon Lake. Fish moving through the dams would have to be present at the intakes which are located at 90 ft depths; Apache Lake becomes thermally and chemically (dissolved oxygen) stratified during summer; however, due to the pumpback that occurs during night time, the stratification near the dam is less strong, and in some cases nonexistent compared to the rest of the reservoir. The depth of the intake somewhat reduces the likelihood that fish will become entrained and it is expected that few fish would be able to survive passing through the turbines or bypass pipe at these depths. The physical force and cutting edges of turbines utilized in the movement of water through the Horse Mesa Dam would also limit the survival and potential movement of live fish Sale et al 2006.

Water passes over the Horse Mesa Dam spillway during episodic runoff events that occur during years when Roosevelt Lake discharges and spillway overflows exceed 3,000 cfs coming into Apache. Salt River Project dams spill on an average of once every 10 years. The passage of some fish, particularly smaller pelagic or littoral species, may go over the spillway into Canyon Lake.

Please see the following sections for fish as they have the potential to move downstream to Canyon Lake, Saguaro Lake, and the Lower Salt River. Also, the Lower Salt Complex section will discuss the overall fish movement potential throughout this entire complex.

Community Description

The lake contains a variety of nonnative species: common carp, threadfin shad, channel catfish, green sunfish, bluegill, largemouth bass, smallmouth bass, yellow bass, rainbow trout, flathead catfish, and walleye. The most recent surveys conducted at Apache Lake documented the presence of: bluegill, buffalo, channel catfish, common carp, flathead catfish, green sunfish, largemouth bass, mosquito fish, rainbow trout, smallmouth bass, threadfin shad, walleye, and yellow bass (Stewart 2008; 2009a). No rainbow trout were collected in fall 2007. One trout was captured in the fall of 2008 after stocking had begun and 15 were sampled in the spring of 2008 (Table 42).

In the fall of 2007, the Department initiated a research project to evaluate the effectiveness of restocking largemouth and smallmouth bass into Saguaro, Apache, and Canyon lakes to recover the warm water fish populations. Intensive electrofishing and gill net surveys were conducted in fall 2007, spring and fall 2008, and spring 2009 (Table 42).

The two bald eagle Breeding Areas (BAs) in the lake vicinity have birds that use Apache Lake for foraging. The adults may remain in the area year round and continue to use the lake. Yuma clapper rails have not been documented at the lake; however, they have been documented from Roosevelt Lake upstream.

Table 42. Total number of fish sampled with gillnets and electrofishing at Apache Lake from fall 2007 through spring 2009 surveys.

	Electrofishing				**Gillnetting**			
Species	**Fall 07**	**Fall 08**	**Spring 08**	**Spring 09**	**Fall 07**	**Fall 08**	**Spring 08**	**Spring 09**
Bluegill	224	358	714	863	1	0	3	11
Buffalo Fish	5	2	14	11	9	2	15	4
Channel Catfish	8	6	10	6	73	51	71	44
Common Carp	41	17	42	45	43	31	61	42
Flathead Catfish	1	3	1	1	20	7	15	9
Green Sunfish	15	93	367	191	1	2	8	35
Largemouth Bass	48	353	229	446	7	14	27	45
Mosquito fish	1	1	2	0	0	0	0	0

Rainbow Trout	0	0	6	5	0	1	15	0
Smallmouth Bass	0	2	104	44	0	3	27	13
Threadfin Shad	178	1,318	442	727	202	1,173	2,255	1,477
Walleye	1	0	2	0	38	11	28	22
Yellow Bass	4	116	43	206	136	78	199	265
Yellow Bullhead	1	6	0	1	0	0	1	0
Total	**527**	**2,275**	**1,976**	**2,546**	**530**	**1,373**	**2,725**	**1,967**

Consultation Species or Critical Habitat
Potential impacts from the stocking of rainbow trout and warm water species into Apache Lake to bald eagle and Yuma clapper rail are discussed below. Potential impacts on bonytail and roundtail chub, razorback sucker and critical habitat and Western yellow-billed cuckoo are discussed in the Lower Salt River Complex Analysis sections.

Bald Eagle
Horse Mesa Breeding Area is approximately 0.9 miles from Apache Lake and is within the Sonoran Desert Bald Eagle Discrete Population Segment (DPS). This BA was established in 1983 and the BA was active in the 2010 season. Nest watchers have not monitored the breeding area so the prey base specifics are largely unknown. Horse Mesa Breeding Area productivity data shows that the nest failed in 2007, was successful in 2008 with one nestling disappearing from the nest at 8-10 weeks old, and was successful in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Rock Creek Breeding Area is approximately 5.6 miles from Apache Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed in 2001 and were last observed 22 April, 2008. Nest watchers have not monitored the breeding area so the prey base specifics are largely unknown. Rock Creek Breeding Area productivity data shows that the nest was unoccupied in 2007, failed in 2008, and unoccupied in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Fish Creek Breeding Area is approximately 0.5 miles from Apache Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed at the breeding area in 2007 and the BA was active in the 2010 season. Nest watchers have not monitored the breeding area so the prey base specifics are largely unknown. Fish Creek Breeding Area productivity data shows that the nest failed in 2007, was unoccupied in 2008, and failed again in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Table 43. Recent (10 years) bald eagle productivity for Apache Lake BAs. (Blank spaces by year indicate the BA did not exist at that time.)

Year	Fish Creek BA	Horse Mesa BA	Rock Creek BA
2000		Fledged 1	
2001		Fledged 1	Occupied (1st year)
2002		Fledged 1	Fledged 1
2003		Fledged 2	Failed
2004		Failed	Failed
2005		Fledged 1	Fledged 1
2006		Fledged 1	Unoccupied
2007	Failed (1st year)	Failed	Unoccupied
2008	Unoccupied	Fledged 1	Failed
2009	Failed	Fledged 1	Unoccupied

Potential impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Apache Lake does have monofilament bins present.

Yuma clapper rail
Yuma clapper rails have not been documented from Apache Lake. There is no suitable habitat at the lake.

Potential impacts
No impacts would be anticipated due to the lack of habitat.

Canyon Lake
Site Description
Canyon Lake is the third in the chain of four large reservoirs on the Salt River northeast of Phoenix. The lake is impounded by the 224 ft Mormon Flat Dam built in 1925. The 926 acre lake has a self-sustaining warm water fishery, which in recent years has been negatively impacted by fish kills attributed to blooms of golden alga, an invasive, toxin-producing alga. Fish Creek and Tortilla Creek are tributaries to Canyon Lake. Canyon Lake is maintained below its spillway elevation of 1,610 ft. The lake is owned by Salt River Project (SRP) and the surrounding lands are part of the Tonto National Forest (TNF). SRP operates Canyon Lake and Mormon Flat Dam as one section of a four part operation of lakes on the Salt River to increase the water supply available to SRP and provide additional hydropower production. Mormon Flat Dam is a hydroelectric generating dam. Two hydroelectric generating units are at the dam; one is a conventional unit rated at 10,000 kW and the other is a pumped storage unit built in 1971 and rated at 50,000 kW (SRP online). Canyon Lake is managed by the TNF for recreation such as

boating, picnicking, camping, and water sports. The area is accessible by road year round and includes a marina, an RV area, campgrounds, and a restaurant.

Management of Water Body

Canyon Lake is primarily a warmwater, year round fishery. Canyon Lake was first stocked by the Department in 1935. Largemouth and smallmouth bass, channel catfish, hybrid sunfish, walleye, bluegill, redear sunfish, yellow perch, and white and black crappie were stocked over the years to a self-sustaining warm water sport fishery for angling recreation by the public (Table 44). Largemouth and smallmouth bass (fry/fingerling, sub-catchable, catchable) and walleye (fry/fingerling, sub-catchable, catchable) are currently stocked on an as needed basis during spring, summer, or fall at densities sufficient to augment/recover the fishery following fish kill (summer or winter) events. Densities, timing, and stocked fish size are adjusted (adjustments not anticipated to be significant) outside the stated ranges depending on fish availability, stocking conditions, need to meet angler demands, or due to shifts in management strategy. A research project was begun by the Department in 2007 to evaluate the effectiveness of restocking Saguaro, Apache, and Canyon lakes with largemouth and smallmouth bass to recover the warm water fish populations after the fish kills.

The secondary fishery is a coldwater intensive-use, put-and-take rainbow trout fishery throughout the winter months. Canyon Lake is typically stocked every 2-3 weeks from early November through February with catchable rainbow trout. Densities, timing, and size of trout stocked are usually adjusted depending on hatchery fish availability, lake stocking conditions, variations in angler demand levels, or due to changes in management strategy.

This fishery of Canyon Lake has been negatively impacted by alga induced fish kills. Fish kills in lakes of this size are often not complete kills. The surviving adult and juvenile fish remain to re-populate the fishery beginning with the next spawning season. The impacts from the 2005 golden alga fish kill on largemouth bass were severe. While Canyon Lake was affected by the 2005 kills, reproduction was documented afterward (Warnecke et al 2005b).

In the fall of 2007 (two years after the initial fish kill), approximately 3,100 juvenile size largemouth bass between 150 and 210 mm were stocked into Canyon Lake. Given the size of the lake, it is believed that these supplemental stockings represent a small contribution to the remaining bass population. Six months post-stocking in spring 2008, the percentage of stocked largemouth bass to the entire population was less that 5% at Canyon Lake (Stewart 2008) and less that 1% 12 months post-stocking (Stewart 2009a). The juvenile largemouth bass stocked were just reaching the minimum spawning size (180-210 mm) and may have contributed to spawning events in the spring of 2008. How much more successful those spawning events were because of the introduction is difficult to determine. The speed with which the largemouth bass populations rebounded may have been influenced by the stocking, or the high reproductive successes of the remaining fish could have been sufficient to repopulate the lake. Stocking of

adult or sub-adult fish to restore a bass population may be effective or may simply address angler concerns about the length of time needed to restore the fishery.

Based on a 2001 angler survey conducted by the Department, this lake provides a significant level of recreation: 23,400 angler user days (AUD) for trout (totally supported by the proposed stocking activity) and 161,400 AUD for other species (supported by naturally occurring and self-sustaining populations of warm water fish, with the exception of stocked walleye) (Pringle 2004).

Table 44. Summary of historic Department fish stockings at Canyon Lake.

Species	First Year	Last Year	Number of Years Stocked	Number Stocked
Black crappie	1935	1936	4	2,800
Bluegill	1935	1956	23	481,610
Brown trout *	1963	1964	2	12,300
Bullhead catfish	1941	1941	1	1,860
Channel catfish	1958	1971	3	75,600
Coho salmon *	1971	1973	4	56,598
Largemouth bass	1935	2009	42	638,579
Rainbow trout	1970	2009	299	1,122,480
Redear sunfish	1947	1950	3	65,400
Smallmouth bass	2007	2008	3	2,545
Sunfish hybrid	1947	1947	1	5,000
Threadfin shad	1958	1960	4	15,000
Walleye	1957	2008	24	8,916,363
White crappie *	1958	1958	1	545
Total				11,396,680

** No longer found in the system.*

Proposed Action

The Department proposes to stock rainbow trout, largemouth bass, smallmouth bass, walleye, channel catfish and black crappie for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked multiple times from October through March each year; the numbers of trout stocked would range from 0 to 22,500 fish annually.

Sac fry and fingerling walleye would be stocked anytime annually; numbers of walleye stocked would be from 0 – 1 million sac fry annually and from 0 - 19,000 fingerling walleye annually.

Largemouth (fry/fingerling, sub-catchable, catchable), smallmouth bass (fry/fingerling, sub-catchable), channel catfish (sub-catchable, catchable), and black crappie (sub-catchable, catchable) may be stocked as needed at any time during the period covered by this consultation to augment or to recover the fishery following catastrophic events such as a golden alga kill. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Canyon Lake is a 10-mile long lake with 28 miles of shoreline, confined between two dams, Horse Mesa Dam (upper end) and Mormon Flat Dam (lower end). Canyon Lake has a surface area of 950 acres at maximum level and a maximum depth of 131.5 feet (www.srpnet.com). The lake is operated along with the other three interconnected Salt River lakes as one unit for hydroelectric power generation. Roosevelt Lake, upstream of Apache Lake, which is upstream of Canyon Lake, is the main storage reservoir for the system. Roosevelt Lake receives its water from two large watersheds, the Salt River and Tonto Creek drainages. Water is released from Roosevelt and travels through the chain lakes (including Apache Lake and Canyon Lake) and released at Stewart Mountain Dam (Saguaro Lake), which is the furthest downstream dam. Water exits Canyon Lake through Mormon Flat Dam and into Saguaro Lake. Saguaro Lake empties into the lower Salt River through Stewart Mountain Dam.

Canyon Lake is operated to maintain a constant balanced level through input from the storage at Roosevelt Lake and pump back from Saguaro Lake (downstream). The pumps that transfer water are located at approximately 90 ft depths. In addition to the pumps the reservoir also contains a bypass pipe. Both the pumps and bypass pipe can only handle up to 3,000 cfs. If incoming water flow increases above 3,000 cfs and the lake is at full capacity, the water will spill over the Mormon Flat Dam spillway and into Saguaro Lake (C. Paradzick pers. com.). Salt River Project dams spill on an average of once every 10 years.

Tortilla Creek, La Barge Creek, and Fish Creek are tributaries to Canyon Lake. Tortilla Creek is considered intermittent with a few perennial reaches, but contains mostly dry reaches throughout, while Fish Creek is considered perennial throughout much of its drainage (ADWR 2007) although Lower and Middle Fish Creek may be intermittent for some portion of the year. Lower and middle Fish Creek is known to contain large pools and runs (Carveth 2006).

Please see the following sections for downstream water distribution and connectivity as flows move downstream to Saguaro Lake and the Lower Salt River. The Lower Salt River Complex section discusses the overall water distribution and connectivity throughout this entire complex.

Fish Movement

Fish within Canyon Lake are confined to the lake by Horse Mesa Dam at the top end and Mormon Flat Dam on the lower end. As there are pumps and bypass valves moving water

through Mormon Flat Dam daily, there is a potential for fish to be displaced downstream into Saguaro Lake. Fish moving through the dams would have to be present at the intakes which are located at 145 ft depths. Due to the depth of the intakes and bypass, water quality (low dissolved oxygen) at such depths would create a chemical and physical fish barrier. It is thought that few fish, if any, would be able to survive passing through the turbines or bypass pipe at these depths. The physical force and cutting edges of turbines utilized in the movement of water through the Horse Mesa Dam would severely limit the survival and potential movement of live fish. Wolff (2009) evaluated studies on fish passage through dams and summarized these severe limitations on fish passage.

Water passes over the Mormon Flat Dam spillway during episodic runoff events that occur during years when Roosevelt Lake discharges and spillway overflows exceed 3,000 cfs and passes through a full Apache Lake. Salt River Project dams spill on an average of once every 10 years. The passage of some fish, particularly smaller pelagic or littoral species, may go over the spillway into Saguaro Lake.

Tortilla Creek, La Barge Creek and Fish Creek are tributaries to Canyon Lake. A fish barrier exists on Tortilla Creek just above Canyon Lake. The barrier consists of an elevated road crossing with no culverts. Fish stocked in Canyon Lake are not expected to be able to migrate above this barrier. Fish Creek also has a barrier to upstream movement from Canyon Lake formed by a waterfall near the Highway 88 crossing, about 5 miles upstream from the lake. Lower and middle Fish Creek are intermittent and periodically contain large pools below the barrier that occasionally go dry. It is highly unlikely that stocked fish would be present or survive in Fish Creek due to barriers or warm water temperatures (for trout) most of the year. Surveys in Fish Creek in 1993 reported only longfin dace present above the waterfall near the road crossing (AGFD unpublished data) and no fish below the waterfall. La Barge Creek is an ephemeral tributary to the Salt River, now flowing into La Barge Cove at Canyon Lake. Fish movement up this stream during flow events would be possible, although extremely improbable because of the 9.6% gradient within the channel and turbidity and sediment transport that occurs during flow events. No non-native fish has been documented at the known perennial water source upstream from Canyon Lake in La Barge Creek, Charlebois Spring.

Please see the following sections for fish as they have the potential to move downstream to Saguaro Lake and the Lower Salt River. Also, the Lower Salt River Complex section discusses the overall fish movement potential throughout this entire complex.

Community Description

The lake contains a variety of nonnative fish species: common carp, threadfin shad, channel catfish, green sunfish, bluegill, redear sunfish, largemouth bass, yellow bass, rainbow trout, flathead catfish, and walleye.

The most recent surveys conducted at Canyon Lake documented the presence of the following fish species: bluegill, buffalo, channel catfish, common carp, flathead catfish, green sunfish, largemouth bass, mosquito fish, rainbow trout, redear sunfish, smallmouth bass, threadfin shad, walleye, yellow bass, yellow bullhead, and tilapia (Stewart 2008; Stewart 2009a, Table 45). No rainbow trout were captured in the fall of 2007 and only one in the spring of 2008 indicating that trout are soon fished out or die off when the water becomes warmer during the spring (Stewart 2008).

Table 45. Total number of fish sampled with electrofishing and gillnets at Canyon Lake from fall 2007 through spring 2009.

	Electrofishing				Gillnetting			
Species	**Fall 07**	**Fall 08**	**Spring 08**	**Spring 09**	**Fall 07**	**Fall 08**	**Spring 08**	**Spring 09**
Black Crappie	0	0	0	0	2	0	0	0
Bluegill	1,462	1,544	1,429	1,565	11	2	4	12
Buffalo Fish	1	1	1	1	0	0	0	0
Channel Catfish	31	3	2	15	88	69	123	74
Common Carp	67	15	38	39	18	8	23	11
Flathead Catfish	13	1	0	1	25	9	5	4
Goldfish	0	0	0	0	1	0	0	0
Green Sunfish	58	34	21	38	6	0	1	4
Largemouth Bass	560	393	558	414	52	73	24	46
Mosquitofish	3	0	0	0	0	0	0	0
Rainbow Trout	0	0	1	3	0	0	0	0
Redear Sunfish	1	0	0	0	0	0	0	0
Smallmouth Bass	0	3	4	3	0	0	1	0
Threadfin Shad	469	159	1,065	609	53	145	116	53
Tilapia	7	1	0	0	2	1	0	0
Walleye	1	7	0	1	0	5	4	11
Yellow Bass	138	59	74	47	168	47	157	204
Yellow Bullhead	32	0	0	0	4	2	1	3
Yellow Perch	0	0	0	0	1	0	2	0
Total	**2,843**	**2,220**	**3,193**	**2,736**	**431**	**361**	**461**	**422**

In the fall of 2007, the Department initiated a research project to evaluate the effectiveness of restocking largemouth and smallmouth bass into Saguaro, Apache, and Canyon lakes to recover the warm water bass populations. Intensive electroshocking and gill net surveys were conducted each spring and fall since fall 2007 (Stewart 2008; Stewart 2009a). Fish Creek was surveyed in February and March 2006 (Carveth 2006) and green sunfish and longfin dace were found in both the lower and middle reaches immediately above and below Hwy. 88. No rainbow trout were

found. Crayfish are also present in the creek. Lowland leopard frogs are also documented in Fish Creek (HDMS data).

Tortilla Creek was recently surveyed in the fall of 2005 and in the winter of 2006 (Voeltz 2005, Voeltz 2006). Only Gila topminnow and fathead minnows were caught below natural falls in a few tinajas and only Gila topminnow were collected above those natural falls. Lowland leopard frogs are also documented in Tortilla Creek (HDMS data).

There are no nesting bald eagles at Canyon Lake; however, the eagles at the Fish Creek BA on Apache Lake and the Saguaro BA on Saguaro Lake may also forage at Canyon Lake. Wintering bald eagles may forage along the Salt River. Yuma clapper rails have not been detected at Canyon Lake.

Consultation Species or Critical Habitat
Potential impacts from the stocking of rainbow trout and warm water species into Canyon Lake on bald eagle, Yuma clapper rail, Gila chub and Gila topminnow are discussed below. Potential impacts on bonytail, roundtail chub, razorback sucker and critical habitat and Western yellow-billed cuckoo are discussed in the Lower Salt River Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Bald Eagle
Fish Creek Breeding Area is approximately 6.2 miles from Canyon Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed at the breeding area in 2007 and the BA was active in the 2010 season. Nest watchers have not monitored the breeding area so the prey base specifics are largely unknown. Fish Creek Breeding Area productivity data show that the nest failed in 2007, was unoccupied in 2008, and failed again in 2009 (Jacobson et al. 2007, McCarty and Jacobson 2008, 2009).

Saguaro Breeding Area is approximately 3.8 miles from Canyon Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed at the breeding area in 2008 and the BA was active in the 2010 season. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 67.9%,

birds 3.6%, mammals 3.6%, and unknown 25%. No prey items could further be identified. Saguaro Breeding Area productivity data show that the nest was successful in 2008 and 2009 (McCarty and Jacobson 2008, 2009).

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Canyon Lake does have monofilament bins present.

Gila Chub
W.L. Minckley reportedly collected Gila chub in 1965 from Fish Creek. No Gila chub have been reported in Fish Creek since then and they are considered extirpated from the stream system (Weedman et al. 1996).

Potential Impacts
Due to the absence of Gila chub in any surveys within these reaches since 1965, this species is extirpated from Fish Creek and that there will be no impacts from stocking in Canyon Lake.

Gila Topminnow
Fish Creek was stocked with Gila topminnow in 1965. No Gila topminnow have been reported in Fish Creek since and it is thought that the Gila topminnows were eliminated by flooding that occurred following the stocking (Weedman and Young 1997).

Gila topminnows are present in two populations in drainages connected to Canyon Lake. The Unnamed Drainage #68 population occurs in plunge pools located in a narrow steep canyon of a tributary to Tortilla Creek which flows into Canyon Lake. Since sampling began in 1985 only topminnows have been detected. This population is functionally isolated from Canyon Lake because of the fish barrier that exists on Tortilla Creek just above Canyon Lake as was described in the fish movement section. Charlebois Spring is located in an isolated spring-fed drainage that joins La Barge Canyon and eventually would run into Canyon Lake after traversing about nine miles of ephemeral channel downstream, but only during flow events of unknown magnitude, frequency or duration. Only topminnows have been recorded in Charlebois Spring since their introduction in 1985. This population is functionally isolated from Canyon Lake because of the miles of ephemeral channel and gradient, especially in the ¼ mile of channel from the spring down to La Barge Canyon that drops about 120’, a gradient of 9.6% (Figure 54). This assumption is supported by the only available data which identifies Charlebois Spring as being inhabited only by Gila topminnow (AGFD monitoring data).

Potential Impacts
Due to the absence of Gila topminnow within Fish Creek since 1965, we expect that this species is extirpated from Fish Creek and for that reason; there will be no impacts from stockings.

Due to the isolation of the Unnamed Drainage #68 and Charlebois Spring populations from Canyon Lake, it is unlikely that any stocked fish or their progeny could access the Gila topminnow populations.

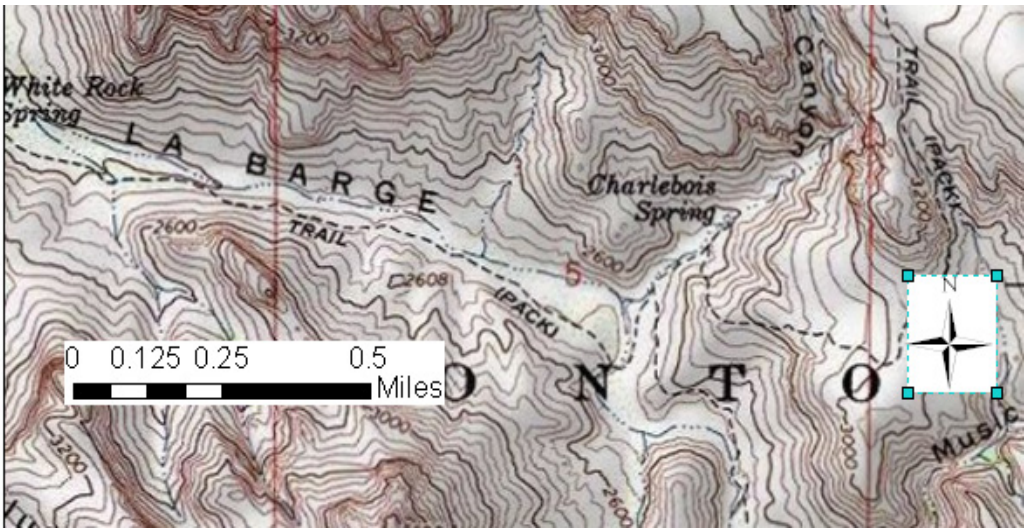

Figure 54. Topographic map of Charlebois Spring and La Barge Canyon.

There is a potential for Gila topminnow reaching the lake during periods of high flow that could carry individuals out of the protected spring. Voeltz and Bettaso (2003) stated that unnamed drainage has a small watershed and the area has probably allowed the topminnows to persist in this steep narrow canyon. Also, native fish species are adapted to the natural cycles of flood and low water periods and resist downstream transport (Minckley and Meffe 1987).The downstream dispersal of Gila topminnow into Canyon Lake has never been documented to occur; however, the small size of the Gila topminnow make finding any individuals unlikely. The intermittent exposure to high flows reduces the opportunity for their transport down to the lake as well.

However, if this was to occur those individuals would be lost to the recovery population in the spring since they could not move back upstream. It is likely that these displaced individuals would not survive in the lake, in part due to a lack of suitable habitat and predation on them by nonnative species including stocked fish or their progeny. Gila topminnow is at risk from predation from the existing and stocked warm water predatory fish; however, there is also a risk of predation from rainbow trout. A loss of these individuals is expected to be minimal, and is not significant to the overall health and survival of the protected population.

Yuma Clapper Rail

Yuma clapper rails have not been documented from Canyon Lake. There is no suitable habitat at the lake.

Potential impacts

No potential impacts are anticipated due to lack of suitable habitat.

Saguaro Lake

Site Description

Saguaro Lake is the fourth in a chain of four large reservoirs on the Salt River northeast of Phoenix. The lake is impounded by the 208 ft Stewart Mountain Dam built in 1930. The 1,100 acre lake has a self-sustaining warm water fishery, which in recent years has been negatively impacted by fish kills attributed to blooms of golden alga, an invasive, toxin-producing alga. Saguaro Lake is maintained below its spillway elevation of 1,506 ft. The lake is owned by SRP and the surrounding lands are part of the TNF. Salt River Project operates Saguaro Lake and Stewart Mountain Dam as the fourth of a series of sequential lakes along the Salt River for water supply and hydropower production. Stewart Mountain Dam is operated as a hydro electric generating dam. There is a 13,000 kilowatt (kW) hydroelectric generating unit operated mainly in the summer months (SRP online). Saguaro Lake is also managed by the TNF as a recreation area that includes a marina and restaurant, camping, picnicking, boating and water recreation. The lake is accessible by paved road year round. The area around the lake includes paths and recreation areas. Saguaro Lake is undoubtedly the busiest watercraft recreation lake in terms of density of boats per acre in Arizona. Most late spring through early fall recreational use is by watercraft and most anglers avoid the lake during this time, except for some night angling when the recreational boaters, speed boaters, jet-skis, and skiers have left the lake.

Management of Water Body

The primary fishery is a warm water self-sustaining fishery. Largemouth and smallmouth bass, channel catfish, sunfish hybrid, walleye, bluegill, redear sunfish and black crappie were stocked over the years to establish a self-sustaining warm water fishery for angling recreation by the public (Table 46). Largemouth and smallmouth bass are currently being stocked on an as needed basis during spring, summer or fall at densities sufficient to augment/recover the fishery following fish kill events (summer or winter). Densities, timing and stocked fish size are adjusted depending on: fish availability, stocking conditions, need to meet angler demands, or due to shifts in management strategy. Saguaro Lake has been negatively impacted by fish kills in recent years, primarily attributed to blooms of golden alga. A research project was begun by the Department in 2007 to evaluate the effectiveness of restocking Saguaro, Apache, and Canyon lakes with largemouth and smallmouth bass to recover the warm water fish populations after the fish kills.

The secondary fishery is a coldwater intensive-use, put-and-take rainbow trout fishery throughout the winter months. Saguaro Lake is typically stocked every 2-3 weeks from early November through February with catchable rainbow trout. Numbers, timing, and size of trout stocked are usually adjusted depending on: hatchery fish availability, stocking conditions, need to meet angler demands, or due to changes in management strategy.

This fishery of Saguaro Lake has been negatively impacted by alga induced fish kills. Fish kills in lakes of this size are not typically complete kills. The surviving adult and juvenile fish remain to re-populate the fishery beginning with the next spawning season. The impacts from the 2005 golden alga fish kill on largemouth bass populations were extensive at Saguaro Lake. Very few adults remained at this reservoir, but enough remained that spawning was noted in fall 2005 at Saguaro (Warnecke et al 2005c).

In the fall of 2007 (two years after the initial fish kill), approximately 3,200 juvenile size largemouth bass between 150 and 210 mm were stocked into Saguaro Lake. Given the size of the lake, it is believed that these supplemental stockings represent a small contribution to the remaining bass population. This is reinforced by data indicating that after six months (spring 2008) the percentage of stocked largemouth bass to the entire population was less that 5% at Saguaro (Stewart 2008) and less that 1% 12 months post-stocking (Stewart 2009a). The largemouth bass stocked were just reaching the minimum spawning size (180-210 mm) and may have contributed to spawning events in the spring of 2008. How much more successful those spawning events were because of the introduction is difficult to determine. The speed with which the largemouth bass populations rebounded may have been influenced by the stocking, or the high reproductive successes of the remaining fish could have been sufficient to repopulate the lake. Stocking of adults or sub-adults to restore a fish population may be effective or may simply address angler and public concerns about the length of time needed to restore the fishery. In either case, there are benefits to the stockings.

Based on a 2001 angler survey conducted by the Department, this lake provides a significant level of recreation: 11,600 angler user days (AUD) for trout (totally supported by the proposed stocking activity) and 205,100 AUD for other species (supported by naturally occurring and self-sustaining populations of warm water fish; Pringle 2004).

Proposed Action

The Department proposes to stock rainbow trout, largemouth bass, smallmouth bass, walleye, channel catfish, and black crappie for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked multiple times from October through March each year; the numbers of trout stocked would range from 0 to 13,000 fish annually.

Sac fry and fingerling walleye would be stocked anytime annually; numbers of walleye stocked would be from 0 – 1.3 million sac fry annually and from 0 - 26,000 fingerling walleye annually.

Largemouth (fry/fingerling, sub-catchable, catchable), smallmouth bass (fry/fingerling, sub-catchable, catchable), channel catfish (sub-catchable, catchable), and black crappie (sub-catchable, catchable) may be stocked as needed at any time during the year to recover the fishery following catastrophic events such as a golden alga kill. Numbers of fish stocked for this purpose

would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Table 46. Summary of historic Department fish stockings at Saguaro Lake.

Species	First Year	Last Year	Num. Years Stocked	Number Stocked
Black crappie	1935	1993	7	75,300
Bluegill	1935	1956	33	648,493
Brown trout *	1975	1975	1	7,836
Channel catfish	1948	1967	5	15,223
Coho salmon *	1972	1972	2	29,998
Largemouth bass	1935	2009	40	365,254
Rainbow trout	1966	2009	97	261,803
Redear sunfish	1947	1953	2	55,400
Smallmouth bass	1941	2008	8	28,700
Sunfish hybrid	1953	1953	3	20,342
Walleye	1973	2003	7	327,568
Total				1,835,917

** No longer found in the system.*

Water Distribution / Connectivity

Saguaro Lake is a 10-mile long lake with 22 miles of shoreline, confined between two dams, Mormon Flat Dam (upper end) and Stewart Mountain Dam (lower end). Saguaro Lake has a surface area of 1,264 acres at maximum level and a maximum depth of 110 feet (www.srpnet.com). The lake is operated with the other three interconnected Salt River lakes as one unit for hydroelectric power generation. Roosevelt Lake, upstream of Apache and Canyon Lakes, which is upstream of Saguaro Lake, is the main storage reservoir for the system. Roosevelt Lake receives its water from the Salt River and Tonto Creek Drainages. Water is released from Roosevelt and travels through the chain lakes (including Apache and Canyon Lakes) and released at Stewart Mountain Dam (Saguaro Lake), which is the lowest most dam.

Saguaro Lake is operated to maintain a constant balanced level through input from the storage at Roosevelt. The pumps that transfer water are located at approximately 90 ft depths. In addition to the pumps, the reservoir also contains a bypass pipe. Both the pumps and bypass pipe can only handle up to 3,000 cfs. If incoming water flow increases above 3,000 cfs and the lake is at full capacity, the water will spill over Stewart Mountain Dam and into the lower Salt River (C. Paradzick pers. com.). Saguaro Lake spills (spikes above 3,000 cfs) on average of once every 10 years.

Cottonwood Wash is an ephemeral wash that drains into Saguaro Lake. Hidden Water Spring is located at the headwaters of Cottonwood Wash.

Please see the following sections for downstream water distribution and connectivity as flows move downstream into the Lower Salt River. The Lower Salt River Complex section will discuss the overall water distribution and connectivity throughout this entire Salt River chain lake complex including the Lower Salt River and Lower Verde River above Granite Reef Diversion Dam.

Fish Movement

Fish within Saguaro Lake are confined to the lake by Mormon Flat Dam at the top end and Stewart Mountain Dam on the lower end. As the pumps and bypass valves move water through Mormon Flat Dam daily, there is a potential for fish to move into the Lower Salt River through Stewart Mountain Dam. Fish moving through the dams would have to be present at the intakes which are located at 90 ft depths. Unlike Apache Lake, Saguaro Lake has a stronger thermal and chemical stratification resulting in uninhabitable dissolved oxygen levels (below 2.0ppm) at depths greater than 30 feet during warmer months of the year (Figure 55). Stewart Mountain Dam does not have pumpback capabilities; hence the stratification surrounding the intake is less likely to be disrupted. Due to the depth of the intakes and bypass, water quality (low dissolved oxygen) at such depths would create a chemical and physical fish barrier during the summer season. It is thought that few fish, if any, would be able to survive passing through the turbines or bypass pipe at these depths. If fish did get entrained the physical force and cutting edges of turbines utilized in the movement of water through the Stewart Mountain Dam would also severely limit the potential fish survival (Wolff 2009).

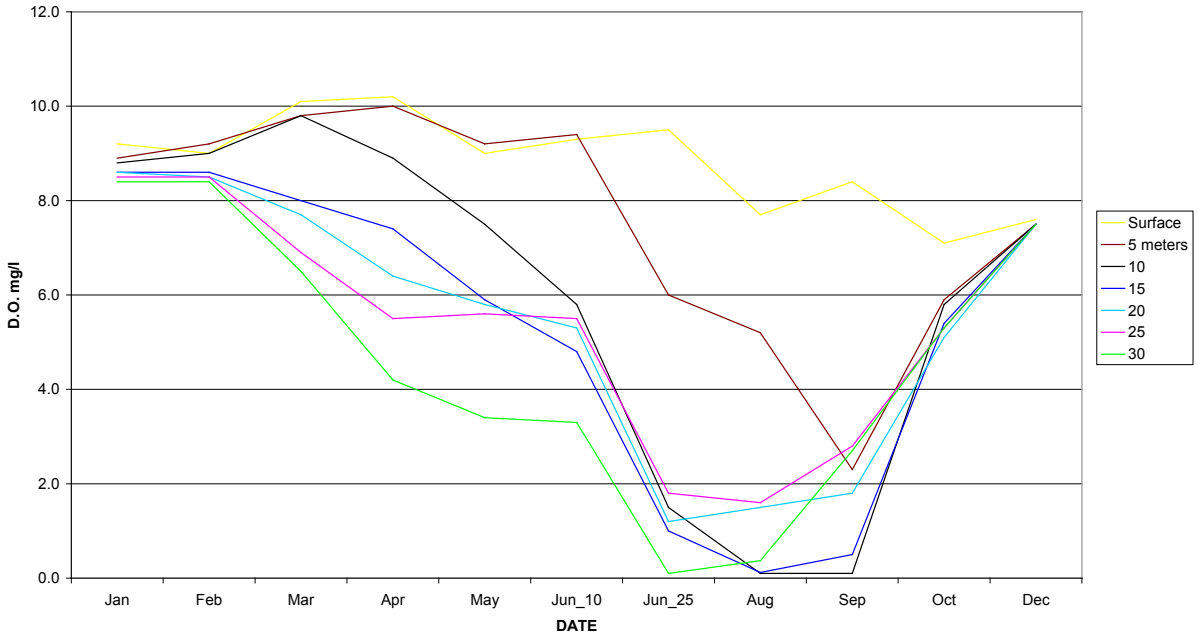

Figure 55. Dissolved Oxygen readings for Saguaro Lake recorded from January to December 1999. Oxygen readings were taken at 15 meter intervals.

Cottonwood Wash is a tributary to Saguaro Lake. There are several known but undocumented barriers within Cottonwood Wash that would prevent upstream migration from Saguaro Lake (Voeltz and Bettaso 2003). In addition to the barriers, the wash is ephemeral creating a geographic barrier as only Gila topminnow, longfin dace, and lowland leopard frogs are found in Hidden Water Spring (Voeltz and Bettaso 2003).

Please see the following sections for fish as they have the potential to move downstream to the Lower Salt River. Also, the Lower Salt River Complex section will discuss the overall fish movement potential throughout this entire complex.

Community Description
Intensive electroshocking and gill net surveys have been conducted in the Fall 2007, Spring 2008, Fall of 2008, and Spring 2009 (Stewart 2008; Stewart 2009a). The most recent surveys conducted at Saguaro Lake documented the presence of the following fish species: bluegill, channel catfish, common carp, flathead catfish, green sunfish, largemouth bass, rainbow trout, redear sunfish, threadfin shad, walleye, yellow bass, yellow bullhead, yellow perch, mosquito fish, and tilapia (Stewart 2008; Stewart 2009a; Table 47). No rainbow trout were found in the fall surveys and only three trout were sampled in spring 2008, indicating that trout do not survive through the warmer months (Stewart 2008; Stewart 2009a).

Table 47. Total number of fish sampled with gillnets and electrofishing at Saguaro Lake from fall 2007 through spring 2009.

	Electrofishing				Gillnetting			
Species	Fall 07	Fall 08	Spring 08	Spring 09	Fall 07	Fall 08	Spring 08	Spring 09
Bluegill	1,623	2,125	3,938	1,728	106	9	23	21
Buffalo Fish	0	1	0	1	0	0	0	0
Channel Catfish	1	8	7	6	150	158	184	107
Common Carp	9	17	21	7	36	16	14	12
Flathead Catfish	2	4	1	0	17	13	5	3
Goldfish	0	0	0	0	0	1	1	0
Green Sunfish	52	98	83	29	0	0	1	0
Largemouth Bass	307	218	1,002	432	694	116	217	141
Mosquito fish	0	1	0	0	0	0	0	0
Rainbow Trout	0	0	2	0	0	0	1	0
Redear Sunfish	0	7	38	0	0	0	0	0
Smallmouth Bass	0	4	0	2	0	0	0	0
Threadfin Shad	1,356	295	516	293	311	36	195	82
Tilapia	123	7	8	1	60	10	0	0
Walleye	0	0	0	0	3	4	3	1
Yellow Bass	21	63	113	225	318	292	345	476

Species	Electrofishing				Gillnetting			
	Fall 07	Fall 08	Spring 08	Spring 09	Fall 07	Fall 08	Spring 08	Spring 09
Yellow Bullhead	10	14	0	0	4	5	1	0
Yellow Perch	0	0	0	0	0	0	1	0
Total	3,504	2,862	5,729	2,724	1,699	660	991	843

Hidden Water Spring is known to contain Gila topminnow and lowland leopard frogs (Voeltz and Bettaso 2003)

Four bald eagle BA's use parts of Saguaro Lake for foraging. Three of these, Bagley, Blue Point, and Saguaro, have nest sites on the lake and the fourth, Bulldog, nests on the river below the dam. The particular nest sites used by each pair on the lake vary between years.

Yuma clapper rail and western yellow-billed cuckoo have been documented along the Salt River downstream of the lake within the riparian corridor, but have not been documented around the lake.

Consultation Species or Critical Habitat
Potential impacts from the stocking of rainbow trout and warm water species into Saguaro Lake to bald eagle, Yuma clapper rail, and Gila topminnow are discussed below. Potential impacts on bonytail and roundtail chub, razorback sucker and critical habitat and Western yellow-billed cuckoo are discussed in the Lower Salt River Complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Bald Eagle
Blue Point Breeding Area is approximately 1.6 miles from Saguaro Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed in 1930 and the BA was unoccupied in the 2010 season. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Blue Point Breeding Area productivity data shows that

nest failed in 2007, failed in 2008 with an eaglet found dead on the ground, and was successful in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Bull Dog Breeding Area is approximately 1.6 miles from Saguaro Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed in 2003 and the BA was active in the 2010 season. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Bull Dog Breeding Area productivity data shows that the nest failed in 2007 when the nestlings were last seen at the nest at 3 weeks old, failed in 2008 when the nestlings were last seen at the nest at 8.5-9 weeks old, and was successful in 2009 (Jacobson et al.; McCarty and Jacobson 2008, 2009).

Bagley Breeding Area is approximately 1.8 miles from Saguaro Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed in 2009 and the BA was active in the 2010 season. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 60.4%, birds 7.5%, mammals 5.7%, reptiles 1.9%, and unknown 24.5%. Of the prey items further identified to species, 50% were American coots, and 25% were koi. Bagley Breeding Area productivity data shows that the nest was successful in 2009 (McCarty and Jacobson 2009).

Saguaro Breeding Area is approximately 1.8 miles from Saguaro Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed at the breeding area in 2008 and the BA was active in the 2010 season. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 67.9%, birds 3.6%, mammals 3.6%, and unknown 25%. No prey items could further be identified. Saguaro Breeding Area productivity data shows that the nest was successful in 2008 and 2009 (McCarty and Jacobson 2008, 2009).

Table 48. Recent (10 years) bald eagle productivity for Saguaro Lake BAs. (Blank spaces by year indicate the BA did not exist at that time.)

Year	Bagley BA*	Blue Point BA	Bulldog BA	Saguaro BA*
2000		Failed		
2001		Fledged 1		
2002		Fledged 2		
2003		Failed	Fledged 2	
2004		Fledged 2	Fledged 2	
2005		Fledged 3	Fledged 2	
2006		Fledged 1	Failed, 2nd nestling went to Granite Reef and fledged	

2007		Failed	Failed	
2008		Failed	Failed	Fledged 2
2009	Fledged 2	Fledged 2	Fledged 2	Fledged 1

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Saguaro Lake does have monofilament bins present.

Gila Topminnow
Since stocked in 1976, Hidden Water Spring is the longest continually surviving population of reestablished Gila Topminnow (Voeltz and Bettaso 2003). In 1985, Brooks moved topminnows from the lower portion of the spring drainage upstream above several barriers that he thought would prevent upstream migration. Since surveys began in 1979-1980, only topminnow and longfin dace have been detected. This population is functionally isolated from Saguaro Lake due to natural barriers, primarily the ephemeral channel, gradient and nature of the stream channel and hydrological dynamics during flow events.

Potential Impacts
Due to the isolation of this population from Saguaro Lake, no nonnative fish have been documented in the spring. Therefore it is unlikely that stocked fish into Saguaro Lake would be able to access the Gila topminnow population in the spring.

The canyon is prone to flooding but is dry through most of the year when there is no run-off (Voeltz and Bettaso 2003), consequently there is a potential for Gila topminnow reaching the lake during periods of high flow that could carry individuals out of the protected spring. However, native fish species are adapted to the natural cycles of flood and low water periods and resist downstream transport (Minckley and Meffe 1987) and the riparian and aquatic vegetation may be thick enough to provide refuge during normal floods (Voeltz and Bettaso 2003). The downstream dispersal of Gila topminnow into Saguaro Lake has never been documented to occur; however, the small size of the Gila topminnow makes finding any individuals unlikely. Also, the intermittent exposure to high flows reduces the opportunity for their transport out of Hidden Water Spring into Saguaro Lake. If this was to occur any individuals transported to the lake would be lost to the recovery population in the spring since they could not move back upstream. It is likely that these displaced individuals would not survive in the lake, in part due to a lack of suitable habitat and predation on them by nonnative species including stocked fish or their progeny. Gila topminnow would be at risk of predation from the existing and stocked warm water predatory fish. There is a remote risk of predation from rainbow trout; however once stocked, trout are quickly harvested out or are consumed by the existing warm water fishery. A

loss of these Gila topminnows is expected to be minimal, and is not significant to the overall health and survival of the protected population.

Yuma Clapper Rail

Yuma clapper rails have not been documented from Saguaro Lake. There are small areas of isolated cattails around the perimeter of the lake that could provide some habitat on a limited basis.

Potential Impacts
Most angling on Saguaro Lake that could be near marsh habitats is via boat access that does not involve creating trails through cattail areas. There may be some limited amount of disturbance to individual Yuma clapper rail from boat anglers fishing in proximity to marsh habitats. Anglers fishing generally tend to be quiet, and not create large noise disturbances. Noise has not been identified as a concern for YCR. Monofilament line or lead fishing tackle has not been shown to be a concern for clapper rails.

Lower Salt River

Site Description
The Lower Salt River stocking site is a 21.5 km (13.3 mi) reach of the Salt River below Stewart Mountain Dam down to Granite Reef Dam. The lower Salt River reach is controlled by water releases from the dam to meet municipal, industrial, and agricultural needs of SRP customers in the Phoenix metropolitan area and is approximately 1,300 ft in elevation.

The TNF owns and manages the recreational access along most of this stocking area. The Salt River Indian Reservation abuts approximately 11 km (six miles) of the northern shoreline of the river at the lower end including the confluence with the Verde River.

The lower Salt River is managed by the TNF for recreation including: boating (non-motorized), picnicking and water activities with year round use. There are several access points to the river: Saguaro Lake Ranch, Water-Users, Blue Point, Goldfield, Coon Bluff, Phon D. Sutton, Tubers Landing and Granite Reef. All access points are along the Power Road/Bush Highway that parallels the river**.** There is a seasonal closure for bald eagle nesting (December 1-June 30) on the south side of the river from approximately one mile downstream of Stewart Mountain Dam to the power line crossing. Access to the south shore of the river is restricted during that period.

Management of Water Body
The lower Salt River is managed as a coldwater, intensive use, put-and-take rainbow trout fishery in the winter, spring and early summer months. Catchable rainbow trout are stocked every other week throughout the stocking season, typically early November through late March

but some years until the end of June if water flows of the appropriate temperature are available (Table 49).

Because flows in the upper part of the reach are low during the winter (due to limited releases from Stewart Mountain Dam), the winter fishery relies on the 400-1,000 cfs releases down the Verde River that provide flows from the confluence to Granite Reef Diversion Dam (Bryan et al. 2000). Generally, winter stockings are at sites below the Verde River confluence at Granite Reef and Phon D. Sutton recreation areas. Increased releases of this cold water in April through June from Stewart Mountain Dam enables rainbow trout stockings at Water Users and Blue Point recreation sites during the late-spring/summer period and allows the recreational fishery to disperse up river.

A 2001 Statewide Survey of Arizona Anglers estimates total Angler Use Days for the Lower Salt River below Saguaro Lake to be 38,664, of which 19,085 Use Days are primarily for trout angling (Pringle, 2004).

This area is intensively used from April to September by inner tubers and kayakers. The Tonto National Forest allows a concessionaire, Salt River Recreation, to manage tube rentals and shuttle bus services along an 11 mile segment of the Lower Salt River. Recreational user days are well over 200,000 annually.

Table 49. Summary of historic Department fish stockings at Lower Salt River.

Species	First Year	Last Year	Num. Years Stocked	Number Stocked
Brook trout *	1982	1982	1	2,500
Brown trout *	1948	1984	3	55,090
Colorado Pikeminnow *	1990	1990	1	4,400
Flathead catfish	1975	1975	1	8,540
Rainbow trout	1947	2008	43	1,288,538
Razorback sucker *	1988	1989	2	3,332
Smallmouth bass	1951	1951	1	18
Woundfin *	1972	1972	1	350
Total				1,362,768

** No longer found in the system.*

Proposed Action

The Department proposes to stock catchable and subcatchable rainbow trout multiple times from October thru June; the numbers of trout stocked would range from 0 to 38,000 trout annually for the period covered by this consultation.

Water Distribution / Connectivity

Water from the Salt River (Saguaro Lake) and Verde River (Bartlett Lake) storage reservoirs are released into the Lower Salt and Lower Verde Rivers. The confluence of these two systems is at the Phon D Sutton TNF recreation site where the Salt River flows a short 2 km downstream until reaching the Granite Reef Diversion Dam. Generally, Salt River flows are as low as 8 cubic feet per second (cfs) in the winter (November through April) and upwards of 1,000 cfs during May through October (Figure 53). Flows in the winter may be higher in response to runoff events or management considerations for overall SRP reservoir storage. Generally, the Verde River flows on average around 100 cfs during the summer months and fluctuates based on snowmelt and rains during the winter months, averaging between 300 to 1000 cfs (Figure 56).

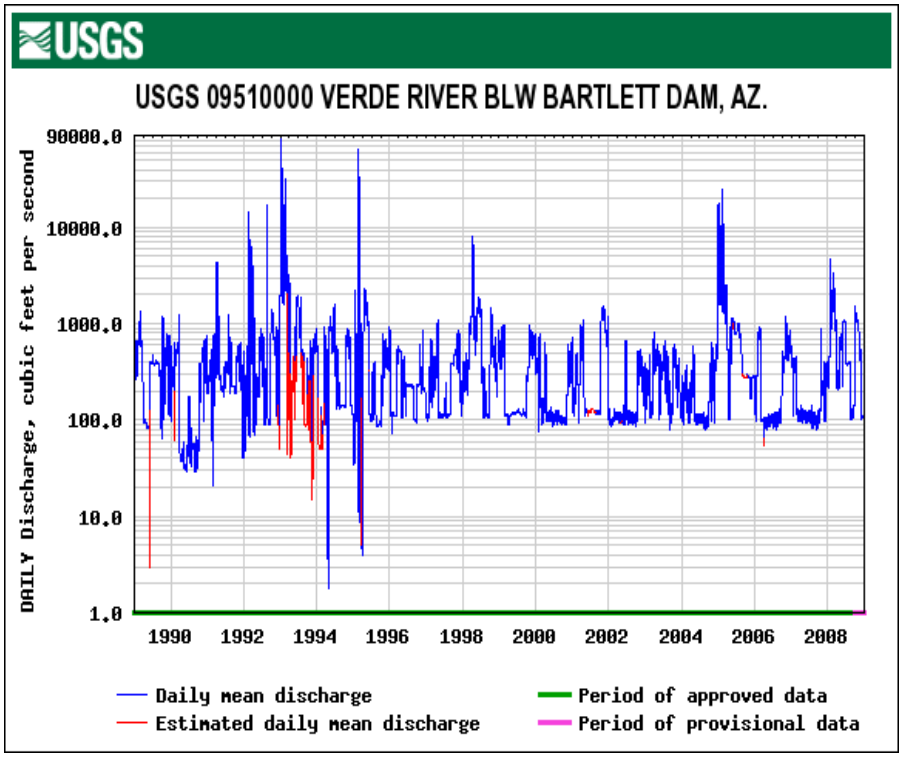

Figure 56. Mean daily discharge in cfs from the Lower Verde River below Bartlett Dam, AZ from 01/01/1989 to 01/01/2009.

The reach of the Verde River downstream of Bartlett Lake and the associated tributaries are perennially connected to the Lower Salt reach from Saguaro Lake (Stewart Mountain dam) to Granite Reef. Due to the connectedness, we discuss the Lower Salt River reach and the Lower Verde River together.

Granite Reef Diversion Dam diverts water away from the Salt River channel into two SRP canals; the Arizona Canal on the north side of the river and the Southern Canal on the south. The

Central Arizona Project (CAP) canal provides additional water supplies into the SRP canals below the Granite Reef Diversion Dam site.

Water that is not diverted into the canal systems flows over or seeps under the Granite Reef Diversion Dam into an intermittent reach of the Salt River. Water in this reach dries up during most of the year, but can connect during times of high flow. The water during these times of connectedness flows 17 miles into Tempe Town Lake and continues 22 miles further to the Gila River confluence.

Refer to the Lower Salt River Complex section for a discussion of the overall water distribution and connectivity throughout this entire complex including the Lower Verde River.

Fish Movement

The reach of the Verde River downstream of Bartlett Lake and the associated tributaries are perennially connected to the Lower Salt reach from Saguaro Lake (Stewart Mountain dam) to Granite Reef. Fish can move freely upstream and downstream between these two reaches during most times of the year when flows are adequate.

The tributaries connected to the Verde are mostly ephemeral with a few perennial sections. A perennial section of Camp Creek is functionally isolated from the mainstem due to the ephemeral condition between the two. This is demonstrated by the aquatic assemblage in Camp Creek, which only contains native fish. Indian Springs Wash is dry unless there is flash flooding and no fish records have been recorded in Indian Spring Wash. Sycamore Creek can connect to the Verde River and nonnative fish records have been recorded within this creek. There is potential for fish to move between these two perennial sections during times of above normal rain events creating a traversable connection.

Fish can and do move downstream from the Salt River, over the Granite Reef outflows into the two main canal systems. Electrical fish barriers/weirs were installed in each canal 100 m downstream of Granite Reef Dam to prevent fish from moving upstream from the canals past the Granite Reef Dam and into the Salt River. Barriers were specifically designed to prevent upstream movement of striped bass and white amur. The electric barriers prevent most fish from moving upstream toward the Granite Reef Diversion Dam, but there is some limited movement of fish upstream past the barriers due to infrequent mechanical failures (Clarkson 2003). There is no evidence or records documenting fish passage upstream from the canals past the Dam. Once fish flow past the Dam and the barriers, it is extremely unlikely they would be able to return to the river.

Community Description

The Lower Salt River contains a mix of native and nonnative fish species. Aside from the stocked rainbow trout, the remaining species maintain their populations through breeding in the reach or overflows from the upstream reservoirs. Four native species (Sonora sucker, desert

sucker, longfin dace, and roundtail chub) and over 18 nonnative species (including largemouth and smallmouth bass, channel catfish, carp, several sunfish species, red shiner and tilapia) were found in recent surveys below Stewart Mountain Dam (Marsh and Kesner 2004, 2006a, 2006b, 2007a, 2007b, 2008; Kesner and Marsh 2009). The Lower Salt River and the SRP Arizona and South Canals are included in this monitoring effort. These surveys are generally conducted from November through January at these three locations.

Historically, 22 species of fish have been documented in the Verde River from Bartlett Lake Dam to the confluence with the Salt River (LCRB Aquatic GAP). These are longfin dace, yellow bullhead, desert sucker, Sonora sucker, common carp, red shiner, mosquitofish, bonytail chub, roundtail chub, channel catfish, green sunfish, bluegill, redear sunfish, hybrid sunfish, smallmouth bass, largemouth bass, fathead minnow, sailfin molly, flathead catfish, and razorback sucker.

There are three tributaries to the Verde River within this reach, Camp Creek, Indian Spring Wash, and Sycamore Creek. Only longfin dace and speckled dace have been documented throughout Camp Creek (Kansas GAP). No fish have been documented in Indian Springs Wash (Kansas GAP). Within Sycamore Creek, longfin dace, desert suckers, Sonora suckers, red shiner, fathead minnow, mosquitofish, Gila topminnow, and speckled dace have been historically documented (Kansas GAP).

Bald eagles have been documented within this reach of the Salt River, upstream to Roosevelt Lake and up the Verde River toward Camp Verde. Within the stocking reach are four bald eagle Breeding Areas (BAs): Granite Reef, Goldfield-Kerr, Bulldog, and Orme. The bald eagles at these BAs forage along the Lower Salt River and on Saguaro Lake. Historically, the Blue Point BA was found on the river; however, this pair has moved up to Saguaro Lake and primarily uses the reservoir at this time. Yellow billed cuckoos and Yuma clapper rails may be found along the lower Salt River.

Consultation Species or Critical Habitat

Potential impacts from the stocking of rainbow trout and warm water species into the Lower Salt River to bald eagle and Gila topminnow are discussed below. Potential impacts on bonytail and roundtail chub, razorback sucker and critical habitat, Yuma clapper rail and Western yellow-billed cuckoo are discussed in the Lower Salt River Complex Analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed

action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Bald Eagle

Blue Point BA is approximately 6.3 miles from the Lower Salt River and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed in 1930 and the BA was unoccupied in the 2010 season. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Blue Point Breeding Area productivity data show that nest failed in 2007, failed in 2008 with an eaglet found dead on the ground, and was successful in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Bull Dog BA is approximately 4.4 miles from the Lower Salt River and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed in 2003 and the BA was active in the 2010 season. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Bull Dog Breeding Area productivity data shows that the nest failed in 2007 when the nestlings were last seen at the nest at 3 weeks old, failed in 2008 when the nestlings were last seen at the nest at 8.5-9 weeks old, and was successful in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Orme Breeding Area is approximately 2.2 miles from the Lower Salt River and is within the Bald Eagle DPS. The eagles were first observed in 1987 and the BA was active in the 2010 season. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 46%, mammals 18%, and unknown 36%. Of the prey items further identified to species, 66.7% were Sonora sucker, 16.7% were common carp, and 16.7% were flathead catfish. Orme Breeding Area productivity data shows that the nest was successful in 2007, was successful in 2008 with one nestling found dead under the nest, and failed in 2009 with one nestling gone, and two nestlings injured on the ground, which later died in rehabilitation (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Granite Reef Breeding Area is approximately 3.7 miles from the Lower Salt River and is within the Bald Eagle DPS. The eagles were first observed in 2002 and the BA was active in the 2010 season. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Granite Reef Breeding Area productivity data shows that the nest was successful in 2007, successful in 2008, and successful in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

Goldfield Breeding Area is approximately 0.2 miles from the Lower Salt River and is within the Bald Eagle DPS. The eagles were first observed in 2009 and the BA was active in the 2010

season. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. In 2009 fish accounted for 66.7%, mammals 11.8%, carrion 5.9%, and unknown 15.7%. Of the prey items further identified to species, 50% were suckers, 12.5% were catfish, 12.5% were common carp, and 12.5% were rock squirrel. Goldfield Breeding Area productivity data show that the nest was successful in 2009 (McCarty and Jacobson 2009).

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. The Lower Salt River does not currently have monofilament bins present.

Continued stocking of rainbow trout into the lower Salt River may have adverse effects to the bald eagle prey base diversity that is important for the successful fledging of eaglets from these BAs. The additive effect of rainbow trout predation on larval suckers to that from existing warm water fish populations is unknown. Alternatively, the benefit of an additional forage species through stocking of rainbow trout is also unknown.

Gila Topminnow
Gila topminnows were thought to be historically stocked, but unfortunately these stockings could not be verified in any records (Weedman and Young 1997).

Potential Impacts
Due to the unverified stockings and lack of documented presence of topminnow within these reaches, we determine no potential impacts from our stockings.

LOWER SALT RIVER COMPLEX ANALYSIS
Water distribution and connectivity, fish movement and community descriptions were discussed for Apache Lake, Canyon Lake, Saguaro Lake, and the Lower Salt River, however we will restate these descriptions again as they contribute to the overall Lower Salt River Complex. Impacts to sensitive species in the Lower Salt River Complex (Apache Lake to Granite Reef Dam) are also discussed below, comprehensively in combination with all potential connected populations of these sensitive species.

Water Distribution / Connectivity
The chain lakes (Roosevelt, Apache, Canyon, and Saguaro) are operated by Salt River Project as one unit for hydroelectric power and water deliveries. Roosevelt Lake, upstream of Apache Lake, is the main storage reservoir for the system. Roosevelt Lake receives its water from the Salt River and Tonto Creek watersheds. Water is released from Roosevelt Dam and travels through the chain lakes (including Apache and Canyon Lakes) and released at Stewart Mountain

Dam (Saguaro Lake), which is the lowest most dam. Stewart Mountain Dam releases flows into the Lower Salt River at approximately 279 cfs of mean water daily. The chain lakes, excluding Roosevelt are operated to maintain constant balanced levels through input from the storage at Roosevelt and pump back from the lakes below. As Saguaro Lake does not have a lake below it, it only uses flow-through water to maintain its level. At Horse Mesa Dam and Mormon Flat Dam, the pumps that transfer water are located between 30-100 ft depths. In addition to the pumps, the reservoirs also contain a bypass valve. Both the pumps and bypass valve can only handle up to 3,000 cfs of water output at one time. If incoming water flows increase above 3,000 cfs and the lake is at full capacity, the water will pass over the spillways of each of the dams eventually flowing into the Lower Salt River (C. Paradzick pers. com.).

Apache Lake is a 17 mile long lake with 41 miles of shoreline, confined between two dams, Horse Mesa Dam (lower end) and Theodore Roosevelt Dam (upper end). Apache Lake has a surface area of 2,568 acres at maximum level and an average depth of 240 feet (Rogers 2009).

Canyon Lake is a 10 mile long lake with 28 miles of shoreline, confined between two dams, Horse Mesa Dam (upper end) and Mormon Flat Dam (lower end). Canyon Lake has a surface area of 950 acres at maximum level and an average depth of 131 feet (www.srpnet.com).

Saguaro Lake is a 10 mile long lake with 22 miles of shoreline, confined between two dams, Mormon Flat Dam (upper end) and Stewart Mountain Dam (lower end). Saguaro Lake has a surface area of 1,264 acres at maximum level and an average depth of 110 feet (SRP online).

Water from the Salt River storage reservoirs are released into the Lower Salt River and just below the Verde River confluence the perennial reach ends at the Granite Reef Diversion Dam. Generally, Salt River flows are as low as 8 cubic feet per second (cfs) in the winter (November through April) and upwards of 1,000 cfs during May through October (Figure 3). Flows in the winter may be higher in response to runoff events or management considerations for overall SRP reservoir storage.

The reach of the Verde River downstream of Bartlett Lake and the tributaries that drain into this reach of the Verde River are perennially connected to the Lower Salt River reach from Saguaro Lake (Stewart Mountain Dam) to Granite Reef Dam. Water from the Verde River (Bartlett Lake) storage reservoir is released into the Lower Verde River, where it connects to the lower Salt and is also diverted just below the confluence of both at the Granite Reef Diversion Dam. Generally, the Verde flows on average around 100 cfs during the summer months and fluctuates based on snowmelt and rains during the winter months, averaging between 300 to 1,000 cfs. Flows within the Verde River also are usually higher in the winter due to runoff events or management considerations for overall SRP reservoir storage.

The Granite Reef Diversion Dam diverts all Salt River water into two SRP canals; the Arizona Canal on the north side of the river and the South Canal on the south. The Central Arizona

Project (CAP) canal delivers additional water into the SRP canals below the Granite Reef Diversion Dam site.

Water that is not diverted into the canal systems flows over or seeps under the Granite Reef Diversion Dam into an intermittent reach of the Salt River. Water in this reach dries up during most of the year, but can connect during times of high flow. The water during these times of connectedness flows 17 miles into Tempe Town Lake and continues 22 miles further to the Gila River confluence.

Fish Movement

No studies have been completed nor has data been documented on the movement of fish out of Saguaro or Bartlett Lake into downstream reaches. There is a potential though for fish to move out of either Saguaro or Bartlett Lakes, through the turbines during the release of water, however, this potential would be extremely low. Specifically for Saguaro Lake, Wolff 2009 states, the Salt River reservoirs do not have hydro-generation like some of the Verde River dams and the intakes are deep (>30-40 ft with some >90 ft). Due to the depth of the intakes and water quality (depleted dissolved oxygen) at such depths, few fish, if any would be anticipated to pass through the turbines (C. Paradzick pers. comm.) during the warmer months (May to October) when the lakes are stratified. During episodic runoff events when Roosevelt Lake discharges and spillway overflows exceed 3,000 cfs, water coming into a full Apache Lake will pass over the spillway into Canyon Lake. A full Canyon Lake will spill over into Saguaro Lake and a full Saguaro will pass all inflows exceeding 3,000 cfs over the Stewart Mountain Dam spillway into the Lower Salt River. The passage of some fish, particularly smaller pelagic or littoral species, is probable going from lake to lake and into the Lower Salt River. Fish can move within the Lower Salt River stocking reach to the Lower Verde River up to Bartlett Dam and downstream past the Granite Reef Dam into the SRP canals that utilize the Salt and Verde River water supplies for deliveries to millions of municipal, industrial, and agricultural users.

Community Description

The aquatic assemblage for Apache Lake, Canyon Lake, Saguaro Lake, and the Lower Salt River/Lower Verde River were discussed in the previous sections. The aquatic assemblage for Bartlett Lake and the Salt River Project Southern and Arizona Canals are discussed below as they also do or have the potential to contribute to the overall complex analysis.

Eighteen species of fish have been documented in Bartlett Lake. These are largemouth bass, channel catfish, black crappie, flathead catfish, bluegill, green sunfish, redear sunfish, common carp, threadfin shad, sunfish hybrid, smallmouth bass, tilapia, goldfish, yellow bullhead, red shiner, golden shiner, mosquitofish, and walleye. The most recent survey (AGFD 2007) only documented 11 species. These are largemouth bass, channel catfish, black crappie, flathead catfish, bluegill, green sunfish, hybrid sunfish, common carp, threadfin shad, redear sunfish, and

golden shiner. Thread fin shad were the most abundant fish in the lake, followed by largemouth bass, bluegill, and then common carp. The rest of the species made up less than 15% of the catch.

The fish species assemblage within the canals is the most diverse of any waterbody in the state. This is due to waters running through the communities of the metropolitan Phoenix area that collect runoff from literally hundreds of public and private waterbodies that contain a wide array of fish assemblages. Further, the proximity of the canals to millions of urban residents offers the public an easy opportunity to illegally stock fish, or transfer fish from aquariums or ponds. Canal species documented in the past include longfin dace, yellow bullhead, goldfish, desert sucker, Sonora sucker, hybrid sucker, grass carp (white amur), common carp, red shiner, threadfin shad, mosquitofish, roundtail chub, channel catfish, green sunfish, redear sunfish, smallmouth bass, largemouth bass, yellow perch, yellow bass, striped bass, rainbow trout, fathead minnow, sailfin molly, shortfin molly, blue tilapia, black crappie, flathead catfish, walleye, Mozambique tilapia, redbelly tilapia (Marsh and Kesner 2004, 2006)

Consultation Species or Critical Habitat
Potential impacts on bonytail and roundtail chub, razorback sucker and critical habitat, Yuma clapper rail and Western yellow-billed cuckoo are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Bonytail Chub
Bonytail chub were last documented in the Lower Salt and Lower Verde reaches in 1963 (LCRB Aquatic GAP). The Lower Verde River and Lower Salt River including all of the connected tributaries were not designated as critical habitat for bonytail chub. Bonytail chub were stocked into ponds at the ASU Research Park in the late 1980's and mid 1990's. The ponds are connected to the SRP canal system and fed by the Western Canal, a branch of the SRP south canal. Adult bonytail chub may remain in the ponds from those past stocking actions, although no recent data are available (P. Marsh, pers. comm.). More than 20 species of non-native fishes were recorded from the ponds when the bonytail were being stocked.

Potential Impacts

Due to the absence in all surveys of bonytail chub within these reaches since 1963, no potential impacts would be anticipated from the proposed action. There is a potential for stocked species to enter the SRP canal system and make it to ASU Research Park ponds where they could compete with bonytail chub, if they persist. Transport of stocked species to this area would not be likely to occur, though.

Colorado Pikeminnow

Colorado pikeminnow were stocked into ponds at the ASU Research Park in the late 1980's and mid 1990's. The ponds are connected to the SRP canal system and fed by the Western Canal, a branch of the SRP south canal. Adult pikeminnow may remain in the ponds from those past stocking actions, although no recent data are available (P. Marsh, pers. comm.). More than 20 species of non-native fishes were recorded from the ponds when the pikeminnow were being stocked.

Potential Impacts

There is a potential for stocked species to enter the SRP canal system and make it to ASU Research Park ponds where they could compete with pikeminnow if they persist. Transport of stocked species to this area would not be likely to occur, though.

Razorback Sucker and Critical Habitat

Razorback suckers were last documented in the Lower Salt and Lower Verde reaches in 1898 (Kansas State 2009). One record exists of a razorback sucker from Saguaro Lake in 1951 and they were known from Roosevelt Lake at least through the 1920's. Neither the Lower Verde River nor the Lower Salt River (below the reservoirs), nor any of the connected tributaries have designated critical habitat. Razorback sucker were stocked into ponds at the ASU Research Park in the late 1980's and mid 1990's. The ponds are connected to the SRP canal system and fed by the Western Canal, a branch of the SRP south canal. Adult razorback suckers may remain in the ponds from those past stocking actions, although no recent data is available (P. Marsh, pers. comm.). More than 20 species of non-native fishes were recorded from the ponds when the pikeminnow were being stocked.

Razorback sucker are currently stocked in the Middle Verde River reach near Camp Verde (see Verde River Chapter for extensive discussion of razorback suckers in the Verde River above Bartlett Dam). Since the initiation of these Middle Verde stockings in 1993, no razorback suckers have been found in the Lower Verde or Salt River drainages except for one individual collected from Tempe Town Lake. The source for that one razorback is unknown. Paucity of razorback records downstream of Horseshoe Lake and Bartlett Lake to the lower Verde reach, including the sampling in the lower Salt River related to the CAP monitoring indicates that movement of razorback suckers below Bartlett Dam is unlikely.

Potential Impacts

Due to the absence of razorback sucker within these reaches no impacts would be anticipated from the proposed action.

Roundtail Chub

The roundtail chub found within this stocking area are located in the Lower Salt River, Lower Verde River, and the upper portions of the SRP Canal system below Granite Reef Dam. These fish are considered one contiguous population throughout this area and genetically similar to the Verde River population above Horseshoe Reservoir (Bryan and Robinson 2000, Bryan and Hyatt 2004, Dowling 2008). Bryan et al. (2000) believed that the Lower Verde River has a more robust, successfully reproducing roundtail chub population, with the Salt only supporting a limited number of adults. Spawning by roundtail chub in the Salt River was not documented even though adults in breeding colors were observed. The authors believed that the Salt River fish went to the Verde River to spawn. Movement of roundtail chub between the two rivers is both hampered and facilitated by SRP's management of the water delivery system. High Verde River flows in the winter can transport roundtail chub to the lower portion of the river above the confluence with the Salt River (Bryan and Robinson 2000) and higher Salt River flows in the summer allow fish to move within that reach. Generally, roundtail chub recaptured after several months had not apparently moved far from the capture site (Bryan and Robinson 2000). The origin of the roundtail chubs found in the SRP canals are likely from the more robust Verde River population flushed downstream. However, during high flow releases from Stewart Mountain Dam, roundtail chubs in the Lower Salt River may also be transported over Granite Reef Dam to the canals.

CAP surveys since 1995 have surveyed fish populations in the Lower Salt River and SRP's Arizona and South Canals below Granite Reef Dam. In 14 years of record, only eight roundtail chub have been captured in the Lower Salt River (Table 50). Roundtail chub have also recently been sampled at the SRP canals. Table 50 also shows a peak year for successful roundtail chub sampling in 1998. In addition to the yearly CAP monitoring surveys, the most recent efforts to evaluate the roundtail chub population in the Lower Verde and Lower Salt Rivers were conducted in 2000 and 2003 (Bryan and Robinson 2000, Bryan and Hyatt 2004). The majority of the roundtail population is in the upper portion of the Verde River reach closer to Bartlett Dam where there are more of the preferred habitat types present (Bryan and Robinson 2000, Bryan and Hyatt 2004). This chub population was estimated at 6,424 (95% CI = 5,048-8,397) in 2000 (Bryan and Robinson 2000). In 2003, the population was estimated at 1,657 (95% confidence interval [CI] = 1,097-2,742), a decrease of 74% (Bryan and Hyatt 2004). It should be noted that roundtail chub are extremely tough to catch utilizing standard fisheries collection gear, so the capture probabilities may have affected actual numbers (Bryan and Robinson 2000). In the Salt River, low flows (~ 8 cfs) during winter confined roundtail chub to deep pools. Although movement of these fish was restricted because of the reduced discharge, they proved difficult to capture using electrofishing and gill nets, probably due to high conductivity (~1350 :S/cm). We snorkeled sites just

after sampling with the electrofisher and determined that we were only collecting approximately 10% of the roundtail at that site. High flows during spring and summer added to our difficulty in capturing fishes in the Salt River, so our perception of chub distribution and abundance may be biased due to the constraints of our sampling gear and methodology.

The roundtail chub population in the Lower Salt and Lower Verde has experienced significant declines that are likely still continuing. The decline in population size is hypothesized as being due to natural mortality of adults and insufficient recruitment to replace them. The flows in the rivers in spring 1998 allowed for a large, successful spawn and recruitment to the population and the passage of that cohort to adult status was documented in the two studies already referenced in this section and in Brouder et al. 2000 and Brouder 2001. Since 1998 there has been a lack of significant levels of recruitment, and the dying off of the 1998 cohort due to old age (roundtail chub may reach 11 or more years of age [AGFD unpublished data cited in Bryan and Hyatt 2004], but five to seven years is more usual [Bestgen 1985]) is the leading explanation for the decline of this population.

The SRP canals also act as a population sink for roundtail chub populations in the river. Once individuals pass over or through the Granite Reef Diversion Dam, enter the canals, and move below the electrical fish barriers, they are lost to the riverine population. Of the roundtail chub recorded in the CAP surveys, the vast majority were taken from the two SRP canals (Table 50). Over time, the decline of roundtail chub in the canals may also be indicative of the decline of the population in the river.

Table 50. CAP monitoring records from 1990 through 2008 for the Lower Salt River, the SRP Arizona Canal, and the SRP South Canal.

Data comes from the following sources: Clarkson 1998, 1999, 2001; Marsh 1999, 2004a, 2004b, 2004c; Marsh and Kesner 2005, 2006b, 2007a, 2007b, 2008; Kesner and Marsh 2009

Survey Reach	Survey Year/Month	Monitoring Site	Young of Year Roundtail Chub	Adult Roundtail Chub	Rainbow trout Caught
Lower Salt River	1995 November	Below Stewart Mountain Dam	0	0	Yes
		Goldfield Administrative Center	0	0	No
		Granite Reef	0	0	No
	1996 November	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	0	4	No
		Granite Reef	0	0	No
	1997 November	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	0	0	No
		Granite Reef	0	0	No
	1998 October and November	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	1	0	No
		Granite Reef	0	0	No
	1999 November	Below Stewart Mountain Dam	0	1	No
		Goldfield Administrative Center	0	0	No
		Granite Reef*	0	0	Yes
	2000 November and December	Below Stewart Mountain Dam	0	1	Yes
		Goldfield Administrative Center	0	0	No
		Granite Reef	0	1	No

Survey Reach	Survey Year/Month	Monitoring Site	Young of Year Roundtail Chub	Adult Roundtail Chub	Rainbow trout Caught
	2001 January (02)	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	ns	ns	No
		Granite Reef	0	0	Yes
	2002 November and December	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	0	0	No
		Granite Reef	0	0	No
	2003 January (04)	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	0	0	No
		Granite Reef*	0	0	Yes
	2004 January (05)	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	ns	ns	ns
		Granite Reef	ns	ns	ns
	2005 February and March (06)	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	0	0	No
		Granite Reef	0	0	No
	2006 December	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center	0	0	No
		Granite Reef*	0	0	Yes
	2007 November	Below Stewart Mountain Dam	0	0	No
		Goldfield Administrative Center*	0	0	Yes
		Granite Reef*	0	0	Yes
	2008 December	Below Stewart Mountain Dam	ns	ns	ns
		Goldfield Administrative Center	ns	ns	ns
		Granite Reef*	0	0	No
SRP Arizona Canal	1990 Dec?	Above and Below electric barrier	0	0	No
	1991 January (02)	Above and Below electric barrier	0	7	No
	1992 January (03)	Above and Below electric barrier	0	21	No
	1993 January (04)	Above and Below electric barrier	0	1	No
	1994 January (05)	Above and Below electric barrier	0	1	No
	1995 November	Above electric barrier	0	1	No
		Below electric barrier	0	1	
	1996 January (97)	Above electric barrier	0	31	No
		Below electric barrier	0	2	No
	1997 January (98)	Above electric barrier	8	2	No
		Below electric barrier	0	12	No
	1998 Nov/Dec	Above electric barrier	244	0	No
		Below electric barrier	5	0	No
	1999 January (00)	Above electric barrier	3	15	No
		Below electric barrier	0	0	No
	2000 January (01)	Above electric barrier	0	1	No
		Below electric barrier	0	0	No
	2001 January (02)	Above electric barrier	0	0	No
		Below electric barrier	0	0	No
	2002 January (03)	Above electric barrier	3	0	No
		Below electric barrier	0	2	No
	2003 January (04)	Above electric barrier	0	0	No
		Below electric barrier	0	0	No
	2004 January (05)	Above electric barrier	0	0	No
		Below electric barrier	0	0	No
	2005 January (06)	Above electric barrier	0	0	No
		Below electric barrier	0	0	No
	2006 January (07)	Above electric barrier	0	0	No
		Below electric barrier	0	0	No
	2007 January (08)	Above electric barrier	0	2	No
		Below electric barrier	0	0	No
	2008 January (09)	Above electric barrier	0	1	No
		Below electric barrier	0	0	No
SRP South Canal	1990 unknown	Above and Below electric barrier	0	0	No
	1991 unknown	Above and Below electric barrier	0	13	No
	1992 unknown	Above and Below electric barrier	0	2	No
	1993 unknown	Above and Below electric barrier	0	25	No
	1994 unknown	Above and Below electric barrier	0	Ns	ns

Survey Reach	Survey Year/Month	Monitoring Site	Young of Year Roundtail Chub	Adult Roundtail Chub	Rainbow trout Caught
	1995 October	Above electric barrier Below electric barrier	0 2	22 1	No No
	1996 October	Above electric barrier Below electric barrier	0 0	18 6	No No
	1997 October	Above electric barrier Below electric barrier	0 2	18 2	No No
	1998 Oct/Nov	Above electric barrier Below electric barrier	428 47	70 0	No No
	1999 November	Above electric barrier Below electric barrier	0 4	20 61	No No
	2000 November	Above electric barrier Below electric barrier	0 0	11 2	No No
	2001	Above electric barrier Below electric barrier	ns ns	Ns ns	ns ns
	2002 Nov/Dec	Above electric barrier Below electric barrier	0 0	2 4	No No
	2003 November	Above electric barrier Below electric barrier	0 0	0 0	No No
	2004 November	Above electric barrier Below electric barrier	0 0	0 0	No No
	2005 November	Above electric barrier Below electric barrier	0 0	6 3	No No
	2006 November	Above electric barrier Below electric barrier	0 0	1 0	No No
	2007 November	Above electric barrier Below electric barrier	0 0	4 0	No No
	2008 November	Above electric barrier Below electric barrier	0 0	10 0	No No

Potential Impacts

Rainbow Trout - Salt River Stockings

Bryan and Hyatt (2004) hypothesize that the roundtail chub may continue to decline due to senescence of the 1998 cohort and recommended, among other research, that the introduction of rainbow trout into the Lower Salt River be evaluated for its effect on the roundtail chub. Stocking rainbow trout into the Lower Salt River may result in competition for food and space between the trout and roundtail chub as they share similar habitats (Bryan et al. 2000). Stocked rainbow trout feed primarily on insects and invertebrates, but are also known, on occasion, to prey on small native or nonnative fish (Propst et al. 1998). Roundtail chub prefer pools and pool-glide habitats adjacent to riffles (Bryan and Robinson 2000), and in the Lower Salt River during the winter months pool habitat is limited (Bryan et al. 2000). The limited amount of habitat present during the winter months provides opportunity for overlap and exposure. The twice monthly stocking of rainbow trout during this period provides a continued pulse of nonnative species into the river and limited habitats. Roundtail chub are also spawning during the stocking period in the Verde River, but larvae may come into contact with stocked rainbow trout if they move down below the confluence with the Salt. Bryan et al. (2000) and Bryan and Hyatt (2004) both raise concerns about competition for food and space between stocked rainbow trout and roundtail chub in the stocking reach. The multi-agency group implementing the Statewide Conservation Agreement for roundtail chub (AGFD 2006) also recommended against stocking rainbow trout into prime roundtail chub habitats to reduce the potential for impacts.

The suite of other nonnative species in the Lower Salt River, particularly largemouth bass, green sunfish, flathead catfish, and channel catfish, are potential predators on roundtail chub eggs, larvae and juveniles, and are more significant predators than the hatchery-raised rainbow trout (Bonar et al. 2004). However, the continual replacement of the stocked rainbow trout population every two weeks results in a continuous load of fish into the system utilizing the same habitats. Other factors that may affect the reproductive potential of the Salt River roundtail chub populations include: 1) the loss of individuals into the SRP canal system at Granite Reef Diversion Dam (data provided in Table 50), and 2) large flow releases and fluctuating flow releases from Bartlett Dam during the spring spawning period that can disrupt spawning and hatching. Once individuals get below Granite Reef Diversion Dam and the electrical barriers in the canals, they are lost to the river populations, and this may be particularly important in the loss of adult spawners from a small population. As discussed previously, releases from Bartlett Dam that mimic the natural hydrograph may contribute to successful spawning by roundtail chub; however this has not been evaluated because those ideal releases have not occurred since.

Warm water species - Salt River Lakes

Due to the potential and suitable habitat for warm water species to reproduce, the potential impacts are evaluated for the proposed stocking of walleye, largemouth bass, smallmouth bass, channel catfish, and black crappie and also their future progeny.

Largemouth bass, smallmouth bass, channel catfish, and black crappie do maintain populations in the river and all of the chain lakes. Walleye do not have self-sustaining populations in the chain lakes, and also do not have self-sustaining populations in the Lower Salt River because the habitat is unsuitable in the Lower Salt for reproduction of this species. With the existing populations of these other fish in the chain lakes and the potential for their escapement into the Lower Salt River, it is impossible to separate and quantify the impacts from the stocked fish and/or their progeny from the larger, already existing fish populations in the river. Therefore, the impacts from the proposed stocking of largemouth bass, smallmouth bass, channel catfish, and black crappie and their progeny on the roundtail chub in the Lower Salt River would be additive to the extant populations of nonnative predators and competitors. There may be a potential for additional predation, competition for food and space, or inhibition of reproduction from these warm water stockings. However, these impacts would only occur if the stocked species or their progeny are able to move through dams and turbines or over the spillway and enter the river from Saguaro Lake, where they would come in contact with occupied roundtail chub sites.

The opportunity for warm water fish and/or their progeny stocked into Saguaro Lake reaching native fish habitat in the Lower Salt River via release is difficult to determine, however presumed to occur. No data has ever been collected to confirm this. The pump-back hydroelectric system allows for water movement between the lakes on a regular basis, but not from the river back up into Saguaro Lake. The fish communities of the three lakes are linked by

this exchange of waters. Additionally, water released through the hydroelectric generating system can also allow fish from Apache Lake and Canyon Lake to reach Saguaro Lake. As stated in each of the chain lakes fish movement sections, fish moving through the dams would have to be present at one of the multiple intakes which are located at: 45 to 230 ft deep at Horse Mesa Dam, 30 to 130 ft deep at Mormon Flat Dam, and 90 ft to 100 ft deep at Stewart Mountain Dam (C. Paradzick pers. comm.). Uninhabitable dissolved oxygen levels (below 2.0 ppm) occur at these depths during certain times of the year (Figure 55). Due to the depth of the intakes and bypass, water quality (low dissolved oxygen) at such depths would create a physical fish barrier during certain times of the year but allow for movement between lakes at other times.

During episodic runoff events when Roosevelt Lake discharges and spillway overflows exceed 3,000 cfs, water coming into a full Apache Lake will pass over the spillway into Canyon Lake. A full Canyon Lake will spill over into Saguaro Lake and a full Saguaro will pass all inflows exceeding 3,000 cfs over the Stewart Mountain Dam spillway into the Lower Salt River. Salt River Project dams spill on an average of once every 10 years. The passage of some fish, particularly smaller pelagic or littoral species, is probable going from lake to lake and into the Lower Salt River. Thus, during extreme runoff events when the chain lakes are at or near capacity, there is a probability of stocked fish and their progeny to move through Stewart Mountain Dam into the Lower Salt River into habitat occupied by roundtail chub.

To reduce the potential for impacts, the multi-agency group implementing the Statewide Conservation Agreement for roundtail chub (AGFD 2006) also recommended against stocking largemouth bass, smallmouth bass and channel catfish directly into sites with roundtail chub populations. However, the group did agree with the stockings of black crappie and walleye as long as the stocking sites had a low potential to contribute to the aquatic community within roundtail chub habitats, as in this case.

It is difficult to determine the magnitude of potential impacts to roundtail chub due to the combination of the low potential for the proposed stocked species and/or their progeny to move through dams and turbines or over the spillway and enter the river from Saguaro Lake and the difficulty in separating additional incremental impacts from the stocked warm water fishes from impacts due to existing nonnative predators and competitors.

Rainbow trout – Salt River Lakes

Rainbow trout do not have self-sustaining populations in the chain lakes or in the Lower Salt River. In 43 years of record of rainbow trout stockings in this complex, there is no documentation of successful reproduction by trout in the lakes or the river. Further, stocked trout have not been shown to have the ability to survive long-term in the Lower Salt River or the chain lakes due to high summer temperatures, competition for food, and predation by warm water species.

The movement of the trout out of the chain lakes through Stewart Mountain Dam and into the Lower Salt River would be the same as the warm water proposed fish species listed above, however the timing would eliminate late spring through late fall or when temperature rises above 25 degrees Celsius (Sublette et. al. 1990) and the oxygen is still above 2.0 ppm (FWS online http://www.fws.gov/nc-es/edout/albefitfish2.html). This can vary between years, but usually occurs May to October as shown in 1999 (Figure 57).

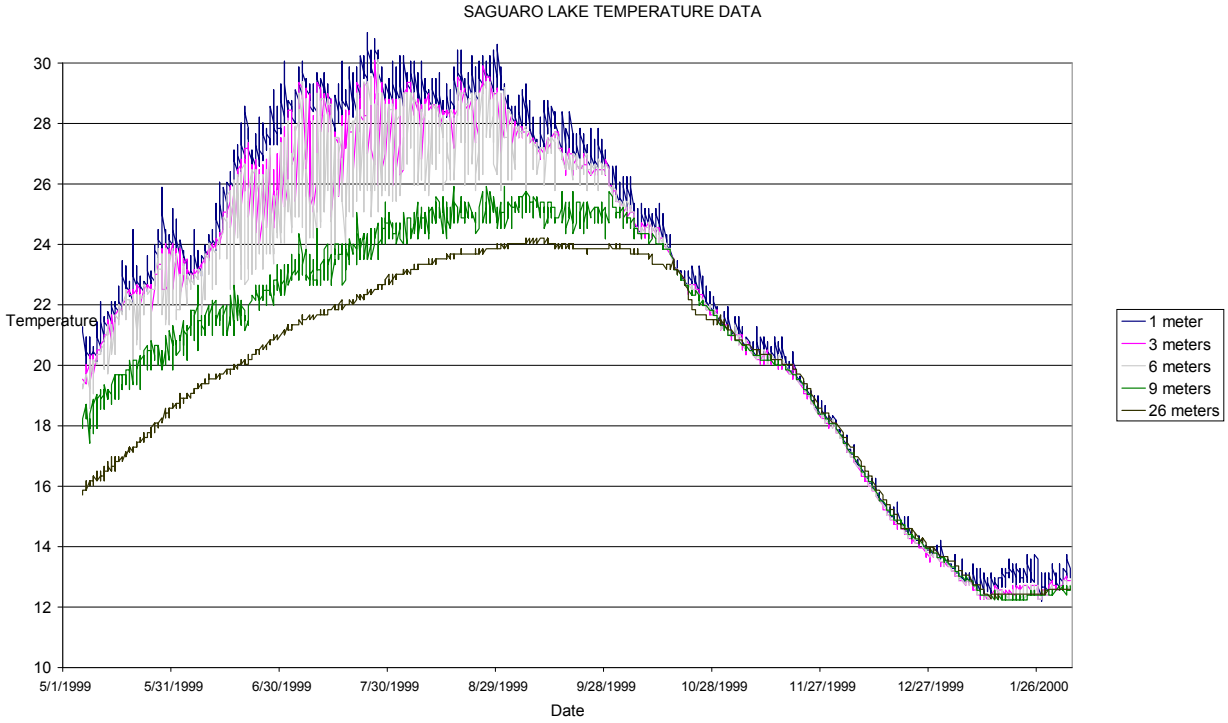

Figure 57. Temperature data readings for Saguaro Lake at various depths, May 1999 to January 2000.

The multi-agency group implementing the Statewide Conservation Agreement for roundtail chub (AGFD 2006) agreed that the stockings of rainbow trout into sites that have a low potential to contribute to the aquatic community within roundtail chub habitats would not create an impact to the chub population, as in the case for the Salt River reservoirs.

Due to the combination of the low potential for the proposed stocked species and/or their progeny to move through dams and turbines or over the spillway and enter the river from Saguaro Lake, the proposed action to stock rainbow trout into the Salt River reservoirs would not be expected to impact the population of roundtail chub in the Lower Salt River, Lower Verde River, and the SRP canals system.

Yuma Clapper Rail

Yuma clapper rails have not been documented from the lower Salt River since 1982, but were once found at Granite Reef Diversion Dam at the lowest end of the reach. There are small isolated areas of cattails along the riverbanks in the stocking site that could provide a limited amount of habitat. Refer to Saguaro Lake site analysis for specific information related to marsh access.

Potential impacts

The open shorelines along the river largely negate the need to create access through the cattail areas for fishing. Anglers fishing generally tend to be quiet, and not create large noise disturbances. Noise has not been identified as a concern for YCR. Monofilament line or lead fishing tackle has not been shown to be a concern for clapper rails.

Western Yellow-Billed Cuckoo

Historic occurrences for the cuckoo have been documented along the lower Salt River. No occurrences have been documented at or adjacent to Apache, Canyon or Saguaro Lakes. No breeding and/or foraging habitat is present at Apache, Canyon or Saguaro Lakes. The lower Salt River contains suitable breeding and/or foraging habitat for the cuckoo.

Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking sites along the lower Salt River.

Potential impacts to migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.); it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance.

PHOENIX METRO COMPLEX

The Phoenix Metro Complex is downstream of the Lower Salt River Complex and includes the following proposed stocking locations (Figure 58):

1. Tempe Town Lake – located in the Salt River channel. This is a state fishing water (not in the Urban Fishing or Fishing in the Neighborhood Programs).

2. Open System Urban Fishing Program Lakes and Proposed Fishing in the Neighborhood Lakes (6 locations) – all artificial, man-made park lakes located in or within Scottsdale and north Tempe's Indian Bend Wash floodway that flows into the Salt River channel at the upper end of Tempe Town Lake, or drains into the Salt River channel immediately below Tempe Town Lake.

    - Chaparral Lake and Papago Ponds (Urban Fishing Program waters)

    - Eldorado Lakes, Indian School Lake, McKellips Lake, and Tempe Papago Lake (proposed Fishing in the Neighborhood lakes)

3. Closed System Urban Fishing Program (UFP) Lakes and Proposed Fishing in the Neighborhood (FIN) Lakes (24 locations) – all closed system; artificial, man-made park lakes without outflow.

    - UFP LAKES: Alvord Lake, Cortez Lake, Desert Breeze Lake, Desert West Lake, Encanto Lake, Evelyn Hallman Pond, Kiwanis Lake, Red Mountain Lake, Rio Vista Pond, Riverview Lake, Steele Indian School Pond, Surprise Lake, Veterans Oasis Lake, and Water Ranch Lake (Urban Fishing Program waters).

    - FIN LAKES: Bonsall Lake, Crossroads Lake, Discovery District Lakes, Freestone Lake, Granada Lake, McQueen Lake, Pacana Lake, Roadrunner Lake, Selleh Lake, and Water Treatment Lake (proposed Fishing in the Neighborhood lakes).

Urban Fishing Program Waters - Background

Arizona's highly popular Urban Fishing Program (UFP) operates on the motto, "If people can't get to the fish, we'll bring fish to the people." In operation since 1985, the UFP includes 21 waters in 11 cities across the state. Sixteen of the UFP waters are in the Phoenix Metro Complex. Lakes range in size from 2.7 to 25 surface acres. Three types of fish stockings occur: 1) put-and-take stockings of catchable sized fish for the purpose of fishing recreation and harvest, 2) supplemental stockings that either add fish to a fishery to help augment low natural reproduction or increase fishing success for a clinic or other fishing event, and 3) restocking of fish communities following catastrophic events (e.g., golden alga blooms or dissolved oxygen crashes) or lake renovation and draining projects.

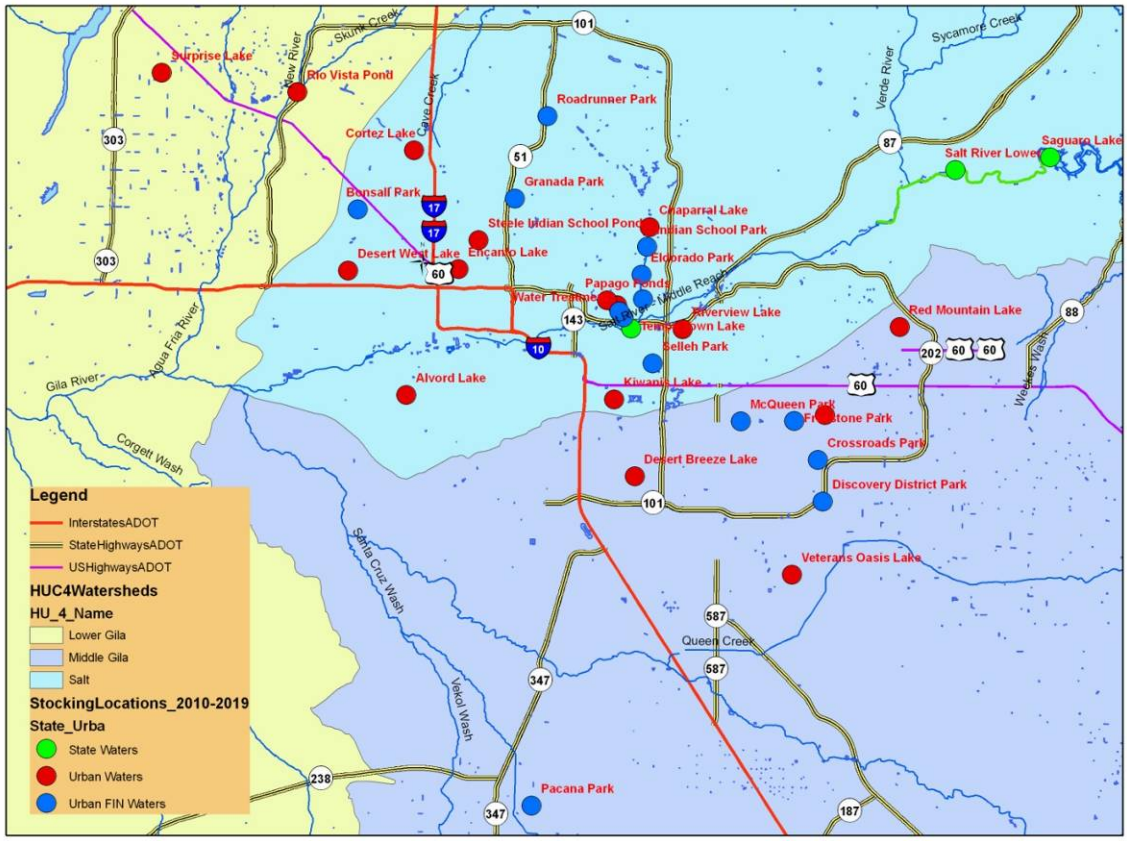

Figure 58. Phoenix Metro Complex Urban Fishing and Prospective Fishing in the Neighborhood Lakes.

Fishing in the Neighborhood Waters - Background

An AGFD priority goal is the recruitment and retention of anglers in Arizona. A proposed strategic concept to support this goal over the next ten years is the Fishing in the Neighborhood (FIN) program concept (note: the FIN name is subject to future change). There are 14 Phoenix area lakes proposed for addition to this new fishing program. Lakes range in size from 1 to 5 surface acres. Based in established urban areas at established urban park lakes, the FIN program would be based on supplemental stockings of these waters with catchable sport fish to increase recreational angling by attracting new anglers and retaining existing anglers. Reasons for stocking would be for: 1) fishing derbies and similar events, 2) supplemental stockings that add fish to augment low natural reproduction and increase fishing success, and 3) stockings of fish species to restart the fish population after a catastrophic event (e.g., golden alga kills) or lake draining.

This new, proposed concept would include stockings of catchable channel catfish 1-5 times per year, stockings of bluegill 1-4 times per year, and stockings of largemouth bass once every 1-3 years. The FIN concept differs from the Urban Fishing Program concept by: 1) primarily

delivering warm water sport fish at significantly fewer stockings each year, and 2) providing moderate, rather than intensive, angling recreation use. Additional fish stockings to augment low natural reproduction or replace fish lost during renovation projects or catastrophic events would include, as needed, stockings of channel catfish, bluegill, redear sunfish, and largemouth bass.

Open System Phoenix Metro Area State, Urban Fishing, and Fishing in the Neighborhood Lakes

This Phoenix Metro Complex Open System category includes Tempe Town Lake (a state fishing water) and six other lakes in either the Urban Fishing Program or the proposed Fishing in the Neighborhood Program. Four of these city park lakes are located in or within the Indian Bend Wash floodway that flows into upper Tempe Town Lake in the Salt River channel. The other two open system waters are the Papago Ponds and the Tempe Papago Lakes that may overflow into urban drainages and storm drains that end up in the Salt River channel immediately below Tempe Town Lake. Many of these Urban Lakes are connected and served by Salt River Project canal systems (Figure 59).

The designated Urban Fishing Program (UFP) waters in this open system grouping include Chaparral Lake and Papago Ponds. The proposed, and as yet unstocked, waters in the Fishing in the Neighborhood (FIN) concept program include the Eldorado Lakes, Indian School Lake, McKellips Lake, and Tempe Papago Lake.

There are an additional 14 UFP waters and 10 FIN waters that are all considered closed aquatic systems. These waters are discussed in the Closed System Urban Fishing Program Lakes and Proposed Fishing in the Neighborhood Lakes section that follows.

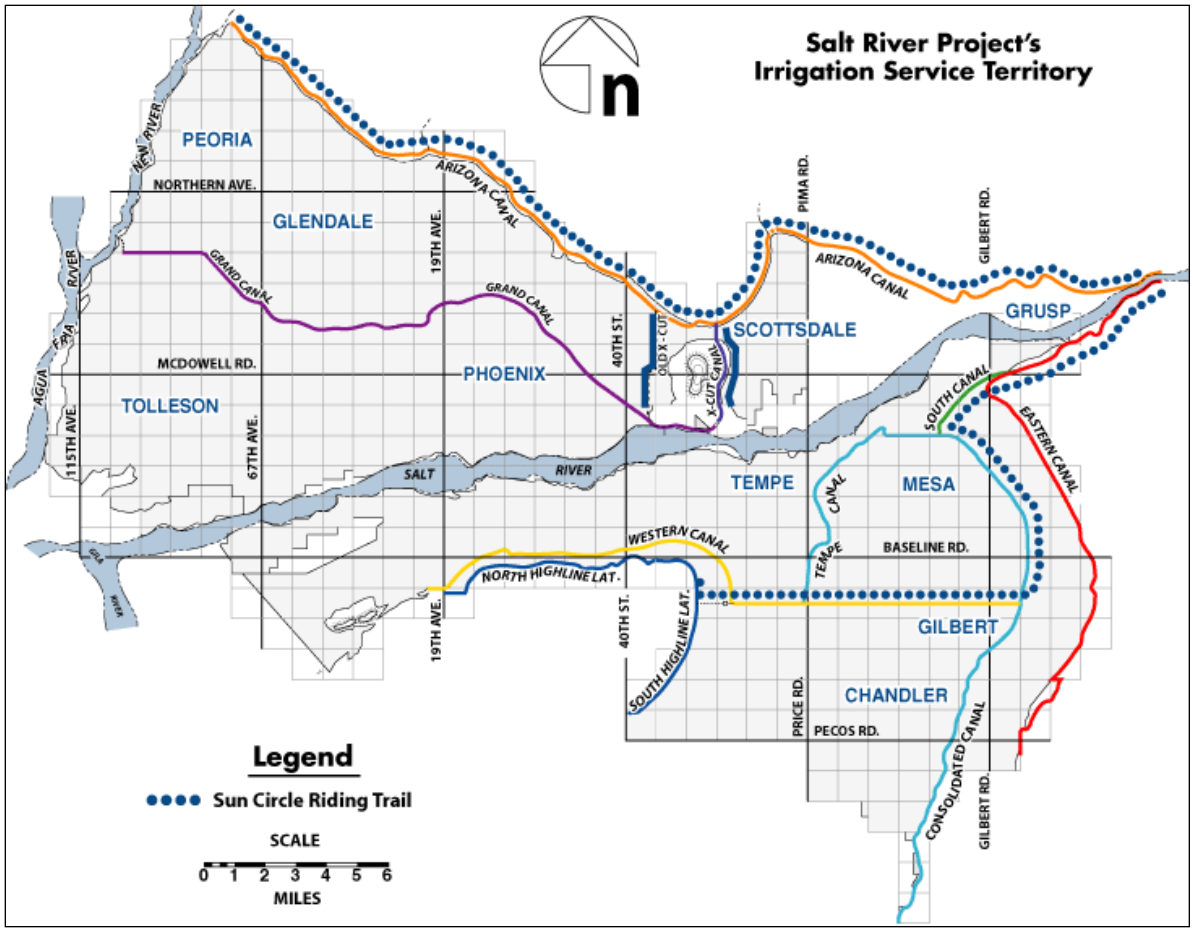

Figure 59. SRP's irrigation service territory.

Tempe Town Lake

Site Description

Tempe Town Lake is a 224-acre lake newly constructed and filled in 1999 and is managed by the City of Tempe for recreation (Figure 60). Tempe Town Lake is managed as a state fishing water and is not in the Urban Fishing Program. The lake is formed by a pair of inflatable dams in the channel of the Salt River. The lower dam is 19 feet tall and lake depths are 17 feet. Nearly two miles upstream, the upper inflatable dam is eight feet tall and lake depths are seven feet. The lake is essentially an impounded, engineered flood flow channel. The sides of the lake are steep, concrete banks that drop off rapidly. Lake levels are maintained through SRP canal water supplies from the Verde and Salt Rivers diverted at the Granite Reef Diversion Dam. Indian Bend Wash, an extensive urban floodway channel, also runs into the upper end of Tempe Town Lake. The Wash has flowed into the lake each year since 1999 during both winter rain events and summer monsoons.

Tempe Town Lake is owned and managed by the City of Tempe with SRP a cooperator. The area surrounding the lake is fully developed including commercial and private development in

addition to the lateral park system. The area includes paved paths, picnic areas, restrooms, docks, parks and a large children's splash area. According to Nancy Ryan, Rio Salado Project Manager, 2.7 million people use the recreational area each year. Non-motorized boating, kayaking and competitive rowing are popular on the lake. During triathlons, hundreds of athletes swim a one-mile distance in the lake.

Figure 60. Photo of Tempe Town Lake.

Management of water body

The primary management objective for Tempe Town Lake, a state fishing water, is to provide a put-and-take intensive-use coldwater rainbow trout fishery throughout the winter and spring months (Table 51). Since 2002, Tempe Town Lake has been stocked with catchable rainbow trout approximately every other week, from mid November to mid March. Numbers of trout stocked annually have ranged from 2,500 to 42,000. Number, timing, and hatchery trout sizes are adjusted depending on fish availability, stocking conditions, need to meet angler demands, or due to changes in management strategy.

A secondary objective of Tempe Town Lake is a self sustaining warm water fishery. Largemouth bass, channel catfish, bluegill, redear sunfish and black crappie populate the lake. The AGFD has not stocked any fish species other than rainbow trout into Tempe Town Lake. The origin of the warm water species is most logically from SRP canal inflows, Salt River flood flows over Granite Reef Dam, and flood flows from Indian Bend Wash.

Angler use, estimated at 16,000 anglers annually, is a minor component of the total Tempe Town Lake recreation use. The winter trout stockings have been very successful providing local angling opportunities for Phoenix area residents and winter visitors. Creel was conducted at Tempe Town Lake in December through March of 2003 and 2004; total angler use days for these four months was 7,602 in 2003 and 15,957 in 2004 (Pringle 2004).

Table 51. Summary of historic Department fish stockings at Tempe Town Lake.

Species	First Year	Last Year	Num. Years Stocked	Number Stocked
Rainbow trout	2002	2008	7	148,292
Total			7	148,292

Proposed action

The Department proposes to stock rainbow trout (catchable and sub-catchable) from November to April annually; numbers of trout may be from 0 to 45,000 fish annually, for the period covered by this consultation.

Water Distribution / Connectivity

Tempe Town Lake is maintained at a constant level using water from the SRP canal system. There is leakage from the inflatable dam that allows water to move a short distance downstream in the Salt River channel before it evaporates and/or sinks back into the alluvium (Figure 61). During flood releases from the Salt or Verde Rivers, the dams at Tempe Town Lake can be deflated within 30 minutes to allow the passage of the floodwaters downstream. If flows exceed 30,000 cfs the up- and downstream dams will be lowered (deflated) part way and then adjusted to any increased flow thereafter. Floodwater is then allowed to flow through the lake in the river channel. The dams are reinflated once the flood nears its end, capturing the tail waters of the flood and refilling the lake. Because the lake bed/channel must be managed to convey major flood flows, it is not a closed system and any fish species in the lake can move into the Salt River downstream of the lake when flood flows occur. Water flows out of Tempe Town Lake further downstream into the Gila River and on to Painted Rock Reservoir (a normally dry flood control impoundment) when flood flows from the Salt or Verde rivers occur.

Incoming flood flows from Scottsdale's Indian Bend Wash may also result in overflows out of Tempe Town Lake. Peak discharge flows down Indian Bend Wash have ranged from a low of 228 cfs in 2001 to 4,400 cfs in 2006 (Maricopa County Flood Control District website, Dec. 2009).

Figure 61. Photo of water releases over the inflatable dam at Tempe Town Lake.

Fish Movement

An inflatable dam at each end of Tempe Town Lake prevents the emigration of rainbow trout or warm water fish outside of the system except under high flow conditions in the Salt River. In these instances fish could theoretically move upstream 17 miles to Granite Reef Diversion Dam and/or move 22 miles downstream to the Gila River confluence. Upstream movement by fish during high flows could occur; however, fish would have to swim a long distance against a high velocity, low visibility flood flow current, then find a way to get over the nine foot tall Granite Reef Diversion Dam to access the lower Salt and Verde Rivers; as such, Granite Reef Diversion Dam is functionally a barrier to upstream fish movement. Fish that move downstream over the Tempe Town Lake dam during spill events may be transported as far as the Gila River confluence or beyond to reach Painted Rock Reservoir near Gila Bend. Under extremely high flood flows of a 100-year flood magnitude, fish may pass through Painted Rock dam and follow the Gila River until the confluence with the Colorado River at Yuma. Long-term survival of rainbow trout outside of Tempe Town Lake in the Salt or Gila Rivers is highly unlikely as temperatures exceed the upper thermal tolerance of rainbow trout during the summer months even in the permanently flowing sections near their confluence or in Painted Rock Reservoir. Warm water fish that escape from the lake could persist upstream or downstream in pools of perennial water, and in fact already exist in much of the Salt/Gila confluence area.

Community Description

Tempe Town Lake was constructed and filled for the first time in 1999. The Department began annual stockings of rainbow trout in Tempe Town Lake beginning in 2002. The City of Tempe has periodically stocked Israeli carp for midge fly control and redear sunfish under permit from AGFD. All other fish species in the lake entered the lake via SRP canals, through Indian Bend Wash during flood events, or down the Salt River channel from flooding in the Salt or Verde Rivers overflowing the Granite Reef Diversion Dam.

Prior to trout stocking in 2002, two fish surveys were conducted in 1999 and 2001 (Warnecke 1999, Warnecke et al 2003) that documented largemouth bass, green sunfish, bluegill, redear sunfish, channel catfish, carp, tilapia, threadfin shad, red shiner, yellow bass, goldfish, crayfish, and fathead minnow in Tempe Town Lake. In nine years of sampling, only two Sonora suckers were found (1999). Three 10 inch rainbow trout were sampled in 2001 and most likely entered the lake via the SRP canal system after being stocked in the Lower Salt River.

Additional surveys were conducted by the Department in March 2001, March 2003, March and April 2004, March 2005, April 2006, March 2007, March 2008 and March 2009 (Warnecke 2003, 2004a; Wiggins and Warnecke 2007; Rogers 2008c, 2009c). Species documented in Tempe Town Lake in these studies included those documented earlier with the addition of mosquito fish, inland silverside minnow, black crappie, flathead catfish, and one razorback sucker. The razorback sucker was caught in March 2004. Potential sources of this fish are from illegal removal from a pond at Arizona State University, transported from Lake Havasu via the CAP canal to the Arizona Canal, or from the stocking in the upper Verde River, through Horseshoe and Bartlett Lake down the Verde River into the Arizona Canal and then into Tempe Town Lake.

The most recent survey conducted at Tempe Town Lake in 2009 documented the presence of common carp, threadfin shad, bluegill, channel catfish, tilapia, largemouth bass, yellow bass, rainbow trout, flathead catfish, and black crappie (Rogers 2009c). Additionally, other than two Sonora suckers in 1999 and one razorback sucker in 2004, no other native species have been collected in Tempe Town Lake since it first filled in 1999. Three native species, Sonora sucker, desert sucker and roundtail chub, however, have been found in the Arizona Canal that supplies water to the lake (Marsh and Kesner 2004, 2006a, 2006b, 2007b, 2008; Kesner and Marsh 2009)

Consultation species or Critical Habitat

Potential impacts to bald eagles, roundtail chub and Yuma clapper rail are evaluated below. Possible impacts from sport fish leaving the lake during flooding events are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

Bald Eagle
Riverside Breeding Area is approximately 3.4 miles from Tempe Town Lake and is within the Bald Eagle DPS. The eagles were first observed in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Riverside Breeding Area productivity data shows that the nest failed with two nestlings found dead in the nest. It was active again in 2010.

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Tempe Town Lake does not currently have monofilament bins present.

Roundtail Chub
Roundtail chub have never been observed, documented or reported in fisheries or creel surveys at Tempe Town Lake. They have been found, however in the Arizona Canal which provides water to the lake. In 1999, roundtail chub were approved for stockings into Tempe Town Lake through an interagency Environmental Assessment and Section 7 compliance documentation (F-7-M). No roundtail chub have been stocked in Tempe Town Lake to date. A discussion on impacts to roundtail chub is included in the Phoenix Metro Complex Analysis section below.

Yuma clapper rail
Yuma clapper rails have not been documented from Tempe Town Lake. There is no suitable habitat at the lake but there is habitat upstream and downstream on the Salt and Gila rivers.

Potential impacts

No impacts would be anticipated due to the lack of habitat at the lake and that rainbow trout are not a threat to rails or their prey base.

Chaparral Lake
Site Description
Chaparral Lake is located at Chaparral Park, at Hayden Road and Chaparral in Scottsdale at 1260 foot elevation. This 10-acre lake is the oldest in the UFP. Constructed by the City of Scottsdale in the 1960's and renovated in 2005, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 10 feet, with a maximum of 15 feet. Scottsdale's popular Chaparral Park has a variety of improvements, including restrooms, ramadas, plazas, picnic tables, lighting, handicap accessibility, a recreation center and pool, a children's playground, and a boat ramp.

Management of Water Body
Since 1977, Chaparral Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 52). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 21,600 angler use days per year, an angler satisfaction rate of 88%, and a 23% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 52. Summary of historic Department fish stockings at Chaparral Lake.

Species	Years	Num. of Stockings	Number Stocked
Rainbow trout	1977-2008	244	129,840
Channel catfish	1977-2008	329	175,009
Bluegill/Hybrid sunfish	1983-2008	51	37,500
Largemouth bass	1980-2008	14	11,540
Redear sunfish	1980	2	8,791
Common carp	1977	8	1,817
Tilapia (Mozambique)	1975-1977	5	3,465
Total		588	367,962

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill sunfish, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 20,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 1,500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be

stocked as needed at any time during the period covered by this consultation to augment a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Chaparral Lake is considered an open system but it has a small urban watershed inflow and controlled grated outflow. The lake is supplied with SRP water, gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Overflow events are rare and tend to occur only with extreme rainfall events of a five to seven year flood magnitude. Chaparral Lake is situated adjacent to the Indian Bend Wash flood control channel and is not directly affected by those high flood flows. Water leaving the lake must pass through a grated structure with ¾ inch bars before entering a culvert under Chaparral Road. From there, the water flows southerly into the newly completed Camelback Park for approximately 0.6 miles before merging into the adjoining Indian Bend Wash greenbelt and floodway corridor. From this point, urban runoff flows 4.6 miles down Indian Bend Wash through a series of urban ponds that are either a part of Scottsdale's park system or that belong to various golf courses. Indian Bend Wash then runs into the upper end of Tempe Town Lake in the Salt River channel.

Fish Movement
There is no opportunity for fish to move up through the irrigation head gates and buried pipelines. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems. There is opportunity for fish to escape downstream through the overflow structures during significant summer monsoon events or winter storm events. The grated structure limits fish with a head width over ¾ inches from passing through. Smaller fish could escape and travel the same pathway described in the water connectivity section above until reaching Tempe Town Lake. No sampling has been done to determine if fish have spilled out of Chaparral Lake.

Because Chaparral Lake can overflow and spill into Indian Bend Wash and connect to Tempe Town Lake, there is a possibility that stocked fish or their smaller progeny could escape. There are numerous perennial ponds and lakes in the Indian Bend Wash watershed above Chaparral Lake that are subject to flooding, that can provide sanctuary for escaping fish to grow and move downstream with the next flood event. These waters are owned by private golf courses and homeowner associations, and include lakes less than one acre to over 30 acres. A diversity of warm water fish species are found in these waters including all species found in Chaparral Lake.

Community Description

AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, largemouth bass, crappie, tilapia, common carp, and threadfin shad as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Consultation Species or Critical Habitat
There are no consultation species or designated critical habitat at Chaparral Lake. Possible impacts from sport fish leaving the lake during monsoon events are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

Papago Ponds

Site Description
Papago Ponds are an interconnected collection of three lakes, located at Papago Park off of Galvin Parkway north of Van Buren Street in Phoenix, at 1250 foot elevation. Constructed by the Department in the 1940's, the three ponds were originally built as part of an eight pond bass hatchery. In the early 1960's, the City of Phoenix took over management of the park, setting aside the upper three ponds for park aesthetics, recreational fishing, and for use in pumping water to the Papago Golf Course. These artificial ponds have natural dirt edges and unsealed dirt bottoms. The ponds have maximum depths of 8-11 feet, and are supplied with SRP water, gravity fed through a pipeline and ditch. Phoenix's popular Papago Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, hiking and biking trails, and the adjacent Phoenix Zoo.

Management of Water Body
Since 1993, Papago Ponds have been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 53). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur. Creel survey results from 2005 found 22,700 angler use days per year, an angler satisfaction rate of 84%, and a 42% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 53. Summary of historic Department fish stockings at Papago Ponds.

Species	Years	Number of Stockings	Number Stocked

Rainbow trout	1993-2008	135	29,880
Channel catfish	1979-2008	181	41,965
Bluegill/Hybrid sunfish	1956-2008	35	44,497
Largemouth bass	1956-2008	13	3,671
Total		364	122,233

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 12,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 1,000.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Papago Ponds #1-3 are considered a predominately closed system water body, because it is a flow-through chain of ponds that overflow to the next downstream pond. Pumps pull lake water from Pond #1 to irrigate the Papago Golf Course turf grass a half-mile away. The ponds flow in a series, with SRP water entering Pond #1. Pond #1 has two outflows, one goes to Pond #2 and the other goes to the Phoenix Zoo ponds via a ditch. Water flows through Pond #2 into Pond #3 and then flows from there to ponds in the Phoenix Zoo via a pipeline and ditch system. Water levels of the five ponds in the Phoenix Zoo are supported by this flow-through system. Lake #8 in the Phoenix Zoo is the final, downstream pond. The entire system is electronically monitored with leveling systems at the inflow into Pond #1 through Pond #8. Small leaks and overflow from Pond #8 may occur, carrying water through a small culvert and drainage ditch system that goes 0.6 miles before entering the Salt River channel below Tempe Town Lake.

Fish Movement
There is no opportunity for fish to move up through the irrigation head gates and buried pipelines. Because the Papago Ponds are interconnected as source water for the Phoenix Zoo ponds, and the Zoo ponds have some leakage through a grated overflow into a ditch/culvert system that eventually empties into the Salt River, there is a slight possibility of smaller stocked fish or their progeny escaping. Smaller fish could escape and travel the same pathway described in the water connectivity section, until reaching the Salt River below Tempe Town Lake. No sampling has been done to determine if fish have spilled out of Papago Ponds or the Phoenix Zoo.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, common carp, white amur, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Consultation Species or Critical Habitat
There are no consultation species or designated critical habitat at Papago Park Lakes. Possible impacts from sport fish leaving the lake are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

Eldorado Park Lakes

Site Description
The Eldorado Lakes are located at Eldorado Park at Miller Road and Murray Lane in Scottsdale. These 4 and 1.5-acre lakes are part of the Scottsdale Parks system. Constructed by the City of Scottsdale and U.S. Army Corps of Engineers in the 1970's, the artificial lakes were built for park aesthetics, recreational fishing, and are an integrated feature in the greenbelt and floodplain. The larger, northern lake was completely renovated by Scottsdale in 2008 and now has a sealed bottom and a concrete perimeter edge. Lake depths average 6 feet with a maximum of 12 feet. The southern lake has a dirt bottom and banks with a maximum depth of 8 feet. Scottsdale's popular Eldorado Park has are a variety of improvements including restrooms, ramadas, plazas, picnic tables, lighting, handicap accessibility, walking trails, a recreation center and pool, ball fields, and a children's playground.

Management of Water Body
Eldorado Lake has been managed by the City of Scottsdale as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for these lakes that reduces the harvest of trout and catfish. Angling use is light to moderate. In 2008, Scottsdale used bond money to fund a complete renovation of the north lake by deepening it, adding fish habitat in the form of rock reefs and spawning gravel, installing concrete walls, sealing the bottom, and putting in an aeration system to support a healthy fishery.

Catchable catfish and bluegill are occasionally stocked by the City of Scottsdale under a permit from AGFD for fishing derbies.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity

The Eldorado Lakes are considered an open-system water body because they have a large urban watershed inflow and a spillway, and are situated in the Indian Bend Wash floodplain greenbelt. The lakes are supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lakes to irrigate surrounding park turf grass.

The lakes are subject to overflow runoff events a couple times a year on average. The Indian Bend Wash watershed above Eldorado captures urban runoff from a large area that brings runoff into the lake during winter and summer rains. Water leaving the lake will flow in a southerly direction in Indian Bend Wash, spilling over into numerous municipal and golf course ponds over 2.6 miles, before entering the upper end of Tempe Town Lake in the Salt River channel. The ephemeral Indian Bend Wash watershed above Eldorado includes numerous golf course ponds, home association ponds, and municipal ponds.

Fish Movement

Because the Eldorado Lakes are part of the Indian Bend Wash floodway and can overflow and spill, stocked fish or their smaller progeny may escape and be flushed downstream, traveling the same pathway described in the water connectivity section above. Most runoff events are substantial enough to transport fish into ponds downstream, or eventually into Tempe Town Lake 2.6 miles away. There are over a dozen perennial ponds and lakes in the Indian Bend Wash

watershed above Eldorado Lake that are subject to flooding and fish escapement that can provide sanctuary for escaping fish to grow and move downstream with the next flood event. These waters are owned by private golf courses, homeowner associations, and municipalities, and include lakes less than one acre to over 30 acres. A diversity of warm water fish species are found in these waters, including all species found in Eldorado. No sampling has been done, or records found, to determine if fish have spilled out of Eldorado Lake, but it is highly likely given the high peak discharges that can occur in Indian Bend Wash.

Community Description

Channel catfish, bluegill, redear sunfish, largemouth bass, carp, threadfin shad, and tilapia are present and have been observed from this lake.

See the Phoenix Metro Urban Lakes Complex Analysis for community description in the SRP canals that provide water to this lake.

Consultation Species or Critical Habitat
Possible impacts to bald eagles at the lakes are evaluated below. Possible impacts from sport fish leaving the lake are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

Bald Eagle

Riverside Breeding Area is approximately 2.9 miles from Eldorado Park and is within the Bald Eagle DPS. The eagles were first observed in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Riverside Breeding Area productivity data shows that the nest failed with two nestlings found dead in the nest in 2009 (McCarty and Jacobson 2009) but was active again in 2010.

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Eldorado Park does not have monofilament bins present.

<u>Indian School Park Lake</u>
Site Description
Indian School Park Lake is located at Indian School Park at Hayden Road and Indian School Road in Scottsdale. This 2.5-acre lake is part of the Scottsdale park system. Constructed by the City of Scottsdale and U.S. Army Corps of Engineers in 1979, the lake was built for park aesthetics, recreational fishing, and is an integrated feature in the greenbelt floodway. This artificial lake has a sealed dirt bottom and a dirt perimeter edge. Lake depths average 5 feet with a maximum of 11 feet. Indian School Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, and handicap accessibility.

Management of Water Body
Indian School Lake has been managed by the City of Scottsdale as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light to moderate.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Indian School Park Lake is considered an open-system water body because it has a large urban watershed inflow and a spillway and is situated in the Indian Bend Wash floodplain greenway. The lake is supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

The lake is subject to overflow runoff events a couple times a year on average. The Indian Bend Wash watershed above Indian School captures urban runoff from a large area that brings runoff into the lake during winter and summer rains. Water leaving the lake will flow in a southerly direction in Indian Bend Wash, spilling over into numerous municipal and golf course ponds over 4.1 miles before entering the upper end of Tempe Town Lake in the Salt River channel. The ephemeral Indian Bend Wash watershed above Indian School Lake includes numerous golf course ponds, home association ponds and municipal ponds.

Fish Movement
Because Indian School Lake can overflow and spill into Indian Bend Wash and connect to Tempe Town Lake, there is a possibility of stocked fish or their smaller progeny escaping and traveling the same pathway described in the water connectivity section above. There are over a

dozen perennial ponds and lakes in the Indian Bend Wash watershed above Indian School Lake that are subject to flooding and fish escapement which can provide sanctuary for escaping fish to grow and move downstream with the next flood event. These waters are owned by private golf courses, homeowner associations, and municipalities, and include lakes less than one acre to over 30 acres. A diversity of warm water fish species are found in these waters, including all species found in Indian School Park Lake. No sampling has been done, or records found, to determine if fish have spilled out of Indian School Park Lake, but it is highly likely given the high peak discharges that can occur in Indian Bend Wash.

Community Description
Channel catfish, bluegill, redear sunfish, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake.

See the Phoenix Metro Urban Lakes Complex Analysis for the community description in canals that provide water to this lake.

Consultation Species or Critical Habitat
There are no consultation species or critical habitat at this site. Possible impacts from sport fish leaving the lake are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

McKellips Lake at Vista del Camino Park
Site Description
McKellips Lake is located at Vista del Camino Park at Hayden Road and Indian School Road in Scottsdale. This 5-acre lake is part of the Scottsdale park system. Constructed by the City of Scottsdale and U.S. Army Corps of Engineers in 1975, the lake was built for park aesthetics, recreational fishing, and is an integrated feature in the greenbelt floodway. This artificial lake has a sealed dirt bottom and a dirt perimeter edge. Lake depths average seven feet with a maximum of 14 feet. Vista del Camino Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, and a children's playground.

Management of Water Body
McKellips Lake has been managed by the City of Scottsdale as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is moderate.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
McKellips Lake is considered an open-system water body because it has a large urban watershed inflow and a spillway, and is situated in the Indian Bend Wash floodplain and greenbelt. The lake is supplied with SRP water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

The lake is subject to overflow runoff events a couple of times a year on average. The Indian Bend Wash watershed above Vista del Camino captures urban runoff from a large area that brings runoff into the lake during winter and summer rains. Water leaving the lake will flow in a southerly direction in Indian Bend Wash, spilling over into a drainage channel and a small riparian area over 1.1 miles before entering the upper end of Tempe Town Lake in the Salt River channel. The ephemeral Indian Bend Wash watershed above McKellips Lake includes numerous golf course ponds, home association ponds, and municipal ponds.

Fish Movement
Because McKellips Lake can overflow and spill into Indian Bend Wash and connect to Tempe Town Lake, there is a possibility of stocked fish or their smaller progeny escaping and traveling the same pathway described in the water connectivity section above. There are over a dozen perennial ponds and lakes in the Indian Bend Wash watershed above McKellips Lake that are subject to flooding and fish escapement, which can provide sanctuary for escaping fish to grow and move downstream with the next flood event. These waters are owned by private golf courses, homeowner associations, and municipalities, and include lakes less than one acre to over 30 acres. A diversity of warm water fish species are found in these waters including all species found in McKellips Lake. No sampling has been done, or records found, to determine if fish have spilled out of McKellips Lake, but it is highly likely given the high peak discharges that can occur in Indian Bend Wash.

Community Description
Channel catfish, bluegill, redear sunfish, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake. Other fish species are unknown.

See the Phoenix Metro Urban Lakes Complex Analysis for the community description in canals that provide water to this lake.

Consultation Species or Critical Habitat
Possible impacts to bald eagles at the lakes are evaluated below. Possible impacts from sport fish leaving the lake are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

Bald Eagle
Riverside Breeding Area is approximately 2.4 miles from Vista del Camino Park and is within the Bald Eagle DPS. The eagles were first observed in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Riverside Breeding Area productivity data shows that the nest failed with two nestlings found dead in the nest in 2009 (McCarty and Jacobson 2009) but was active again in 2010.

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Vista del Camino Park does not have monofilament bins present.

Tempe Papago Park Lake
Site Description
Tempe Papago Park Lake is located at Curry Road and College Avenue in Tempe. This 0.6 acre lake is part of the Tempe Parks system (Figure 62). Constructed by the City of Tempe in the 1970s, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. The artificial lake has a sealed bottom and a dirt shoreline perimeter. Lake depths average four feet with a maximum of seven feet.

Figure 62. Photo of Tempe Papago Park Lake.

Management of Water Body
Tempe Papago Park Lake has been managed by the City of Tempe as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light.

Catchable catfish and bluegill have been stocked by the North Tempe Neighborhood Association under permit from AGFD for an annual fishing derby the past four years.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Tempe Papago Park Lake has a small urban watershed inflow and an overflow feature. The lake is supplied by SRP water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Overflow events tend to occur only with extreme rainfall events of a two-year flood magnitude. Flood waters leaving the lake pass into an overflow structure, then into a buried pipeline and into a ditch. From there the water would flow along the ephemeral ditch about one mile westerly before entering a storm water drain near Highway 202 and Mill Avenue. The 0.5 mile drain eventually enters the Salt River channel below Tempe Town Lake.

Fish Movement
In the event of a spill from Tempe Papago Park Lake, water containing stocked fish or their progeny may potentially escape. Any escaped fish would travel the same pathway described in the water connectivity section until they reach the Salt River channel downstream of Tempe Town Lake. There is limited permanent water in this Salt River reach, and most fish that arrive there do not survive any length of time. No sampling has been done, or records found, to determine if fish have spilled out of Tempe Papago Park Lake.

Community Description
Channel catfish, bluegill, redear sunfish, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake.

See the Phoenix Metro Urban Lakes Complex Analysis for a community description in canals that provide water to this lake.

Consultation Species or Critical Habitat
There are no consultation species or critical habitat at this site. Possible impacts from sport fish leaving the lake are evaluated in the Phoenix Metro Urban Lakes Complex Analysis.

OPEN SYSTEM PHOENIX METRO AREA LAKES ANALYSIS
Water distribution and connectivity, fish movement and community descriptions were discussed for Tempe Town Lake, Chaparral Lake, Papago Ponds, Indian School Lake, Eldorado Lakes, McKellips Lake and Tempe Papago Lake. Descriptions for these waters will be restated again as

they contribute to the overall Phoenix Metro complex. Impacts to sensitive species in the Phoenix Metro complex are also discussed below, comprehensively in combination with all potential connected populations of these sensitive species.

Water Distribution / Connectivity

Seven of the proposed stocking locations in the Phoenix Metro area have water connectivity with the lower Salt River through Phoenix. Tempe Town Lake is right in the Salt River channel. Chaparral Lake, Indian School Lake, Eldorado Lakes and McKellips Lake are in or adjacent to the Indian Bend Wash, an environmentally engineered flood control channel that flows into the Salt River channel in the upper end of Tempe Town Lake. These four waters are periodically subjected to extreme overflow events in the form of winter storms or summer monsoons resulting in water discharges into the Salt River. The remaining two locations, Papago Ponds and Tempe Papago Lake reside on small urban drainages that may overflow during significant events with flows ending up in the Salt River immediately downstream of Tempe Town Lake.

All of these lakes are supplied with water from the SRP Arizona Canal system. SRP's 131-mile main canal system is supplied with water from the Salt and Verde River watersheds. These rivers flow together above Granite Reef Diversion Dam where SRP regulates the water into the canal system. From Granite Reef Diversion Dam, water travels into two canal networks; the north side of the dam delivers water to the Arizona Canal and all the canals on the north side of the Salt River channel; the south side of the dam provides water to the South Canal and all the connecting canals on the south side of the river. Gated outflow structures along the canals are used to supply water to each of the lakes through buried pipelines. Additional discussion of the SRP canal system is covered in the Lower Salt River section.

SRP distributes water to the Phoenix Metropolitan area municipalities, and for agricultural irrigation using an extensive series of transfer canals, ditches, and pipelines. Some water eventually returns to the Salt and Gila Rivers through community wastewater treatment plants and agriculture return drains.

Indian School, Eldorado and McKellips Lakes are subject to overflow runoff events a couple of times a year on average. The 101 square mile Indian Bend Wash watershed captures urban runoff from a large area that brings runoff into the series of lakes during winter and summer rains. Water leaving the lakes flows in a southerly direction in Indian Bend Wash, spilling over into a drainage channel and a small riparian area over 1.1 miles before entering the upper end of Tempe Town Lake in the Salt River channel. The ephemeral Indian Bend Wash upper and middle watershed includes numerous golf course ponds, home association ponds, and municipal ponds.

While Chaparral Lake is not in the immediate flood channel, it is susceptible to urban runoff from a side drainage. Overflow events are rare and tend to occur only with extreme rainfall events of a five to seven year flood magnitude. Chaparral Lake is situated adjacent to the Indian

Bend Wash flood control channel and is not directly affected by those high flood flows. Water leaving the lake must pass through a grated structure with ¾ inch bars before entering a culvert under Chaparral Road. From there, the water flows southerly into the newly completed Camelback Park for approximately 0.6 miles before merging into the adjoining Indian Bend Wash greenbelt and floodway corridor. From this point, urban runoff flows 4.6 miles down Indian Bend Wash through a series of urban ponds that are either a part of Scottsdale's park system or that belong to various golf courses. Indian Bend Wash then runs into the upper end of Tempe Town Lake in the Salt River channel.

Tempe Town Lake, located in the Salt River channel, receives a regular water supply from the SRP Arizona Canal system, flood flows released over Granite Reef Dam from the lower Salt River and Verde River systems, and flood flows from urban runoff through Indian Bend Wash. Tempe Town Lake is maintained at a constant level using water from the SRP canal system. There is leakage from the inflatable dam that allows water to move a short distance downstream in the Salt River channel before it evaporates and/or sinks back into the alluvium. During flood releases from the Salt or Verde Rivers, the dams at Tempe Town Lake can be deflated within 30 minutes to allow the passage of the floodwaters downstream. If flows exceed 30,000 cfs the up- and downstream dams will be lowered (deflated) part way and then adjusted to any increased flow thereafter. Floodwater is then allowed to flow through the lake in the river channel. The dams are reinflated once the flood nears its end, capturing the tail waters of the flood and refilling the lake. Because the lake bed/channel must be managed to convey major flood flows, it is not a closed system and any fish species in the lake can move into the Salt River downstream of the lake when flood flows occur.

Incoming flood flows from Scottsdale's Indian Bend Wash may also result in overflows out of Tempe Town Lake. Peak annual discharge flows down Indian Bend Wash have ranged from a low of 228 cfs in 2001 to 4,400 cfs in 2006 (Maricopa County Flood Control District website, Dec. 2009).

Fish Movement

SRP Canals - Native and nonnative fish originating from the Salt and Verde systems are entrained in SRP canals below the Granite Reef Diversion Dam. These fish move downstream throughout the canal system. The SRP canals have a series of variously sized grates and barriers that limit or restrict upstream and downstream fish movements. Gated outflow structures along the canals are used to supply water to each of the lakes through buried pipelines. These systems of gravity-fed pipelines create a distinct fish barrier, precluding fish in the lakes from re-entering the pipelines and moving into the canals, but smaller bodied fish are free to enter the lake from the canal.

Salt River Channel – Escapement of rainbow trout or warm water resident fish species from Tempe Town Lake may occur when the dams are lowered (deflated) and the river flows through

the lake. Rogers (2008c) discussed the 2008 and 2004-2005 overflow events at the lake. In 2004-2005, the inflatable dams were completely lowered for the 30,000 cfs flood flows, resulting in an estimated loss of 50% of the fish in the lake to the river downstream. In 2008, the 18,000 cfs flood flows required only a partial deflation of the dams; however, fish were washed over the dam, with over 700 dead and dying fish reported in the river channel below. Species flushed downstream included Israeli (mirror) carp, rainbow trout, channel catfish, yellow bass, threadfin shad, and common carp.

An inflatable dam at each end of Tempe Town Lake prevents the emigration of rainbow trout or warm water fish outside of the system except under high flow conditions in the Salt River. In these instances fish could theoretically move upstream 17 miles to Granite Reef Diversion Dam and/or move 22 miles downstream to the Gila River confluence. Upstream movement by fish during high flows could occur; however, it is unlikely that any stocked rainbow trout or warm water fish and their progeny in Tempe Town Lake could swim a long distance against a high velocity, low visibility flood flow current, then find a way to get over the nine foot tall Granite Reef Diversion Dam to access the lower Salt and Verde Rivers.

Fish that move downstream over the Tempe Town Lake dam during spill events may be transported as far as the Gila River confluence, or beyond to reach Painted Rock Reservoir near Gila Bend. Under extremely high flood flows of a 100-year flood magnitude, fish may pass through Painted Rock dam and follow the Gila River until the confluence with the Colorado River at Yuma. Long-term survival of rainbow trout outside of Tempe Town Lake in the Salt or Gila Rivers is highly unlikely as temperatures exceed the upper thermal tolerance of rainbow trout during the summer months even in the permanently flowing sections near their confluence or in Painted Rock Reservoir. Warm water fish that escape from the lake could persist upstream or downstream in pools of perennial water.

The Salt River is normally dry through much of the Phoenix metropolitan area; however, there are places of permanent water where warm water fish may persist after releases from the lake. Rainbow trout are actively stocked during the period of the year when the lake is most likely to spill and may persist in the river for a short time until temperatures become lethal. Warm water fish species would be expected to persist in the permanently watered areas. During spill events, suckers, roundtail chub and nonnative fish species present in the Salt and Verde River upstream of Granite Reef Diversion Dam may also move downstream with the high flows. The native fish component found in the Salt and Gila Rivers is extremely limited and the individuals washed into this area are essentially removed from the upstream populations by the movement barriers of Tempe Town Lake and the Granite Reef Diversion Dam.

The composition of the fish community in the pond and wetland habitats of the Salt River above Tempe Town Lake is not known. The area includes numerous large and small ponds, with limited riffle habitat so may not provide a suitable spawning area for native fish and it may be

supported by fish that come over Granite Reef Diversion Dam during flood flows or by natural reproduction in the intermittent pools.

Indian Bend Wash - Because Chaparral, Indian School, Eldorado and McKellips Lakes can overflow and spill into Indian Bend Wash and connect to Tempe Town Lake, there is a possibility of stocked fish or their smaller progeny escaping and traveling the same pathway described in the water connectivity section above. There are over a dozen perennial ponds and lakes in the Indian Bend Wash watershed above and between these four lakes that are subject to flooding and fish escapement, which can provide sanctuary for escaping fish to grow and move downstream with the next flood event. These waters are owned by private golf courses, homeowner associations, and municipalities, and include lakes less than one acre to over 30 acres. A diversity of warm water fish species are found in these waters including all species found in McKellips Lake. No sampling has been done, or records found, to determine if fish have spilled out of these lakes, but it is highly likely given the high peak discharges that can occur in Indian Bend Wash.

Community Description

SRP Canals - The fish species assemblage within the canals is the most diverse of any waterbody in the state. This is due to waters running through the communities of the metropolitan Phoenix area that collect runoff from literally hundreds of public and private waterbodies that contain a wide array of fish assemblages. Further, the proximity of the canals to millions of urban residents offers the public an easy opportunity to illegally stock fish, or transfer fish from aquariums or ponds. Canal species documented in the past include longfin dace, yellow bullhead, goldfish, desert sucker, Sonora sucker, hybrid sucker, grass carp (white amur), common carp, red shiner, threadfin shad, mosquitofish, roundtail chub, channel catfish, green sunfish, redear sunfish, smallmouth bass, largemouth bass, yellow perch, yellow bass, striped bass, rainbow trout, fathead minnow, sailfin molly, shortfin molly, blue tilapia, black crappie, flathead catfish, walleye, Mozambique tilapia, redbelly tilapia (LCRB Aquatic GAP, Table 50).

Wright and Sorensen (1995) found the presence of 20 fish species, 3 native and 17 nonnatives, in the SRP canals. The three native fish are the desert sucker, Sonora sucker, and roundtail chub. Nonnative species, in order of abundance are: threadfin shad, red shiner, white amur, largemouth bass, yellow bass, channel catfish, yellow bullhead, mosquitofish, common carp, bluegill, seasonal rainbow trout, goldfish, green sunfish, smallmouth bass, oscar, walleye, and flathead catfish. This species assemblage is almost identical, with a few nonnative fish differences, to those found by Marsh and Kesner (2008) in 2007. They found two tilapia species (blue and redbelly), redear sunfish, and striped bass, but did not capture mosquitofish, yellow bass, or walleye.

Salt River Channel – There are no known studies documenting fish species found in the permanent pools of water in the Salt River immediately above and below Tempe Town Lake.

Anecdotal evidence from visual observations suggest that common carp, largemouth bass, channel catfish, bluegill and threadfin shad occur in the pool and wetland habitat above Tempe Town Lake. Similar observations and personal communication with Steve Fairheisl (Sky Harbor Airport bird control consultant) indicate that in addition to the above species, yellow bass and black crappie have been found below Tempe Town Lake during periodic fish salvage and removal efforts.

During flooding events when water is spilled over Granite Reef Dam, fish communities in the Lower Salt River and lower Verde River are apt to be swept downstream into the Salt River channel, into Tempe Town Lake, and onto the river below. The Lower Salt River contains a mix of native and nonnative fish species. Aside from the stocked rainbow trout, the remaining species maintain their populations through breeding in the reach or overflows from the upstream reservoirs. Four native species (Sonora sucker, desert sucker, longfin dace, and roundtail chub) and over 18 nonnative species (including largemouth and smallmouth bass, channel catfish, carp, several sunfish species, red shiner and tilapia) were found in recent surveys in the Lower Salt River below Stewart Mountain Dam (Marsh and Kesner 2004, 2006a, 2006b, 2007b, 2008; Kesner and Marsh 2009).

Historically 22 species of fish have been documented in the Verde River from Bartlett Lake Dam to the confluence with the Salt River (LCRB Aquatic GAP). These are longfin dace, yellow bullhead, desert sucker, Sonora sucker, common carp, red shiner, mosquitofish, bonytail chub, roundtail chub, channel catfish, green sunfish, bluegill, redear sunfish, hybrid sunfish, smallmouth bass, largemouth bass, fathead minnow, sailfin molly, flathead catfish, and razorback sucker.

Indian Bend Wash – No fisheries investigations have been conducted in many of the dozens of public and private waterbodies along the Indian Bend Wash. However, known fish species from the four proposed stocking locations include: rainbow trout (seasonally stocked), channel catfish, bluegill, redear sunfish, hybrid sunfish, largemouth bass, black crappie, tilapia, common carp, threadfin shad, red shiner, and mosquitofish.

Salt River and Gila River west of Phoenix -- The Gila River downstream from the 91st Ave. Wastewater Treatment Plant (including Tres Rios area) appears to maintain a persisting and self-sustaining population of warm water nonnative fishes (Table 54).

Consultation Species or Critical Habitat
Potential impacts to bald eagle, desert pupfish, roundtail chub, Western yellow-billed cuckoo, woundfin and Yuma clapper rail are discussed below.

Bald Eagle

Discussion of the new, 2008 bald eagle BA immediately upstream of Tempe Town Lake on the Salt River channel is covered in the Tempe Town Lake section.

Desert Pupfish

Desert pupfish are located within proximity to Papago Ponds and Kiwanis Lake (HDMS data). The two populations are more than 5 miles away from either site at the Arizona Trail exhibit of the Phoenix Zoo, and at an interpretive pond within the Desert Botanical Gardens. Pupfish were established at the Phoenix Zoo in 1986, and the Desert Botanical population was established in 1987. Both populations remain extant, are isolated from existing surface waters, and have restricted public access.

Potential Impacts

No potential impacts are anticipated on the desert pupfish due to the lack of exposure of these isolated populations from surface waters.

Table 54. Summary of Fish collected from the Gila River downstream from the 91st Ave. Wastewater Treatment Plant in 1998.

Species	91 AVE TO 107 AVE	115 AVE.	BULLARD POND	COHEN LAKE	Total
yellow bullhead	3		1		4
goldfish			4		4
carp	28	20	62	21	131
red shiner	1038	919	276		2233
threadfin shad				19	19
mosquitofish	906	4	54		964
channel catfish	2	26	24	8	60
green sunfish			46	18	64
bluegill		5	14		19
redear sunfish				20	20
largemouth bass	4	61	48	83	196
yellow bass				3	3
sailfin molly	707	196	280		1183
black crappie			1	2	3
Tilapia spp.	726	55	68	41	890
Total	3414	1286	878	215	5793

Roundtail Chub

The nearest roundtail chub occurring within this stocking area are located in the Lower Salt River, Lower Verde River and the SRP Canal system below Granite Reef Dam. These fish are considered one contiguous population throughout this area and genetically similar to the Verde

River population above Horseshoe Reservoir (Bryan and Robinson 2000, Bryan and Hyatt 2004, Dowling 2008). Within the Lower Salt River section, this population is common, yet has declined in the past decade. Please refer to the Lower Salt River section for the specific status of this population.

Tempe Town Lake and Phoenix Metro open system UFP and FIN lakes have a hydrological connection to the sub-watershed; fish stocked into the lakes are not likely to escape to roundtail chub habitat. Roundtail chub in the canal could enter the lake(s) through the inflow if they are small enough to pass the 2-inch white amur grating. The existing data suggest that this may be a rare occurrence, since no roundtail chub have been found to date in UFP waters, and the number of roundtail chub in the canal system is small (Marsh and Kesner 2008). Over 20 years ago there were a couple of recalled incidences of Sonoran and desert suckers occurring in two UFP lakes fed by the SRP Arizona Canal, which suggests the potential for fish in the canals to enter UFP waters. However, ever since the white amur grating was installed throughout the SRP canal system (circa 1985-1988), there have been no reported findings or observations of suckers in any of the 13 UFP lakes supplied with SRP water.

In the event of a spill from the Papago Ponds or the Tempe Papago Lake, water containing stocked fish or their progeny may reach the Salt River channel immediately downstream of Tempe Town Lake. There is limited permanent water in this reach, and most fish that arrive there do not survive for any length of time. Any stocked fish or progeny reaching the river would not impact roundtail chub in the Salt River, the upstream barriers (Tempe Town Lake and Granite Reef Dam) and distance (17 miles) during flood flows would preclude it.

Roundtail chub that are small enough to enter the lake(s) through the 2-inch grating are subject to predation by other nonnative fish resident in the canals. However, should they reach the proposed stocking waters, the individual roundtail chub would be trapped in the water body, unable to leave and rejoin the Salt and Verde River populations, only to be eaten by stocked fish species or their progeny in the lake, or captured by anglers, since roundtail chub are a legal sport fish in Arizona.

As stated in the Tempe Town Lake consultation section for roundtail chub, no roundtail chub have ever been documented in Tempe Town Lake since it was first filled in 1999. The most recent survey conducted at Tempe Town Lake (Rogers 2008c) documented the presence of common carp, threadfin shad, bluegill, channel catfish, tilapia, largemouth bass, yellow bass, rainbow trout, flathead catfish, and black crappie. Roundtail chub have never been observed, documented, or reported in fisheries or creel surveys at Tempe Town Lake.

As discussed in the Lower Salt River Complex Analysis section, any roundtail chub passing over the Granite Reef Dam into the Salt River channel or passing over the Diversion Dam into the SRP canal system are considered permanently lost from the river populations. However, if

roundtail chub were able to get into Tempe Town Lake, the lake would be considered a "sink" for such individuals. Roundtail chub in Tempe Town Lake would be pursued or predated on by the existing warm water fish or their progeny. Roundtail chub in the lake would not be expected to breed successfully, and eventually the adult individuals would die. Due to this aspect it is assumed that the lake cannot support a reproducing population of roundtail chub and any adults present would eventually die.

Movement of fish species out of the lake and back into the canals or, more importantly, the riverine habitats of the lower Salt and Verde Rivers, is not likely to occur. No data have been documented to show the movement of fish back into the canals. If it were to occur as stated above in the Lower Salt River Fish Movement section, electrical fish barriers were installed in each canal downstream of Granite Reef to prevent fish from moving out of the canals back upstream into the Salt River. The electric barriers are preventing most fish from moving upstream toward the Granite Reef Diversion Dam, but still allow some limited movement of fish upstream of the barriers due to rare mechanical failures (Clarkson 2003). Once fish are below the barriers, it is extremely unlikely they would be able to return to the river.

The multi-agency group implementing the Statewide Conservation Agreement for roundtail chub (AGFD 2006) agreed that the stockings of rainbow trout into sites that have a low potential to contribute the aquatic community within roundtail chub habitats would not create an impact to the chub population, as in this case.

Potential Impacts

As discussed in the Lower Salt River Complex Analysis section, any roundtail chub passing over the Granite Reef Diversion Dam into the SRP canal system, or over the spillway during flood flows into the Salt River channel, are considered permanently lost, and disconnected from the Salt and Verde River populations. Subsequent exposure of any escaped roundtail chub living in the SRP canals, or isolated permanent pools along the Salt River channel, or flushed into Tempe Town Lake, to any of the proposed trout or warm water fish stockings would be nominal and inconsequential. Nevertheless, any minimal exposure will be discussed.

Although access is possible for roundtail chub to move into the UFP or FIN lakes, no roundtail chubs have been documented or reported in any urban lakes fed by SRP canal water. Over 20 years ago, there were a couple recalled incidences of Sonoran and desert suckers occurring in two UFP lakes fed by SRP canal water, which suggests the potential for fish in the canals to enter UFP waters (E. Swanson, pers com). However, ever since the white amur grating was installed throughout the SRP canal system (circa 1985-1988), there have been no documented or reported findings of suckers in any of the urban lakes.

Rainbow Trout – Predation on roundtail chub fingerlings by rainbow trout is possible although trout prefer insects and invertebrates and artificial baits, they have been documented to be

piscivorous if small fish are available. Propst et al. (1998) determined that stocked rainbow trout can prey on young or small native fish under certain conditions. Any potential predatory impacts by rainbow trout would only apply to larval or fingerling roundtail chub. There is no documentation in either the CAP canal fish sampling studies or the AGFD study by Wright and Sorenson (1995) that roundtail chub of this smaller size occur in the canals. Further, if rainbow trout from any of the proposed stocking locations were to escape into waters with roundtail chub, it may result in competition for food and space between the trout and roundtail chub as they prefer similar habitats (Bryan et al. 2000). The limited amount of habitat present during the winter months provides opportunity for exposure. It is unlikely that stocked rainbow trout survive in any of the proposed stocking locations much beyond June due to lethal high temperatures exceeding 26°C.

Warm Water Fish (channel catfish, largemouth bass, bluegill and redear sunfish) – Predation on roundtail chub by stocked channel catfish and largemouth bass, or their progeny is possible but unlikely due to the following factors. Catfish, bass, bluegill and redear sunfish stocked into the six open system UFP and FIN lakes would have to escape through overflows and end up in Tempe Town Lake or the Salt River below it to be exposed to any roundtail chub. Any roundtail chub that may, in the future, be found in Tempe Town Lake could be preyed on by stocked fish or their progeny that escape downstream from Chaparral Lake, Indian School Lake, Eldorado Lakes or McKellips Lake. Any roundtail chub in Tempe Town Lake are already at risk of predation by nonnative fish or by capture by anglers, and the additional risk to the individual roundtail chub from the stocked fish in the five urban waters in or along Indian Bend Wash is negligible. To date, no chub have been documented in Tempe Town Lake or the Salt River below.

Roundtail chub that are small enough to enter any of the proposed stocking locations through the 2-inch grating on the SRP canal outflows are subject to predation by other nonnative fish resident in the canals. The suite of other self-sustaining, nonnative species in the SRP canal systems, particularly largemouth bass, green sunfish, and channel catfish, are potential predators on roundtail chub eggs, larvae and juveniles, and are likely to be significant predators. Indian School, Eldorado and McKellips Lakes are all in the middle of the Indian Bend Wash and are exposed to nonnative fish transfers from a large suite of private and public ponds and lakes in the large urban watershed. These other waters are known to contain predatory fish including largemouth bass, bluegill, redear sunfish, common carp, and channel catfish.

Should roundtail chub reach the Phoenix Metro complex lakes via the SRP canal system, the individual chub would be trapped in the water body unable to leave and rejoin the Salt and Verde River populations, only to be eaten by stocked fish species or their progeny in the lake, or captured by anglers, since roundtail chub is a legal sport fish in Arizona.

The implementation of the proposed stocking action would not be expected to change the overall status of the population of roundtail chub in the Lower Salt River, Lower Verde River, and the SRP canal system because it is expected that few stocked species or their progeny will move downstream over dams or spillways. If they did they would have to then move upstream from 17-23 miles against flood flows in the intermittent Salt River channel and pass over the nine foot tall Granite Reef Dam and enter the Lower Salt River, where they would join the already existing nonnative predators and competitors,

To reduce the potential for impacts, the multi-agency group implementing the Statewide Conservation Agreement for roundtail chub (AGFD 2006) recommended against stocking largemouth bass and channel catfish directly into sites with roundtail chub populations. They also agreed that the stockings of rainbow trout into sites that have a low potential to contribute to the aquatic community within roundtail chub habitats would not create an impact to the chub population. The only roundtail chub populations existing within the Phoenix Metro complex are a relict, escaped population in the SRP canals. Consequently, these proposed stocking actions would not create an impact.

Woundfin

The Fish and Wildlife Service established "nonessential" experimental population areas for the woundfin in Arizona on July 24, 1985 (50 FR30188-30195). For incidental take due to Federal actions requiring consultations, the woundfin in these populations are considered proposed for listing.

On July 2, 2007, the Arizona Game and Fish Department and The Nature Conservancy released 50 adult woundfin into the experimental reach near the TNC Hassayampa River Preserve. The Hassayampa River site (Red Cliffs to Wagoner) is partly perennial through the vicinity of Wickenburg, with the lower section to the Gila River usually dry.

It is unknown if these fish reproduced or persisted in the river. Future stockings with woundfin into the Hassayampa River are uncertain; however, since they may occur within the 10-year period covered by this consultation, they will be evaluated. Although woundfin, like most desert evolved fish species is resistant to downstream displacement by flooding, data from the Virgin River indicates that they will move downstream during flow events.

Potential Impacts

If woundfin are displaced to the lower Hassayampa or to the Gila River approximately 35 miles below the experimental reach, they could be exposed to both warm and cold water species stocked under this program into the lower Salt River, the Salt River lakes, Tempe Town Lake, and those urban waters that drain into Tempe Town Lake.

Closed System Phoenix Metro Area Lakes

The following 14 UFP lakes and the 10 FIN lakes in the greater Phoenix Metro area are all closed system fisheries. These artificial lakes are all in municipal public parks and urban recreational areas. They have no outflow, they have no watershed inflow, they are simply excavated basins designed to hold water and provide an aesthetic and recreational component to urban parks.

There are no listed species found in association with these 24 park locations. Since all these Phoenix Metro lake systems are considered closed with no hydrological connection to the sub-watershed, and significant barriers precluding movement back upstream into the SRP canal, there is no possibility of escapement of stocked fish. Consequently, the closed system complex analysis at the end of this section is mostly background documentation supporting a no potential impact conclusion.

Alvord Lake at Cesar Chavez Park

Site Description

Alvord Lake is located at Cesar Chavez Park at 35th Avenue and Baseline Road in Phoenix, at 1065 foot elevation (Figure 63). This 25-acre lake is the largest in the UFP. Constructed by the City of Phoenix in the 1970's, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 14 feet, with a maximum of 18 feet. Cesar Chavez Park has a variety of improvements including restrooms, ramadas, plazas, picnic tables, lighting, handicap accessibility, a library, a children's playground, and a boat ramp.

Figure 63. Photo of Alvord Lake.

Management of Water Body

Since 1987, Alvord Lake has been managed in partnership with the City of Phoenix as an intensively stocked put-and-take fishery to provide year round high-use urban fishing opportunities for anglers of all ages and abilities. Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 43,500 angler use days per year, an angler satisfaction rate of 66%, and a 41% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring (Table 55). Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 55. Summary of historic Department fish stockings at Alvord Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1987-2008	191	188,835

Channel catfish	1980-2008	254	279,105
Bluegill/Hybrid sunfish	1987-2008	42	119,500
Largemouth bass	1987-2008	11	29,400
Redear sunfish	1980	1	1,000
Total		500	617,840

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 30,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 3,000.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Alvord Lake is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with Salt River Project (SRP) water, gravity fed through a pipeline and ditch. Fish from the lake cannot go back up the pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feed the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, largemouth bass, yellow bass, white amur, and common carp as

being present. See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Cortez Lake

Site Description

Cortez Lake is a 3-acre lake located at Cortez Park at 35th Avenue and Dunlap Road in Phoenix, at 1230 foot elevation. Constructed by the City of Phoenix in the 1970's and completely renovated in 2000, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 10 feet, with a maximum of 14 feet. The City of Phoenix's popular Cortez Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, ball fields, and a children's playground.

Management of Water Body

Since 1989, Cortez Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 56). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 34,800 angler use days per year, an angler satisfaction rate of 73%, and a 36% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 56. Summary of historic Department fish stockings at Cortez Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1989-2008	171	34,200
Channel catfish	1979-2008	229	57,250
Bluegill/Hybrid sunfish	1989-2008	40	28,950
Largemouth bass	1974-2008	12	4,131
Redear sunfish	1978	1	47
White bass	1975	1	1
Total		454	124,579

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 6,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Cortez Lake is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with SRP water, gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, largemouth bass, common carp, tilapia, and white amur as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Desert Breeze Lake
Site Description
Desert Breeze Lake is a 4-acre lake located at Desert Breeze Park at Desert Breeze Parkway south of Ray Road, at 1175 foot elevation (Figure 64). Constructed by the City of Chandler in 1989, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 8 feet, with a maximum of 12 feet. Chandler's popular Desert Breeze Park has a variety

of improvements, including restrooms, ramadas, plazas, picnic tables, lighting, handicap accessibility, a railroad ride, a children's playground, and ball fields.

Figure 64. Photo of Desert Breeze Lake.

Management of Water Body

Since 1990, Desert Breeze Lake has been managed as an intensively stocked put-and-take fishery to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 57). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 26,000 angler use days per year, an angler satisfaction rate of 86%, and a 30% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 57. Summary of historic Department fish stockings at Desert Breeze Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1990-2008	162	32,220
Channel catfish	1990-2008	216	47,250
Bluegill/Hybrid sunfish	1990-2008	37	23,000
Largemouth bass	1990-2008	10	5,402
Total		425	107,872

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 8,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 600.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Desert Breeze Lake is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with SRP water, gravity fed through a buried pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, common carp, white amur, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Desert West Lake

Site Description
Desert West Lake is a 5-acre lake located at Desert West Park at 63rd Avenue and Encanto Boulevard in Phoenix, at 1075 foot elevation. Constructed by the City of Phoenix in the 1995, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 11 feet, with a maximum of 15 feet. Phoenix's Desert West Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, volleyball, soccer and softball fields, a children's playground, skateboard park, and multi-generational recreation center.

Management of Water Body
Since 1995, Desert West Lake has been managed as an intensively stocked put-and-take fishery to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 58). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 32,900 angler use days per year, an angler satisfaction rate of 74%, and a 17% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 58. Summary of historic Department fish stockings at Desert West Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1995-2008	117	23,400
Channel catfish	1995-2008	156	32,149
Bluegill/Hybrid sunfish	1995-2008	27	30,000
Largemouth bass	1995-2008	7	3,627
Total		425	89,176

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 10,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 800.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Desert West Lake is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with SRP water, gravity fed through a buried pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, white amur, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Encanto Lake

Site Description
Encanto Lake is a 7.5-acre lake located at Encanto Park at 15th Avenue and Encanto Boulevard in Phoenix, at 1095 foot elevation. Constructed by the City of Phoenix in the 1940's, the lake

was built for park aesthetics, paddle boat rentals, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 8 feet, with a maximum of 12 feet. Phoenix's popular Encanto Park has a variety of improvements, including restrooms, picnic tables, lighting, handicap accessibility, paddle boat rental, a children's playground, and Enchanted Island, which is a small amusement park featuring children's rides.

Management of Water Body
Since 1989, Encanto Lake has been managed as an intensively stocked put-and-take fishery to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 59). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 22,300 angler use days per year, an angler satisfaction rate of 82%, and a 31% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 59. Summary of historic Department fish stockings at Encanto Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1989-2008	171	55,670
Channel catfish	1979-2008	229	80,300
Bluegill/Hybrid sunfish	1942-2008	59	269,912
Largemouth bass	1942-2008	34	25,067
Redear sunfish	1949-1988	2	1,400
Tilapia species	1966	1	783
Total		496	433,132

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 15,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 1,100.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Encanto Lake is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with SRP water, gravity fed through a buried pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass and a golf course.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, common carp, white amur, tilapia, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Evelyn Hallman (formerly Canal) Pond

Site Description
Evelyn Hallman Pond is a 3-acre pond located at Evelyn Hallman Park at College Avenue and McClintock Road in Tempe, at 1245 foot elevation. Constructed by the City of Tempe in the 1970's, the lake was built for park aesthetics and recreational fishing. This artificial lake has a natural dirt edge and an unsealed dirt bottom. Lake depths average 5 feet, with a maximum of 7 feet. Tempe's Evelyn Hallman Park, which was previously called Canal Park up to July 2007, has some improvements, including a restroom, armadas, and handicap accessibility.

Management of Water Body
Since 1987, Evelyn Hallman Pond has been managed as an intensively stocked put-and-take fishery to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 60). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 15,800 angler use days per year, an angler satisfaction rate of 81%, and a 15% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 60. Summary of historic Department fish stockings at Evelyn Hallman Pond.

Species	**Years**	**Number of Stockings**	**Number Stocked**
Rainbow trout	1987-2008	189	20,370
Channel catfish	1987-2008	252	35,700
Bluegill/Hybrid sunfish	1987-2008	42	20,580
Largemouth bass	1987-2008	11	4,200
Total		494	80,850

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 5,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major

fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Evelyn Hallman Pond is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with SRP water, gravity fed through a pipeline and ditch. There are no pumps to pull water from the lake. Without a lined bottom, the lake bottom is semi-porous, allowing water to seep into the aquifer.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. Movement up through the ditch and irrigation head gates is impossible. There is no lake outflow or means of pumping water from the lake.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, white amur, common carp, tilapia, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Kiwanis Lake

Site Description
Kiwanis Lake is a 13-acre lake located at Kiwanis Park at Mill Avenue and Baseline Road in Tempe, at 1190 foot elevation (Figure 65). Constructed by the City of Tempe in the 1970's, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 5 feet, with a maximum of 8 feet. Tempe's popular Kiwanis Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, soccer fields, a paddle boat concession, a children's playground, and a boat ramp.

Figure 65. Photo of Kiwanis Lake.

Management of Water Body

Since 1984, Kiwanis Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 61). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 37,300 angler use days per year, an angler satisfaction rate of 77%, and a 27% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 61. Summary of historic Department fish stockings at Kiwanis Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1984-2008	216	126,720

Channel catfish	1979-2008	289	178,916
Bluegill/Hybrid sunfish	1989-2008	50	47,788
Largemouth bass	1984-2008	12	10,992
Total		567	364,416

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 25,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 2,000.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Kiwanis Lake is a closed system; it has no drainage inflow and no spillway or outflow. The lake is supplied with SRP water, gravity fed through a buried pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. Movement up through the pipeline and irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, largemouth bass, common carp, tilapia, flathead catfish, white amur, black crappie, and yellow bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Red Mountain Lake

Site Description

Red Mountain Lake is an 8-acre lake located at Brown Avenue and Sun Valley Boulevard in Mesa, at 1505 foot elevation (Figure 66). Constructed by the City of Mesa in the 1995, the lake was built for park aesthetics, recreational fishing, groundwater recharge, and for use in watering park landscape. This artificial lake has an unsealed bottom and a concrete perimeter edge. Lake depths average 12 feet, with a maximum of 17 feet. Mesa's popular Red Mountain Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, ball fields, a children's playground, and a multigenerational recreation center.

Figure 66. Photo of Red Mountain Lake.

Management of Water Body

Since 1995, Red Mountain Lake has been managed as an intensively stocked put-and-take fishery to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 62). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 40,600 angler use days per year, an angler satisfaction rate of 77%, and a 31% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 62. Summary of historic Department fish stockings at Red Mountain Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1995-2008	123	47,647
Channel catfish	1995-2008	156	72,332
Bluegill/Hybrid sunfish	1995-2008	28	20,036
Largemouth bass	1995-2008	8	4,588
Total		315	144,603

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 16,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 1,200.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity

Red Mountain Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with Central Arizona Project (CAP) water,

gravity fed through a 0.7 mile buried pipeline that originates at the Mesa Water Treatment facility. CAP water from the facility passes through a grinder box device that allows for no movement potential of live fish to Red Mountain. Pumps pull water from the lake to irrigate surrounding park turf grass and soccer fields. A significant amount of water percolates into the aquifer.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, common carp, white amur, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in CAP canals that provide water to this lake.

Rio Vista Pond

Site Description
Rio Vista Pond is a 2.7-acre pond located at Rio Vista Park on Rio Vista Boulevard north of Thunderbird Road in Peoria, at 1165 foot elevation (Figure 67). Constructed by the City of Peoria in 2004, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 7 feet, with a maximum of 13 feet. Peoria's popular Rio Vista Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, skate park, ball fields, splash play area, a children's playground, and multigenerational recreation center.

Figure 67. Photo of Rio Vista Lake.

Management of Water Body

Since 2004, Rio Vista Pond has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 63). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 23,600 angler use days per year, an angler satisfaction rate of 81%, and a 42% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 63. Summary of historic Department fish stockings at Rio Vista Pond.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	2004-2008	36	4,000

Channel catfish	2004-2008	48	7,512
Bluegill/Hybrid sunfish	2004-2008	8	3,332
Largemouth bass	2004-2008	2	516
Total		94	15,360

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 5,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Rio Vista Pond is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with SRP water, gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this pond. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, white amur, common carp, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Riverview Lake

Site Description

Riverview Lake is a 3.3-acre lake located at Riverview Park at 8th Street and Dobson Road in Mesa, at 1200 foot elevation (Figure 68). Constructed by the City of Mesa in the 1970's, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a shotcrete perimeter apron. Lake depths average 10 feet, with a maximum of 16 feet. Mesa's popular Riverview Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, ball fields, and a children's playground.

Figure 68. Photo of Riverview Lake.

Management of Water Body

Since 1987, Riverview Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 64). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 28,300 angler use days per year, an angler satisfaction rate of 82%, and a 31% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 64. Summary of historic Department fish stockings at Riverview Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	1987-2008	189	37,380
Channel catfish	1987-2008	252	65,961
Bluegill/Hybrid sunfish	1987-2008	42	18,795
Largemouth bass	1987-2008	11	4,116
Total		494	126,252

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 7,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 600.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity

Riverview Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with SRP water, gravity fed through a pipeline with two cascading water features. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the water features, buried pipelines, or irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, common carp, white amur, tilapia, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Bald Eagle

Riverside Breeding Area is approximately 1.6 miles from Riverview Lake and is within the Bald Eagle DPS. The eagles were first observed in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Riverside Breeding Area productivity data shows that the nest failed with two nestlings found dead in the nest in 2009 (McCarty and Jacobson 2009). It is unknown if Riverview Lake has monofilament bins present.

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Steele Indian School Pond

Site Description
Steele Indian School Pond is a 2.5-acre lake located at Steele Indian School Park at 3rd Street and Indian School Road in Phoenix, at 1120 foot elevation. Constructed by the City of Phoenix in 2003, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 8 feet, with a maximum of 12 feet. Phoenix's popular Steele Indian School Park has a variety of improvements including restrooms, ramadas, plazas, picnic tables, lighting, handicap accessibility, historical buildings, memorials and peace gardens, and a children's playground.

Management of Water Body
Since 2005, Steele Indian School Pond has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 65). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 13,900 angler use days per year, an angler satisfaction rate of 83%, and a 31% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 65. Summary of historic Department fish stockings at Steele Indian School Pond.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	2005-2008	27	2,523
Channel catfish	2005-2008	36	5,559
Bluegill/Hybrid sunfish	2005-2008	6	2,724
Largemouth bass	2005-2008	2	498
Total		71	11,304

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 5,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity

Steele Indian School Pond is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with SRP water, gravity fed through a pipeline and ditch. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, white amur, threadfin shad, largemouth bass, and tilapia as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Surprise Lake

Site Description
Surprise Lake is a 5-acre lake located at the Surprise Recreation Campus on Bullard Avenue south of Bell Road in Surprise, at 1215 foot elevation. Constructed by the City of Surprise in 2003, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape and sports fields. This artificial lake has a sealed bottom and a gently sloping dirt/gravel shoreline. Lake depths average 8 feet, with a maximum of 12 feet. Surprise's popular Surprise Recreation Campus has a wide variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a library, a children's playground, municipal pool and aquatic center, dog runs, and a large spring training baseball facility.

Management of Water Body
Since 2003, Surprise Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 66). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Creel survey results from 2005 found 35,600 angler use days per year, an angler satisfaction rate of 86%, and a 35% youth participation rate.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 66. Summary of historic Department fish stockings at Surprise Lake.

Species	Years	Number of Stockings	Number Stocked

Rainbow trout	2003-2008	45	12,800
Channel catfish	2003-2008	60	18,385
Bluegill/Hybrid sunfish	2003-2008	10	6,990
Largemouth bass	2003-2008	3	1,045
Total		118	39,220

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 10,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 800.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Surprise Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with either Maricopa Water District water, gravity fed through a pipeline, or from groundwater. Pumps pull water from the lake to irrigate surrounding park turf grass and a large sports field complex.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, tilapia, white amur, and largemouth bass as being present.

See Phoenix Metro Urban Lakes Complex Analysis for community description in Maricopa Water District canals that provide water to this lake.

Veterans Oasis Lake

Site Description

Veterans Oasis Lake is a 5-acre lake located at Veterans Oasis Park at Lindsay Road and Chandler Heights Road in Chandler, at elevation 1275. Constructed by the City of Chandler in 2007, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a perimeter edge of concrete and shallow dirt. Lake depths average 12 feet, with a maximum of 14 feet. Chandler's Veterans Oasis Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, an environmental center, and watchable wildlife areas.

Management of Water Body

Since 2008, Veterans Oasis Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 67). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 67. Summary of historic Department fish stockings at Veterans Oasis Lake.

Species	Years	Number of Stockings	Number Stocked
Rainbow trout	2008	4	1,005
Channel catfish	2008	4	1,090
Bluegill/Hybrid sunfish	2008	2	6,350
Largemouth bass	2008	1	600
Total		11	9,045

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 10,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 1,000.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Veterans Oasis Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with pumped groundwater. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD has stocked rainbow trout seasonally, channel catfish, bluegill, redear sunfish, hybrid sunfish, tilapia, and largemouth bass. White amur have been stocked by the City of Chandler for aquatic weed control.

Water Ranch Lake

Site Description
Water Ranch Lake is a 5-acre lake located at Gilbert's Riparian Preserve at Greenfield Road and Guadalupe Road in Gilbert, at 1275 foot elevation. Constructed by the City of Gilbert in 1999, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a perimeter edge of concrete and shallow dirt. Lake depths average 12 feet, with a maximum of 17 feet. Gilbert's Riparian Preserve at Water Ranch Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a library, children's playground, and extensive watchable wildlife areas.

Management of Water Body

Since 1999, Water Ranch Lake has been managed as an intensively stocked put-and-take fishery, to provide year round high-use urban fishing opportunities for anglers of all ages and abilities (Table 68). Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur.

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 68. Summary of historic Department fish stockings at Water Ranch Lake.

Species	**Years**	**Number of Stockings**	**Number Stocked**
Rainbow trout	1999-2008	81	21,303
Channel catfish	1999-2008	108	23,400
Bluegill/Hybrid sunfish	1999-2008	19	17,987
Largemouth bass	1999-2008	5	3,105
Total		213	65,795

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 10,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 1,000.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation to restore a depleted fishery, to recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for

this purpose will be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines (sections 3.2.3).

Water Distribution/Connectivity
Water Ranch Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with pumped groundwater. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Movement up through the irrigation head gates is impossible. There is no lake outflow. Water pumped from the lake has screened intakes and feeds the turf sprinkler systems.

Community Description
AGFD records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, bluegill, redear sunfish, hybrid sunfish, tilapia, white amur, and largemouth bass are present.

Bonsall Park Lake

Site Description
Bonsall Lake is located at Bonsall Park on 59th Avenue and Bethany Home Road in Glendale (Figure 69). This 2-acre lake is part of the Glendale Parks system. Constructed by the City of Glendale in the 1960's and completely renovated in 2001, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 6 feet with a maximum of 11 feet. Bonsall Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, and handicap accessibility.

Figure 69. Photo of Bonsall Lake.

Management of Water Body

Bonsall Lake has been managed by the City of Glendale as a light-use recreational fishery, primarily for families, with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light to moderate.

Catchable catfish, rainbow trout, and bluegill are occasionally stocked by the City of Glendale for fishing derbies.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Bonsall Lake is a closed system; it has no drainage inflow and no outflow or spillway. The lake is supplied with Salt River Project water gravity fed through a pipeline. Pumps pull lake water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Largemouth bass, bluegill, and channel catfish have been observed from this lake. Other fish species are unknown.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Crossroads Park Lake

Site Description
Crossroads Lake is located at Crossroads Park at Knox Road and Greenfield Road in Gilbert (Figure 70). This 3-acre lake is part of the Gilbert Parks system. Constructed by the City of Gilbert in the 1990's, the lake was built for park aesthetics, recreational fishing, storage of reclaimed water, stormwater retention, and for use in watering park landscape. This artificial lake has a sealed bottom and both a dirt and concrete perimeter edge. Lake depths average 7 feet with a maximum of 12 feet. Crossroads Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a children's playground, and ball fields.

Figure 70. Photo of Crossroads Park Lake.

Management of Water Body

Crossroads Lake has been managed by the City of Gilbert as a light-use recreational fishery with a modest warm water fishery. The lake also serves a role for reclaimed water utilization, urban runoff storage, and flood control. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity
Crossroads Lake is considered a predominately closed system water body because it has a small urban watershed inflow and an overflow feature. The lake is entirely supplied and maintained with reclaimed water piped in from the nearby water treatment plant. Pumps pull water from the lake to irrigate surrounding park turf grass.

Overflow events are rare and tend to occur only with extreme rainfall events of a 5-year flood magnitude. Water leaving the lake passes over a spillway down a short ephemeral drainage of 0.2 miles, and then empties into a municipal storm drain. The route of the underground storm drain has not been researched. It likely empties into a dry drainage to the south where it would eventually empty into the ephemeral Gila River approximately 20 miles to the south southwest.

Fish Movement
At infrequent intervals, Crossroads Lake can overflow and spill into a small drainage where there is a limited chance of stocked fish or their progeny escaping. Any escaped fish would travel the same pathway described in the water connectivity section until reaching the ephemeral Gila River a few miles upriver of the Interstate 10 crossing. No sampling has been done, or records found, to determine if fish have spilled out of Crossroads Lake.

Community Description
Largemouth bass, bluegill, tilapia, common carp, and threadfin shad have been observed from this lake. Other fish species are unknown.

Discovery District Park Lakes
Site Description
The Discovery Lakes are located at Discovery District Park on Santan Village Parkway and Pecos Road in Gilbert. These 1.5 and 0.6-acre lakes are part of the Gilbert Parks system. Constructed by the City of Gilbert in 2007, the lakes were built for park aesthetics, recreational fishing, and for use in watering park landscape. These artificial lakes have sealed bottoms and a concrete perimeter edge. Lake depths average 5 feet with a maximum of 10 feet. Discovery District Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, ball fields, and ball courts.

Management of Water Body
Discovery District Lakes have been managed by the City of Gilbert as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light to moderate.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
The Discovery Park Lakes are considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement

There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Largemouth bass, bluegill, redear sunfish, and tilapia have been observed from this lake. Other fish species are unknown.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Freestone Park Lakes

Site Description

The Freestone Lakes are located at Freestone Park on Juniper Avenue and Lindsay Road in Gilbert. These 1.5 and 1.7-acre lakes are part of the Gilbert Parks system. Constructed by the City of Gilbert in 1990, the lakes were built for park aesthetics, recreational fishing, storage of reclaimed water, and for use in watering park landscape. These artificial lakes have sealed bottoms and a concrete perimeter edge. Lake depths average 7 feet with a maximum of 12 feet. Freestone Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a children's playground, ball fields, ball courts, and a train depot for children.

Management of Water Body

These lakes were in the Urban Fishing Program for a brief period in early 1990, but high and persistent pH levels due to the reclaimed water were not compatible with regular fish stockings, and the lake was withdrawn from the program. Freestone Lake has been managed by the City of Gilbert as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for these lakes that reduces the harvest of trout and catfish. Angling use is light.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity

The Freestone Park Lakes (north and south) are considered a closed system water body because they have no drainage inflow and no outflow or spillway. The lakes are entirely supplied with

reclaimed water from the nearby water treatment plant. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Channel catfish, bluegill, largemouth bass, carp, and tilapia have been observed from this lake.

Granada Park Lakes

Site Description
The Granada Lakes are located at Granada Park on 20th Street and Maryland Road in Phoenix. These 1.0 and 1.2 acre lakes are part of the Phoenix Parks system. Constructed by the City of Phoenix in the 1970's, the lakes were built for park aesthetics, recreational fishing, and for use in watering park landscape. The artificial lakes have a sealed bottom and a concrete perimeter edge/apron. Lake depths average 4 feet with a maximum of 8 feet. Granada Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, and tennis courts.

Management of Water Body
Granada Lake has been managed by the City of Phoenix as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for these lakes that reduces the harvest of trout and catfish. Angling use is light to moderate.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
The two small, interconnected Granada Lakes are considered a closed system water body because they have no drainage inflow and no outflow or spillway. The lakes are supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Channel catfish, bluegill, redear sunfish, hybrid sunfish, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake. Other fish species are unknown.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

McQueen Park Lake

Site Description
Located at McQueen Park on McQueen Park Road and McQueen Road in Gilbert, this 1.4-acre lake is part of the Gilbert Parks system. Constructed by the City of Gilbert in 2007, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 5 feet with a maximum of 10 feet. McQueen Park has a limited number of improvements including restrooms, ramadas, picnic tables, lighting, and handicap accessibility.

Management of Water Body
McQueen Lake has been managed by the City of Gilbert as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
McQueen Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Channel catfish, bluegill, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Pacana Park Lake

Site Description
Pacana Lake is located at Pacana Park on Honeycut Road and Porter Road in Maricopa. This 3-acre lake is part of the Town of Maricopa Parks system. Constructed by the Town of Maricopa in 2006, the lake was built for park aesthetics, recreational fishing, storage of reclaimed water, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 7 feet with a maximum of 12 feet. Pacana Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a children's playground, and ball fields.

Management of Water Body
Pacana Lake has been managed by the Town of Maricopa as a light-use recreational fishery with a modest warm water fishery. Angling use is moderate. Catchable catfish are occasionally stocked by the Town of Maricopa for fishing derbies.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
Pacana Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is entirely supplied with reclaimed water from the nearby water treatment plant. Pumps pull water from the lake to irrigate surrounding park turf grass and deliver water to nearby housing developments.

Fish Movement
There is no opportunity for fish to leave this lake. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Channel catfish, bluegill, largemouth bass, carp, and tilapia have been observed from this lake. Other fish species are unknown.

<u>Roadrunner Park Lake</u>
Site Description
Located at Roadrunner Park on 34th Street and Cactus Road in Phoenix, this 1.6-acre lake is part of the Phoenix Parks system. Constructed by the City of Phoenix in the 1960's, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. The artificial lake has a sealed bottom and a concrete perimeter edge/apron. Lake depths average 4 feet with a maximum of 8 feet. Roadrunner Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a children's playground, ball fields, tennis courts, and swimming pool.

Management of Water Body
Roadrunner Lake has been managed by the City of Phoenix as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is moderate. Catchable catfish, rainbow trout and bluegill have occasionally been stocked by the City of Phoenix, and other sponsors, for fishing derbies.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
Roadrunner Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Channel catfish, bluegill, redear sunfish, hybrid sunfish, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Selleh Park Lake

Site Description

Selleh Lake is located at East Concordia Drive east of McClintock Drive in Tempe. This 1.5-acre lake is part of the Tempe Parks system. Constructed by the City of Tempe in the 1970's, the lake was built for park aesthetics, recreational fishing, and for use in watering park landscape. The artificial lake has a sealed bottom and a concrete perimeter edge/apron. Lake depths average 4 feet with a maximum of 8 feet. Selleh Park has a variety of improvements including restrooms, picnic tables, lighting, handicap accessibility, a children's playground, and ball court.

Management of Water Body

Selleh Lake has been managed by the City of Tempe as a light-use recreational fishery with a modest warm water fishery. Special regulations are in place for this lake that reduces the harvest of trout and catfish. Angling use is light.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution/Connectivity

Selleh Lake is a closed system water body since it has no drainage inflow and no outflow or spillway. The lake is supplied with Salt River Project water gravity fed through a pipeline. Pumps pull water from the lake to irrigate surrounding park turf grass.

Fish Movement

There is no opportunity for fish to leave this lake. Fish from the lake cannot go back up the pipeline. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Channel catfish, bluegill, largemouth bass, carp, threadfin shad and tilapia have been observed from this lake.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

Water Treatment Lake

Site Description
Water Treatment Lake is located south of Marigold and College Avenue in Tempe. This 1-acre lake is currently under renovation within the City of Tempe Water Treatment Plant and has been closed to public access. By 2010, the City of Tempe plans to modify access to this pond and allow public access. Constructed by the City of Tempe in the 1980s, the lake was built as a storage reservoir as part of the Water Treatment Plant complex. The artificial lake has a sealed dirt bottom and a dirt shoreline. Lake depths average four feet with a maximum of eight feet.

Management of Water Body
Located in the City of Tempe's Water Treatment Plant and not open to the public, there are no current improvements. The City plans to include restrooms, picnic tables, lighting, and handicap accessibility to the recreation site before it opens to public use. There is no current angling use of this lake. The City plans to create a recreational area at the pond and manage for a light-use recreational fishery with a modest warm water fishery. Once opened, special regulations that apply to all public fishing waters in the City of Tempe would apply to this park water reducing the harvest of trout and catfish.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (subcatchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, subcatchables, catchables), bluegill (fry/fingerlings, subcatchables, catchables), and redear sunfish (fry/fingerlings, subcatchables, catchables) may be stocked on an as-needed basis at any time during the period covered by this consultation, to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or construction events that require draining the lake. Numbers of fish stocked for this

purpose would be determined according to stocking guidelines identified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
Water Treatment Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lake is supplied with SRP water gravity fed through a pipeline and water that is processed through the Tempe Water Treatment facility.

Fish Movement
There is no opportunity for fish to leave this lake. There is no lake outflow.

Community Description
Bluegill, largemouth bass, carp, threadfin shad, and tilapia have been observed from this lake.

See Phoenix Metro Urban Lakes Complex Analysis for community description in SRP canals that provide water to this lake.

CLOSED SYSTEM PHOENIX METRO AREA LAKES ANALYSIS
Water distribution and connectivity, fish movement and community descriptions were discussed for the 14 closed system Urban Fishing Program (UFP) waters and the 10 Fishing in the Neighborhood (FIN) waters. Impacts to sensitive species (roundtail chub) in the Phoenix Metro complex are also discussed below, comprehensively in combination with all potential connected populations of these sensitive species.

Water Distribution/Connectivity
Eighteen of the 24 closed system Phoenix UFP lakes and FIN lakes are supplied with water from the SRP Canal system. SRP's 131-mile main canal system is supplied with water from the Salt and Verde River watersheds. There are no outlets from these closed systems.

Fish Movement
SRP Canals - The SRP canals have a series of variously sized grates and barriers that limit or restrict upstream and downstream fish movements. It is possible for a small fish to move through the system and access the lakes, although this is thought to be unlikely because… Gated outflow structures along the canals are used to supply water to each of the lakes through buried pipelines. These systems of gravity-fed pipelines create a distinct fish barrier in the lakes, precluding fish from the lakes from entering the pipelines and moving into the canals.

Community Description
SRP Canals - The fish species assemblage within the canals is the most diverse of any waterbody in the state. This is due to waters running through the communities of the metropolitan Phoenix area that collect runoff from literally hundreds of public and private waterbodies that contain a wide array of fish assemblages. Further, the proximity of the canals to millions of urban residents offers the public an easy opportunity to illegally stock fish, or transfer fish from aquariums or

ponds. Canal species documented in the past include longfin dace, yellow bullhead, goldfish, desert sucker, Sonora sucker, hybrid sucker, grass carp (white amur), common carp, red shiner, threadfin shad, mosquitofish, roundtail chub, channel catfish, green sunfish, redear sunfish, smallmouth bass, largemouth bass, yellow perch, yellow bass, striped bass, rainbow trout, fathead minnow, sailfin molly, shortfin molly, blue tilapia, black crappie, flathead catfish, walleye, Mozambique tilapia, redbelly tilapia (LCRB Aquatic GAP; Table 50).

Wright and Sorensen (1995) found the presence of 20 fish species, 3 native and 17 nonnatives, in the SRP canals. The three native fish are the desert sucker, Sonora sucker, and roundtail chub. Nonnative species, in order of abundance are: threadfin shad, red shiner, white amur, largemouth bass, yellow bass, channel catfish, yellow bullhead, mosquitofish, common carp, bluegill, seasonal rainbow trout, goldfish, green sunfish, smallmouth bass, oscar, walleye, and flathead catfish. This species assemblage is almost identical, with a few nonnative fish differences, to those found by Marsh and Kesner (2008) in 2007. They found two tilapia species (blue and redbelly), redear sunfish, and striped bass, but did not capture mosquitofish, yellow bass, or walleye.

Consultation Species or Critical Habitat

Roundtail Chub

The nearest roundtail chub occurring within this stocking area are located in the Lower Salt River, Lower Verde River and the SRP Canal system below Granite Reef Dam. Phoenix Metro closed system UFP and FIN lakes have no hydrological connection to the sub-watershed and fish stocked into the lakes have no access to roundtail chub habitat. Roundtail chub in the canal could enter the lake(s) through the inflow if they are small enough to pass the 2-inch white amur grating. The existing data suggest that this may be a rare occurrence, since no roundtail chub have been found to date in UFP waters, and the number of roundtail chub in the canal system is small (Marsh and Kesner 2008). Over 20 years ago there were a couple of recalled incidences of Sonoran and desert suckers occurring in two UFP lakes fed by the SRP Arizona Canal, which suggests the potential for fish in the canals to enter UFP waters. However, ever since the white amur grating was installed throughout the SRP canal system (circa 1985-1988), there have been no reported findings or observations of suckers in any of the 13 UFP lakes supplied with SRP water.

Roundtail chub that are small enough to enter the lake(s) through the 2-inch grating are subject to predation by other nonnative fish resident in the canals. However, should they reach the proposed stocking waters, the individual roundtail chub would be trapped in the water body, unable to leave and rejoin the Salt and Verde River populations, only to be eaten by stocked fish species or their progeny in the lake, or captured by anglers, since roundtail chub are a legal sport fish in Arizona.

Movement of fish species out of the lake and back into the canals or, more importantly, the riverine habitats of the lower Salt and Verde Rivers cannot occur from these closed stocking sites.

Potential Impacts

No potential impacts are anticipated on the roundtail chub due to the lack of connectivity of these closed system stocking locations to chub habitat in the Lower Salt and Verde Rivers.

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Chapter 9 VERDE RIVER WATERSHED

Physical geographic description

Drainage area

The Verde River watershed (Figure 1) is located in north-central Arizona and drains an area of approximately 6623 square miles. The area includes the 2,153 square miles of the Big Chino watershed that drains into the Verde River mainstem above Sullivan Dam. The river flows eastward from Sullivan Dam to Perkinsville, then heads southeastward to its confluence with Fossil Creek, where it continues southward until its joins the Salt River (ADWR 2003). Perennial sections of the mainstem Verde River are divided up into three reaches for this consultation. The Upper Verde is defined as that part of the watershed above and including Sullivan Dam to the mouth of Sycamore Creek; the Middle Verde is defined as the mouth of Sycamore Creek to Childs Power Plant; and the Lower Verde is defined as Childs Power Plant to Horseshoe Lake Dam, and includes Horseshoe Lake.

The Verde River is intermittent immediately below Sullivan Dam and begins flowing at the upstream end of Stillman Lake, about 1mile downstream of the dam. Perennial flow extends approximately 140 miles from this area to its confluence with the Salt River just east of Phoenix. Within the Middle reach, numerous agriculture diversions exist. The Pecks Lake Diversion, also called the TAPCO Diversion Dam, near the community of TAPCO is a significant diversion owned by the Freeport McMoran Corporation located in the vicinity of Clarkdale. The Department conducted research from 1994 to 1996 and determined that it was an effective barrier to upstream trout movement (Kubacki 1998). Other diversion dams exist in the Middle reach, providing water for the following ditch systems: Cottonwood, Woods, Ok and Eureka.

Range of Elevations

Elevations in the watershed range from 7,400 feet at Mount Floyd in Big Chino Wash; 7,273 feet at Hide Mountain in Williamson Valley Wash; 4,366 at Sullivan Dam; 3,868 at Perkinsville; 3,449 at Peck Diversion; and down to 1300 feet at the Salt River Confluence.

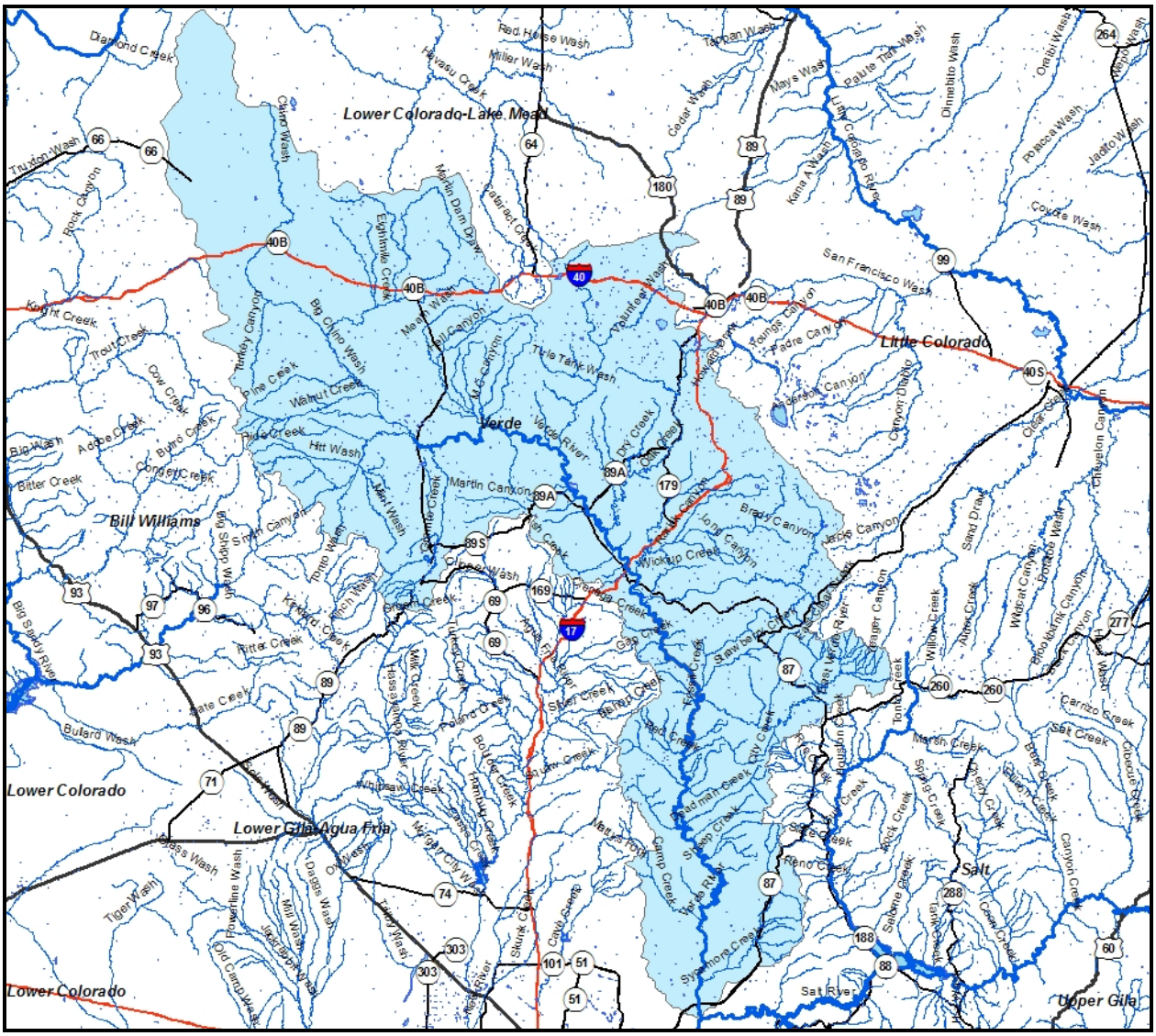

Figure 1. Verde River Watershed.

Tributaries

Several major perennial tributaries drain the area north and east of the Verde River and flow in a southwesterly direction. Groundwater discharge maintains perennial flow in these tributaries and in the Verde River mainstem. The largest of the perennial stream reaches in the Verde River watershed are listed in Table 1 (ADWR 2003). Other tributaries in the watershed not listed below have less than 2 miles of perennial water. Most are intermittent or ephemeral.

Table 1. Selected significant perennial stream reaches in the Verde River watershed upstream of Horseshoe Lake.

Reach	**Length (mi)**
Sycamore Creek (North of Cottonwood)	2
Oak Creek	33
Wet Beaver Creek	20
West Clear Creek	37
Fossil Creek	9
East Verde River	40

Vegetation

Extensive reaches of riparian vegetation are found along the Verde and several tributary streams, composed mainly of mixed broadleaf, cottonwood/willow, mesquite, and strand vegetation. Conifer and oak riparian habitat is found within the higher elevation areas of West Clear Creek and the East Verde River (ADWR 2007).

Twenty four stocking locations are proposed for the Verde watershed. These include tanks at Garrett, Presley, Elk, Perkins, Middle, Scholze, JD Dam, Stone Dam and Huffer; lakes at Granite Basin, White Horse, Mingus, Deadhorse, Stoneman, Watson, Willow, Goldwater; and stream reaches at Middle Verde, Wet Beaver Creek, Oak and West Fork of Oak Creek, West Clear Creek, Dude Creek, and East Verde River. Proposed stocking actions in the watershed will be evaluated as three reaches, the Upper Verde, which consists of the Big Chino Wash complex, Granite Creek Complex, and Sycamore Creek Complex for a total of 13 stocking sites; Middle Verde at 8 stocking sites; and the Lower Verde at 3 stocking sites. Of these, proposed stocking regime changes are at 19 of the locations, and additionally, we propose three new locations for stocking.

UPPER VERDE RIVER SUB-WATERSHED

Physical geographic description

Drainage Area

The Upper Verde Watershed contains 14 proposed stocking locations. These locations form three distinct groups; Big Chino Wash including Garrett, Shucking, Presley, Stone Dam and Granite Basin Lake; Granite Creek including Watson, Willow Creek, and Goldwater; and Sycamore Creek at Scholz, White Horse, Elk, Middle, JD Dam, and Perkins. One major and several minor

diversion dams exist in the Upper Verde River. The Peck's Lake diversion (Figure 2) is located upstream of Clarkdale and also may be known as the TAPCO diversion. This diversion dam forms the downstream extent of what is herein considered the Upper Verde Watershed.

Figure 2. Photo of Pecks Lake Diversion circa 2001.

Range of elevations

Elevations in the watershed range from over 7,600 feet near Mingus Mountain down to approximately 3,300 feet at the Pecks Lake diversion Dam.

Tributaries

The significant tributaries in this sub-watershed are the Big Chino Wash including Williamson Valley Wash, Granite Creek, Sycamore Creek and Hell Canyon. The Big Chino and Granite Creek flow into the Upper Verde at the upstream end of the reach near Sullivan Dam, and Sycamore Creek flows into the Upper Verde, and defines the downstream end of the Upper Verde reach.

BIG CHINO WASH COMPLEX

Physical Geographic Description

Drainage area and elevations

Big Chino Wash drains a surface area of 2,153 square miles, nearly one third of the entire Verde River Watershed. Elevations range from a high of over 7,000 feet near Granite Basin Lake down to about 4,366 feet above sea level at Sullivan Dam (Figure 3). The significant tributaries in the Big Chino Complex are intermittent Partridge Creek, intermittent Big Chino Wash, and Williamson Valley Wash, which is interrupted perennial and ephemeral.

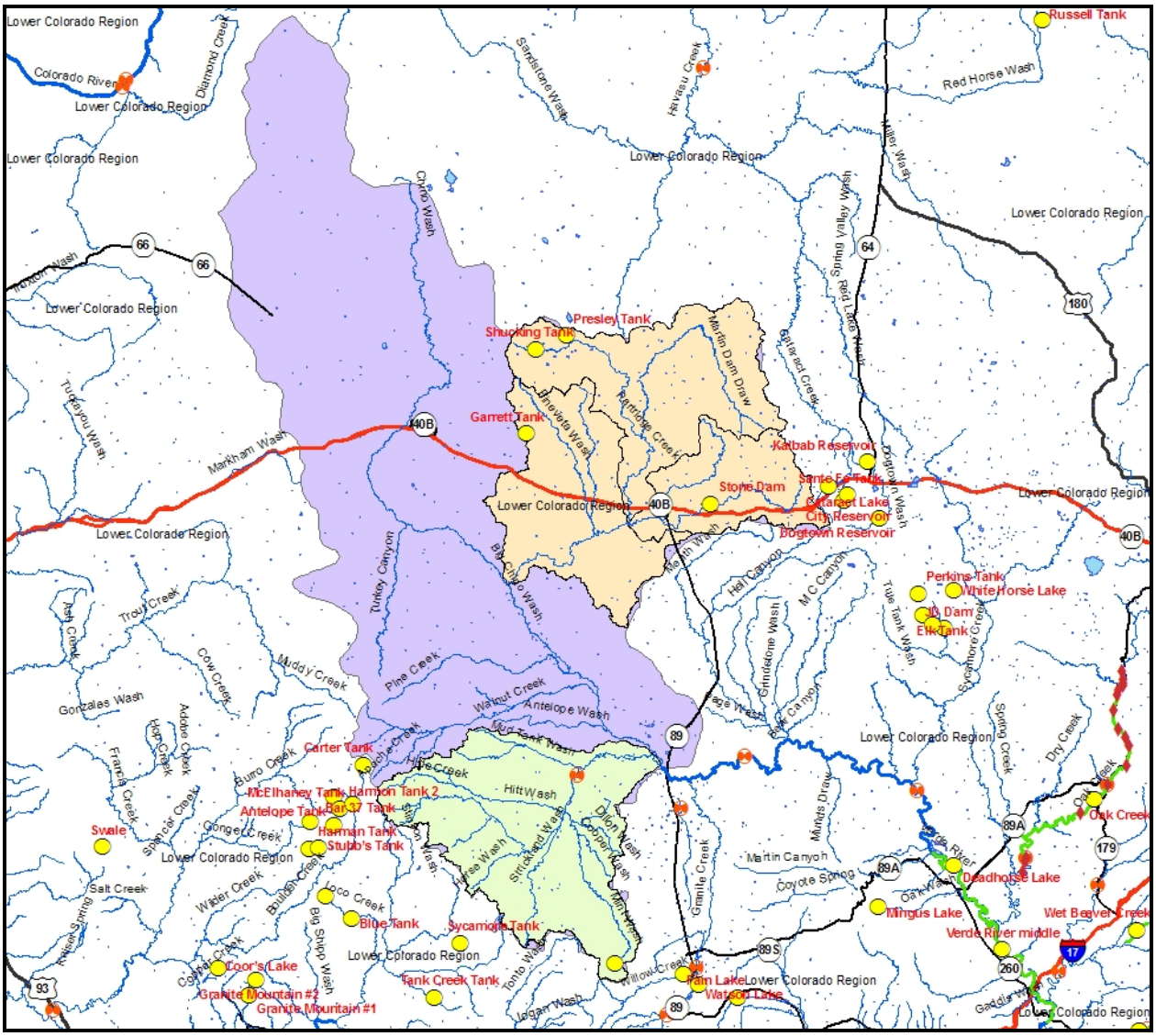

Figure 3. Big Chino Wash drainage overview indicating the partridge Creek, Big Chino and Williamson Valley was sub-drainages.

There were two USGS stream gauges in the watershed, 09502800 Williamson Valley Wash near Paulden, and 09502750 Walnut Creek near Ashfork; the Walnut Creek gage only operated for one year, between August 1991 and September 1992. The Williamson Valley Wash gauge is located approximately 12.5 miles upstream from its confluence with Big Chino Wash. The gauge measures runoff from a 255 square mile area and is located as 4,455 feet above sea level. Daily gauge discharge data are available from 1965 to 2009, and daily precipitation data are available from 2002 to 2009 (Figure 4 and Figure 5).

Big Chino Wash only flows in response to broad-scale precipitation events and spring-runoff in years of normal to above normal snowfall in the watershed. Many flood events in the desert southwest can by characterized as “local”. A local event can be heavy rain or snow water equivalent occurring in a relatively small area of a watershed. USGS gauge 09503700 near Paulden is the first gauge in the Verde River main stem. From this gauge, precipitation event magnitudes can be extrapolated for widespread non-local events. For this to be done on local tributary events such as the Big Chino, one must use other gauges and tools. Major tributaries to the upper Verde include Williamson Valley Wash, Big Chino Wash, Walnut Creek, and Granite Creek. USGS gauge 09502800 is situated just above the mouth of Williamson Valley Wash near Paulden. A gauge was installed in 1999 just downstream of Watson Lake on Granite Creek (USGS 09503300). Rainfall and snow water equivalent records are another way to look at possible “local” events. Records are kept for Prescott (upper Granite Creek), Seligman (Big Chino Wash), and a site on Walnut Creek. With these data sources, it is possible to look at precipitation events in tributaries and make assumptions about periodicity, location and magnitude.

Small headwater channels of a drainage network are important in determining the amount of sediment transported downstream during storm events. This increased sediment load can have negative effects on channel stability, fish, invertebrates, and overall stream productivity. High sediment loads can often result in fish mortality as a result of decreased dissolved oxygen concentrations, concurrent with increased suspended sediments (Bozek and Young 1994; Waters 1995; Rinne and Carter 2008). Fine clay sediments transported with runoff often prohibit fish survival in pools following runoff events.

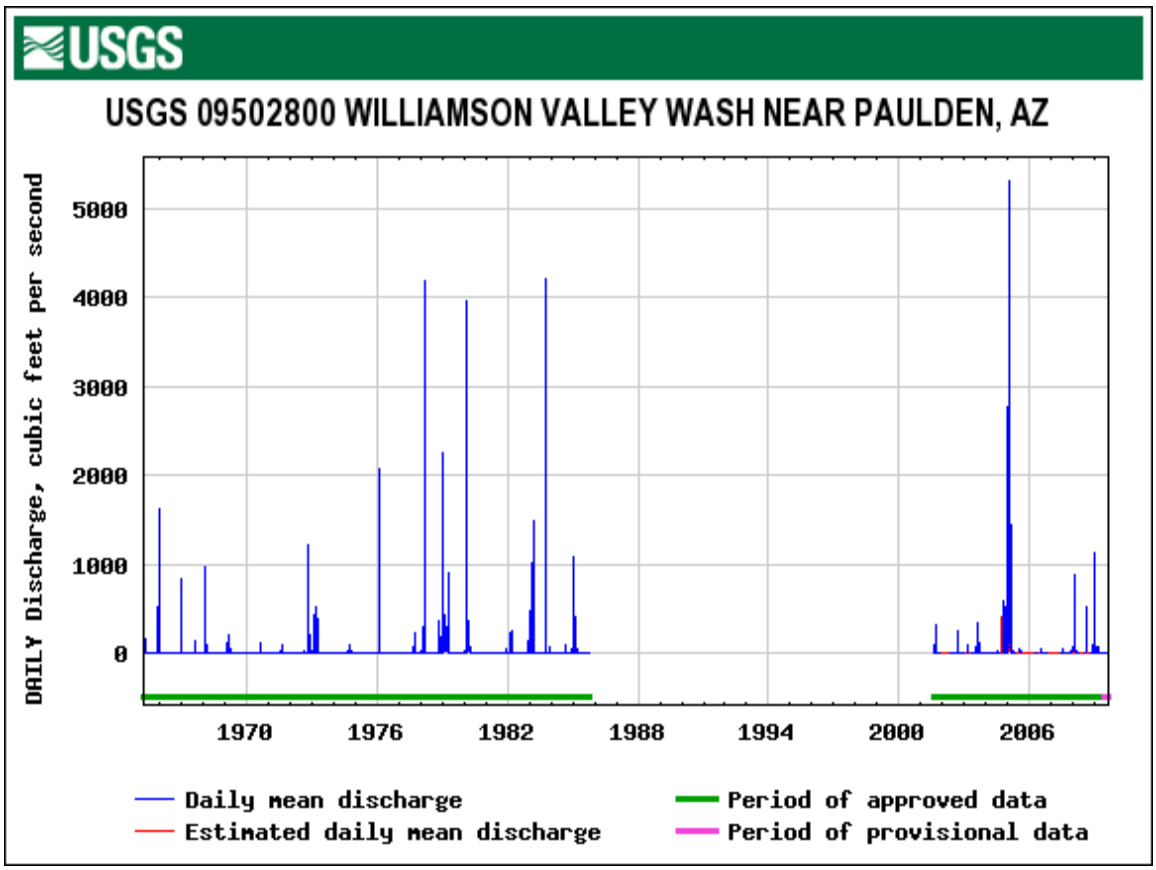

Figure 4. USGS Daily gauge discharge at Williamson Valley Wash near Paulden, Arizona 1965 – 2009.

The Big Chino Complex contains five proposed stocking locations: Garrett, Shucking and Presley tanks, Stone Dam and Granite Basin Lake. These locations are contained within two distinct tributaries, Partridge Creek and Williamson Valley Wash. The Big Chino Wash originates east of the Aubrey Cliffs area northwest of Seligman. Big Chino Wash flows southeast to Paulden during spring-runoff in years of normal to above normal snowfall in the watershed or in response to heavy broad-scale precipitation events; otherwise it is dry.

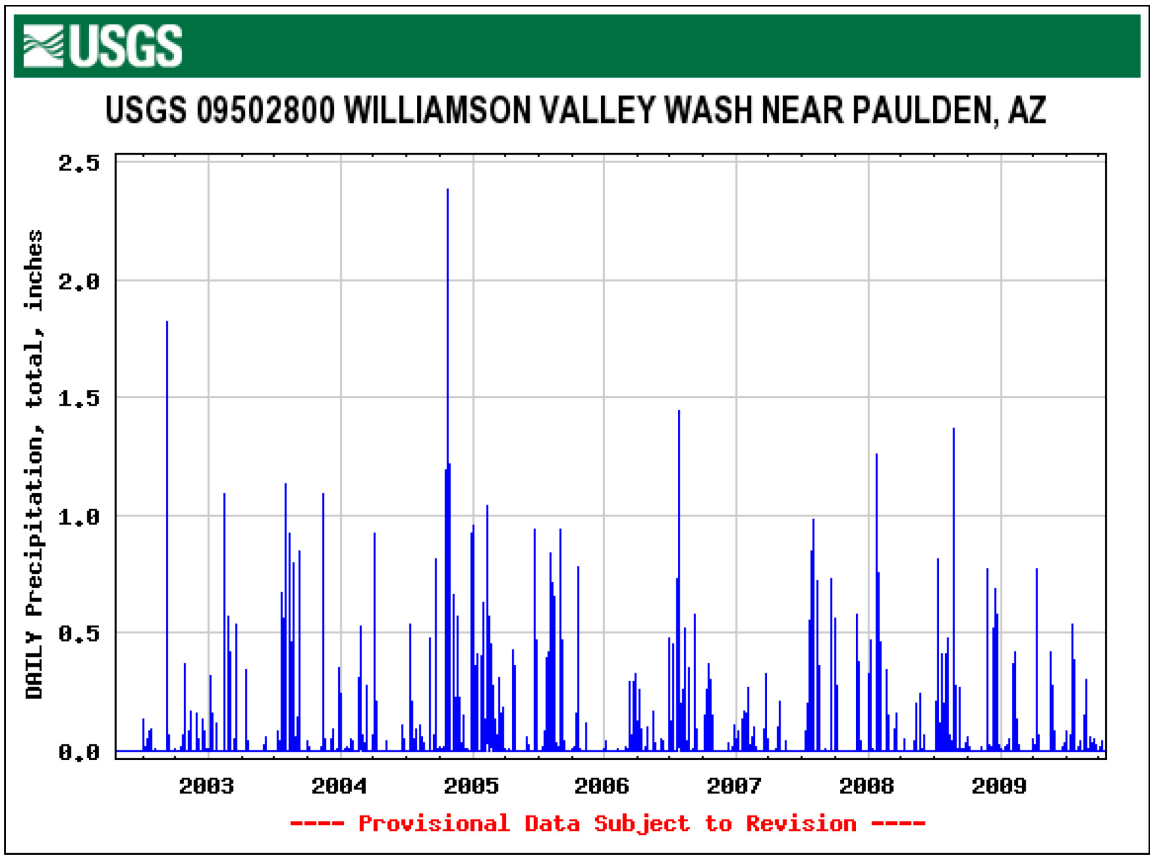

Figure 5. USGS Daily gauge precipitation at Williamson Valley Wash near Paulden, Arizona 2002 – 2009.

Garrett Tank

Site Description

Garrett Tank is a 1.5 acre impoundment located roughly 8 miles east of Seligman, on a small unnamed tributary to Pineveta Wash, which is a tributary to Partridge Wash, approximately 6 miles south of Mt. Floyd (Figure 6). This water is primarily used for livestock and is on private land surrounded by a checkerboard of State Trust Land and adjacent private sections. The tank is on the Diamond 7 Ranch, with access permission granted via a letter of support signed by the ranch in 1996. It is not known when the tank was created but it has provided fishing opportunities since at least the late 1970's. Garrett Tank can be accessed by 3 miles of dirt road from Route 66 near Seligman, and currently has no recreational facilities.

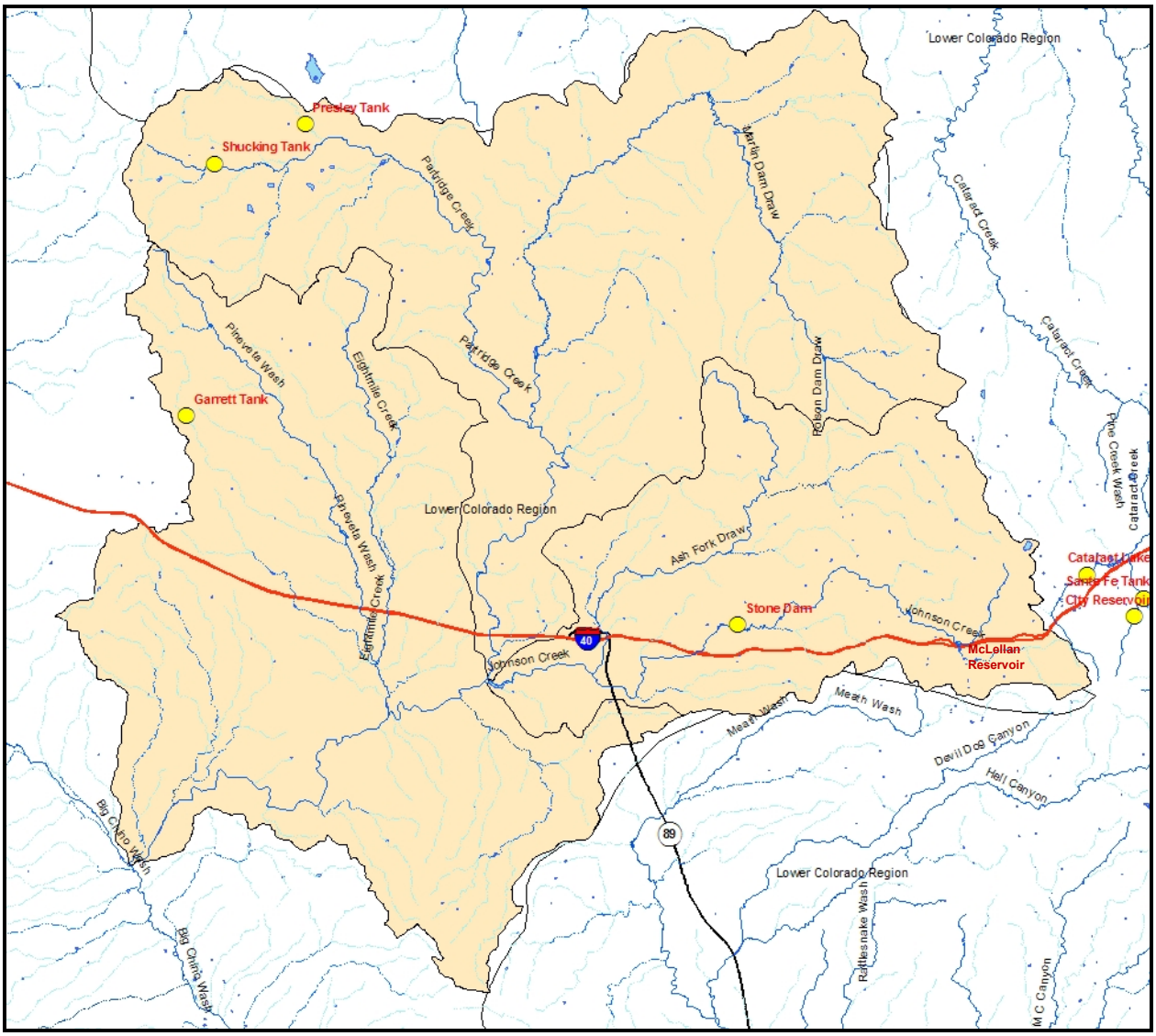

Figure 6. Partridge Creek drainage.

Management of Water Body

Garrett Tank is managed primarily as a warm water self-sustaining largemouth bass and bluegill fishery, and a put-and-take channel catfish and rainbow trout fishery. Since local recreational fishing opportunities are few in the area, the tank is utilized for angling retention and recruitment activities and the Department uses the tank during "National Fishing Week" and "Kiddy Fishing Derbies" in summer months. To increase angler success, catchable sized channel catfish have been stocked annually since 1996 for such events with approximately 200 catchable 2 pound (average size) channel catfish (Table 2).

No formal creel data have been gathered for Garrett Tank. Anecdotal information from Officer Tim Pender (Wildlife Manager for Game Management Unit 10) regarding fishing pressure at Garrett Tank indicates that fishing is typically by local residents of Seligman and Ash Fork. Fishing in Garrett Tank is highest after the catfish stockings for "Free Fishing Day". Rainbow trout are not expected to persist in Garrett Tank due to the high water temperatures in the summer, and would be considered a put-and take-fishery only. The channel catfish fishery will continue to be primarily a put-and-take fishery with some over wintering of individuals. Black crappie is a new species proposed for stocking in this water.

The Department conducts periodic sampling using hoop-nets or gill nets to monitor populations. Largemouth bass do not appear to grow to a quality size of 300 mm in Garrett Tank, and just barely reach a stock size of 200 mm (Gabelhouse 1984). While largemouth bass persist in Garrett Tank, they do not appear to be an important component in the fishery, and are not requested for additional stockings, as these resources are better utilized elsewhere.

Table 2. Stocking history of Garrett Tank 1979 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1987	1994	4	5,500
Channel catfish	1979	2009	17	5,942
Largemouth bass	1985	2000	2	1,402
Rainbow trout	1991	1998	4	4,467
Total			16	14,011

As with all the small ponds or cattle waters in the area, Garrett Tank evaporates periodically, to the point where warm water sport fish species may stunt or die. Future management would focus on providing stock sizes of channel catfish, black crappie, and bluegill for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire.

Proposed Action

The Department proposes to stock bluegill sunfish, black crappie, rainbow trout, and channel catfish for the period covered by this consultation.

Catchable and fingerling bluegill sunfish and black crappie stockings would occur in spring, summer, or fall, depending on stock availability and costs; numbers would not exceed 500 per acre for fingerlings and 50 per acre for catchables annually.

The Department proposes to stock catchable sized channel catfish and catchable sized rainbow trout. Rainbow trout and channel catfish stockings would be used to support angler retention and recruitment activities. Rainbow trout stocking would only occur in the winter months of December through March, in support of fishing workshops for area anglers. Catfish stockings would occur during the summer months of May through August. Numbers of catfish and trout stocked would not exceed 100 per acre of each species twice annually.

Water distribution/connectivity

Garrett Tank is located in the headwaters of the Partridge/Big Chino Wash drainage, upstream of the Verde River. It is separated from the Verde River by approximately 52 miles of ephemeral channel. The tank is primarily fed by spring snow melt. There are no other tanks upstream from Garrett Tank and rarely, the tank may catch runoff from localized thunderstorms. Garrett Tank has a fairly large capacity to hold water, and during most spring-runoff events the tank is able to retain most if not all flows. Figure 7 shows the tank and surrounding habitat.

Figure 7. Garret Tank and downstream drainage, July 2008.

If the tank fills to the point of spilling, water flows to the southwest down an access road roughly one-quarter mile before reaching an unnamed wash. From here the water continues 6.8 miles into Pineveta Wash, then 5.4 miles down Pineveta Wash, through Little Pineveta Tank, 8.5 miles downstream from Garrett Tank, and Williscraft Tank, which is 0.75 miles upstream from its

confluence with Partridge Creek. It flows into Partridge Creek for 13.2 miles along the intermittent, ephemeral channel into Big Chino Wash, and 26.5 miles along Big Chino Wash to Sullivan Lake at the upstream end of the Upper Verde Reach.

Garrett Tank spilled in 2005 and water flowed down and connected to Pineveta Wash. It is assumed flow continued to Partridge Creek though no data exists to confirm this. Garrett Tank has never gone completely dry as far as records show. It did get extremely low in 2002 and 2003 before filling again in 2004. Williscraft Tank is thought to completely dry on a frequent basis; there is no information about Little Pineveta Tank. See the Big Chino Complex section for discussion of downstream water distribution and connectivity for Partridge Creek downstream to Big Chino Wash and the Upper Verde River.

There are no known downstream water users, since surface water is not available during most months of the year. The Yavapai County Flood Control District (YCFCD) plans to install rain gauges and stream flow meters in Partridge Creek due to increased development in the area. YCFCD also indicated that accuracy of flow meters is extremely variable due to the high sediment loads carried in Partridge Creek (M. Massis, pers. comm.). The purpose of these gauges is not to measure permanent flow but to predict flood events downstream of the gauges.

Fish Movement

There are no known barriers to downstream fish movement from Garrett Tank. Upstream movement of fish is possible temporarily but persistence is not possible due to the lack of permanent surface water. Movement of stocked fish would only occur during extreme storm events when the tank spills, typically during spring; it generally takes multiple storm events in a row that saturate stream channels to result in flow events sufficient to move fish (Figures 4 and 5 and pers. com. Andy Clark). Fish leaving Garret Tank could move downstream to Little Pineveta Tank or Williscraft Tank and persist there if the tanks have water, serving as a source of fish to downstream locations. Garrett Tank spilled most recently in 2005. It is presumed water made it to Pineveta Wash and possibly transported fish.

Of the species proposed for stocking, small channel catfish would be the most likely to move downstream in these events, because the spill would likely be shallow and muddy. Adults would be unlikely to physically leave the tank under these conditions due to the shallowness of water flow over the tank. Garrett Tank would be most likely to spill in spring prior to spawning of stocked fish; small age classes of channel catfish have not been documented in Garrett Tank since 1988 (Table 3).

Potential for fish movement from Pineveta Creek into Partridge Creek, downstream to Big Chino Wash and subsequently the Upper Verde River is discussed further in the Big Chino Wash Complex section.

Community Description

Garrett Tank currently supports viable populations of bluegill and channel catfish (Table 3). Sampling gear used to survey include experimental monofilament gillnets measuring 150' long, 6'tall with six panels that go from 1" to 3" mesh, and hoop nets that measure 2.5' at the opening and are 10' long. Depending on depths of the tanks, nets are set adjacent to the shore and are usually completely submerged. A weighted bottom line and a top line that floats usually keep the gill nets upright in a position to capture fish. In both cases, netting is a passive capture technique and requires fish to move into the nets.

Recruitment of bluegill sunfish and largemouth bass has been documented historically from netting surveys; however hoop net surveys in August 2006 yielded no largemouth bass. In June 2007, a fish kill was reported and investigated, where channel catfish and bluegill sunfish were documented dead and dying in the tank. A high pH of over 9 and low dissolved oxygen of less than 4 ppm were identified as contributing factors. No largemouth bass mortalities were recorded. Channel catfish recruitment has not been documented in Garrett Tank.

The aquatic community is restricted to the tank itself. There are no emergent aquatic plant species or trees near the water edge. Floating aquatic vegetation does occur within the tank and is thought to be Sago pondweed. Shaggy bark juniper is the predominant tree species around and downstream of the tank. Neither waterdogs nor crayfish have ever been documented in Garrett Tank.

Williscraft Tank, which interrupts the flow in Pineveta Wash, 0.75 miles upstream from its confluence with Partridge Creek, historically supported populations of largemouth bass, channel catfish, redear sunfish, and fathead minnow. The tank dried completely in 1980 and was not restocked, due to private land issues; it is currently not proposed for stocking.

Table 3. AGFD Fish Survey data from Garrett Tank from 1982 – 2007.

Year	Capture Method	Species	Num.	TL (mm)
1982	Seine Net	none	-	-
1985	Seine Net / Gill Net*	Channel catfish	15	205-440
		Green sunfish	1	150
1986	Seine net / Gill Net	Largemouth bass	9	142-211
		Channel catfish	4	304-432
1987	Seine Net	Largemouth bass	20	85-220
		Channel catfish	9	308-397
1988	Hoop net / Seine Net	Bluegill	27	69-145
		Largemouth bass	150	20-32
		Channel catfish	1	156

1989	Hoop Net	Largemouth bass	1	270
		Bluegill	20	155-197
1991	Hoop Net / Seine Net	Largemouth bass	3	194-284
1992	Hoop Net / Angling	Largemouth bass	26	YOY - 354
		Channel catfish **	2	-
1995	Hoop Net	Largemouth bass	1	217
		Bluegill	19	104-128
1997	Hoop Net	Largemouth bass	15	167-234
		Green sunfish	1	192
		Bluegill	74	99-201
1998	Hoop Net	Yellow bullhead	1	291
		Largemouth bass	23	162-240
		Bluegill	40	130-196
2002 (June)	Hoop Net	Bluegill	206	99-260
		Largemouth bass	57	200-235
2006 (August)	Hoop Net	Bluegill	48	28-150
2007 (Sept)	Hoop Net	Bluegill	35	50-145

*Water quality data also collected
** Channel catfish were collected via angling, and are assumed to be of catchable size.

Other tanks exist on channels that flow into Pineveta Wash and Partridge Creek; for example, Potts Tank, Pineveta Tank, Tom Locket Tank, Dawson Tank, and Georgia Tank. These tanks are located primarily on private land as well as State Trust Land, are not stocked by AGFD, and there is no information on whether or not they have fish present.

No recent surveys have been done in Pineveta Wash, Partridge Creek, or Big Chino Wash because the only time these drainages have water to support fishes is during high precipitation events resulting in run-off. These events are infrequent, as documented by multiple years of gauge data for Williamson Valley Wash, the closest and only gauging station in the Big Chino watershed. Conducting surveys that coincide with surface flow is extremely difficult due to lack of instantaneous information on when such flows exist, difficulty sampling effectively during high flow conditions, sediment loads that make it difficult to discern fish, and concern for survey crew safety.

Consultation Species and/or Critical Habitat
There are no consultation species in the immediate vicinity of Garrett Tank. Consultation species, including Gila Chub, found downstream in Big Chino Wash, are discussed in the Big Chino Wash Complex Analysis section.

Shucking Tank

Site Description

Shucking Tank is a 2 acre livestock water tank located roughly 17 miles east of Seligman (Figure 6). Similar to Garrett Tank, Shucking Tank sits on private land owned by the Diamond 7 Ranch, and is surrounded by a checkerboard of State Trust Land and adjacent private sections. The tank is located in the upper most portions of the Partridge Creek Drainage and Big Chino Wash Complex. It is unknown when this tank was created but it has been providing fishing opportunities for more than 20 years. Permission for public access was provided by the ranch via a letter of support in 1996. Shucking Tank can be accessed by 12 miles of dirt road from Route 66 near Seligman, and currently has no recreational facilities.

Management of Water Body

Shucking Tank is managed primarily as a self-sustaining warm water fishery with largemouth bass and bluegill, and secondarily as a put-and-take rainbow trout and channel catfish fishery. Bluegill and largemouth bass have been stocked on a supplemental basis since 1992 (Table 4). As with all the small ponds or cattle waters in the area, Shucking Tank dries periodically to the point where warm water sport fish species may stunt or die.

Management objectives center on providing stock sizes of channel catfish, largemouth bass, black crappie, and bluegill sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire. Rainbow trout are not expected to persist in Shucking Tank due to the high water temperatures, and would be considered a put-and-take fishery only. It is expected that the channel catfish fishery will be a put-and-take fishery, as well with some over wintering of individuals. The Department conducts periodic sampling using hoop-nets or gill nets to monitor populations.

Table 4. Shucking Tank fish stocking history 1992 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1992	2007	7	5,000
Channel catfish	1992	1994	2	500
Largemouth bass	1994	1994	1	300
Total			11	25,715

Proposed action

The Department proposes to stock largemouth bass, bluegill sunfish, black crappie, channel catfish, and rainbow trout for the period covered by this consultation.

Catchable and/or fingerling largemouth bass, bluegill sunfish, and black crappie stockings would occur in spring, summer or fall, depending on stock availability and costs. Numbers of each species would not exceed 500 per acre for fingerlings and 50 per acre for catchables annually.

The Department proposes to stock catchable channel catfish and rainbow trout. Rainbow trout and channel catfish stockings would be used to support angler retention and recruitment activities. Rainbow trout stocking would only occur in the winter months of December through March, in support of fishing workshops for area anglers. Catfish stockings would occur during the summer months of May through August. Numbers of catfish and rainbow trout stocked would not exceed 100 per acre (for each species) twice annually.

Water Distribution/Connectivity

Shucking Tank is separated from the upper Verde River by approximately 73 miles of ephemeral channels. The tank is located just off-channel in the headwaters of Partridge Creek (Figure 8). Two small tanks, Smith Tanks, are located approximately 2 miles upstream from Shucking Tank. These tanks are not known to hold water every year or through dry periods (A. Clark, pers. comm.). Partridge Creek is dry except during high run-off events or infrequent thunderstorms, when it is expected water would flow though Shucking Tank and downstream. Inputs to Shucking Tank would occur in storm or snowmelt runoff events. If Smith Tanks filled and overflowed, flows would travel the approximate 2 miles downstream to Shucking, as well as from the 2.5 miles of Partridge Creek headwaters that flows parallel to Smith Tanks, and enters Shucking Tank. If water did spill from Shucking Tank, it would leave the tank as sheet flow because there is no dam structure that regulates flow. Water would flow into Partridge Creek and travel 41.5 miles to Big Chino Wash, over Sullivan Dam and into the Upper Verde River.

In 1998, Tim Pender, former wildlife manager for the area, said that Shucking Tank had not overflowed during the 24 years he worked in the area (AGFD Memo, T.A. Liles to K. Young, June 2, 1998). Figure 9 shows a photo of Shucking Tank taken during September 2006, following the driest period of the year. Figure 10 is a photo of Shucking Tank taken December 2004, when high precipitation and flooding occurred (Figures 4 & 5). A spill at this tank has not been recorded by the Department, although it did fill completely in December 2004 (V. Gouldsbury, pers. comm.; Figure 10).

The Big Chino Complex Analysis contains the discussion of downstream water distribution and connectivity for Partridge Creek downstream to Big Chino Wash and the Upper Verde River.

There are no known downstream water users, since surface water is not available during most months of the year. The YCFCD plans to install rain gauges and stream flow meters to predict flood events, but has indicated that accuracy of flow meters is extremely variable due to the high sediment loads carried in Partridge Creek (M. Massis, pers. comm.).

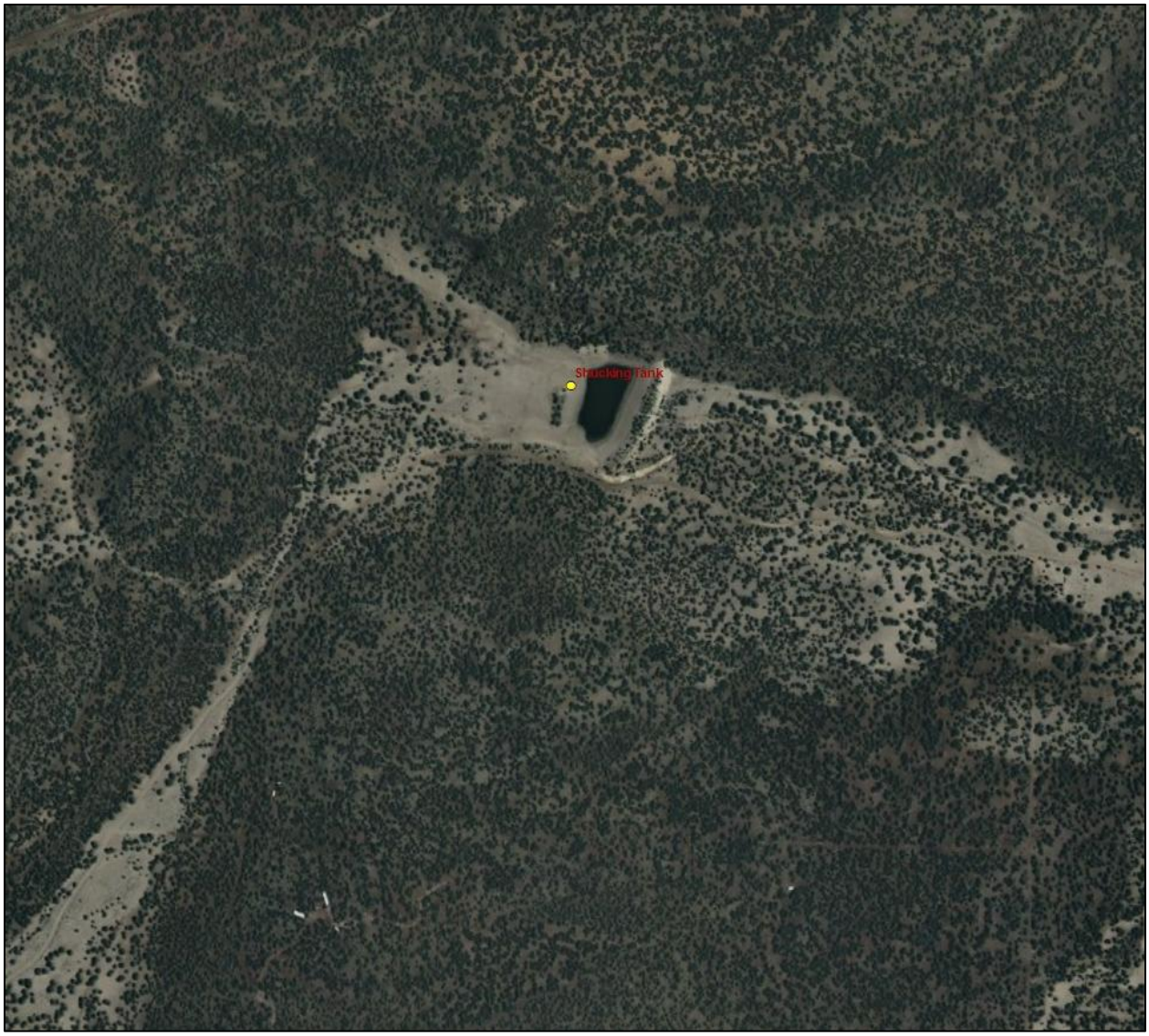

Figure 8. Image of Shucking Tank, located just off-channel of Partridge creek (Copyright:© 2009 ESRI, i-cubed, GeoEye).

Figure 9. Shucking Tank in September 2006.

Figure 10. Shucking Tank, December 2004.

Fish Movement

Movement of stocked fish would only occur during extreme storm events when the tank spills, typically during spring, and it generally takes multiple storm events in a row that saturate stream channels to result in flow events sufficient to move fish (Figures 4 and 5 and pers. com. Andy Clark). There are no known barriers to upstream or downstream fish movement from Shucking Tank; however, upstream movement is not possible due to the lack of permanent surface water, except for possibly during a storm, even when the tributaries are flowing. If fish moved upstream, the only place they could persist would be in Smith Tanks, as long as the tanks maintain water.

Fish leaving Shucking Tank in a flood event could move downstream via Partridge Creek and up any of the tributaries along the creek if water is present. Many of the tributaries to Partridge Creek have in-channel tanks, and there are several tanks located on Partridge Creek itself. Martin Dam Draw is a tributary that joins Partridge Creek half way between Shucking Tank and the confluence of Partridge Creek and the Big Chino. Johnson Creek and Pineveta Creek enter,

Partridge Creek 13 and 17 miles (respectively) downstream of the Martin Dam Draw confluence. Both of these tributaries have multiple tanks in their drainages.

Of the species proposed for stocking, small fish would be the most likely to move downstream in flood events because the spill would likely be shallow, wide and muddy, and adults would be unlikely to physically survive if they leave the tank under these conditions.

Potential for fish movement from Partridge Creek, downstream to Big Chino Wash and subsequently the Upper Verde River is discussed in the Big Chino Wash Complex section.

Community Description
Shucking Tank currently does not support viable populations of any fish species; however, historically the tank supported populations of bluegill and largemouth bass. Recruitment of bluegill and largemouth bass has been documented historically, although fish have not been detected in surveys of Shucking Tank since 2006 (Table 5).

The tank went completely dry in 2003. Waterdogs were the only aquatic species documented during a survey in 2006. Bluegills were stocked in 2007. The tank was again surveyed in 2009 and no fish or waterdogs were captured. Water quality measurements have not been taken, and it is unknown why the tank does not maintain viable populations of fish.

The tank is surveyed using experimental monofilament gillnets measuring 150’ long, 6’tall with six panels that go from 1” to 3” mesh, and hoop nets that measure 2.5’ at the opening and are 10’ long set in evening hours and allowed to fish overnight. Depending on depths of the tank, nets are set adjacent to the shore and are typically completely submerged. A weighted bottom line and a top line that floats typically keeps the gillnet upright in a position to capture fish. In both cases, netting is a passive capture technique in that it requires fish to move into the net. The tank is managed as a self-sustaining warm water fishery for bluegill and largemouth bass, and recruitment of these two species has been assumed historically, although no fish currently inhabit the tank.

The Department believes that Shucking Tank is holding water of sufficient quantity and quality to provide fishing opportunities. If largemouth bass are stocked, it is believed they will establish. There are no emergent aquatic plant species or trees near the water edge. Floating aquatic vegetation does occur within the tank and is thought to be Sago pondweed. Shaggy bark juniper is the predominant tree species around and downstream of the tank. Crayfish have never been documented from Shucking Tank.

Table 5. Fish Survey history for Shucking Tank, 1991 – 2009.

Year	Method	Species	Num.	TL (mm)

1991	Hoop Net / Seine*	Largemouth bass	1	349
1992	Hoop Net / Seine*	Bluegill	-	-
1995	Hoop Net	Bluegill	54	112-144
1997	Hoop Net	Largemouth bass	1	241
		Bluegill	10	99-200
1998	Hoop Net	Bluegill	40	102-142
2006	Hoop Net / Gill Net**	none	-	-
2009	Hoop Net / Gill Net	none	-	-

* Water quality data collected
** Waterdogs documented as being present

Consultation Species and/or Critical Habitat
There are no consultation species in the immediate vicinity of Shucking Tank. Consultation species includes Gila Chub, found downstream in the Big Chino Wash, and are discussed in the Big Chino Wash Complex Analysis section.

Presley Tank
Site Description
The proposed stocking site is a 4 acre livestock water tank located in the upper portion of the Partridge Creek Watershed in an unnamed tributary that flows into Partridge Creek, about 4.5 miles downstream from Shucking Tank (Figure 6). Similar to both Garrett and Shucking Tanks, Presley Tank is also located on the Diamond 7 Ranch with access permission granted via a letter of support signed by the ranch in 1996. Presley Tank is a remote tank and does not have any recreation facilities. It is accessed by more than 15 miles of dirt road from Interstate 40 near Ash Fork.

Management of Water Body
Presley Tank is managed primarily as a self-sustaining warm water fishery with largemouth bass, black crappie, and bluegill sunfish, and secondarily as a put-and-take rainbow trout and channel catfish fishery. As with all the small ponds or cattle waters in the area, Presley Tank dries periodically to the point where warm water sport fish species may stunt or die.

Bluegill and largemouth bass have been stocked on a supplemental basis for almost 30 years (Table 6). Access to all of the Diamond 7 stock ponds is currently open. Presley was first stocked with 75 largemouth bass transplanted from Heifer Tank in 1982. The tank dried to the point of completely killing the fishery in 1989 (Table 7). Five hundred channel catfish were re-stocked in October 1991. Conditions at Presley Tank caused another fish kill in 2002, but the tank did not go dry. The 2002 event may not have been a complete kill, because two large bluegill were collected during a 2006 survey (Table 7).

Management objectives center on providing stock sizes of channel catfish, largemouth bass, black crappie, and bluegill for anglers to enjoy. Black crappie is a new species proposed for stocking in this water. Periodic stocking to maintain sizes usable to anglers may also be necessary due to drying and/or catastrophic wildfire. Rainbow trout and channel catfish stockings may occur to support angler recruitment and retention activities. Rainbow trout are not expected to persist in Presley Tank and would be considered a put-and-take fishery only. It is expected the channel catfish fishery would be a put-and-take fishery as well with some over-wintering of individuals. The Department conducts periodic sampling using hoop-nets or gillnets to monitor populations.

Table 6. Stocking history of Presley Tank 1982 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1987	2008	5	12,853
Channel catfish	1984	1994	3	3,700
Largemouth bass	1982	2008	4	4,368
Tadpole	1982	1982	2	10,000
Total			14	25,715

Proposed action

The Department proposes to stock largemouth bass, bluegill sunfish, black crappie, channel catfish, and rainbow trout for the period covered by this consultation.

Catchable and/or fingerling largemouth bass, bluegill, and black crappie stockings would occur in spring, summer, or fall depending on stock availability and cost of fish. Numbers of fish of each species would not exceed 500 per acre for fingerlings and 50 per acre for catchables annually.

The Department proposes to stock catchable channel catfish and rainbow trout. Rainbow trout and channel catfish stockings would be used to support angler retention and recruitment activities. Rainbow trout stocking would only occur in winter months in support of fishing workshops for local kids. Catfish stockings would occur during summer months. Numbers of catfish and trout stocked would not exceed 100 per acre of each species, twice annually.

Water Distribution/Connectivity

Presley Tank is separated from the Upper Verde River by approximately 69 miles of ephemeral channels. Presley Tank is located on a headwater tributary of Partridge Creek approximately 4.5 miles downstream from Shucking Tank, and approximately 0.8 miles up the tributary. As with other tanks in the area, Presley Tank is primarily fed by spring snow melt. Rarely, the tank may

catch runoff from localized thunderstorms. There are no tanks upstream of Presley Tank. In 1998, Tim Pender, the former wildlife manager for the stocking area, said that the tank had not overflowed during the 24 years he worked in the in the area (AGFD Memo, T.A. Liles to K. Young, June 2, 1998). Figure 11 and Figure 12show photos of Presley Tank taken during September 2006 and July 2009, and depict water levels during the driest period of the year.

If water did spill from the tank, it would flow 0.8 miles down an unnamed dry wash to Partridge Creek. See the Big Chino Complex section for discussion of downstream water distribution and connectivity for Partridge Creek downstream to Big Chino Wash and the Upper Verde River.

Fish Movement

Movement of stocked fish would only occur during extreme storm events when the tank spills, typically during spring, and it generally takes multiple storm events in a row that saturate stream channels, to result in flow events sufficient to move fish (Figures 4 and 5 and pers. com. Andy Clark). There are no known barriers to upstream or downstream fish movement from Presley Tank, however, upstream movement is not possible due to the lack of permanent surface water, except for possibly during a storm event when the tributaries are flowing.

Figure 11. Photo of Presley Tank, September 2006

Figure 12. Photo of Presley Tank, July 2009.

Of the species proposed for stocking, small fish would be the most likely to move downstream in these events, because the spill would likely be shallow and muddy and adults would be unlikely to physically leave the tank under these conditions. Recruitment of bluegill and largemouth bass has been documented historically.

If Presley Tank were to spill and result in fish escapement, fish could travel 0.8 miles downstream to Partridge Creek. From this point, fish could potentially move upstream towards Shucking Tank or continue downstream in Partridge Creek. Potential for fish movement from Partridge Creek, downstream to Big Chino Wash and subsequently the Upper Verde River is discussed in the Big Chino Wash Complex section.

Community Description

Presley Tank currently supports viable populations of bluegill (Table 7). Recruitment of bluegill and largemouth bass has been documented historically from netting surveys; however, surveys conducted in August 2006 and July 2009 yielded only bluegill and no largemouth bass. As with all small tanks in the region, fish are surveyed using experimental monofilament gillnets measuring 150’ long, 6’tall with six panels that go from 1” to 3” mesh, and hoop nets that

measure 2.5' at the opening and are 10' long. Depending on depths of the tanks, nets are set adjacent to the shore and are typically completely submerged. A weighted bottom line and a top line that floats typically keeps the gill nets upright in a position to capture fish. In both cases, netting is a passive capture technique in that it requires fish to move into the nets.

The aquatic community is restricted to the tank itself. There are no emergent aquatic plant species or trees near the water edge. Floating aquatic vegetation does occur within the tank and is thought to be Sago pondweed. Shaggy bark juniper is the predominant tree species around and downstream of the tank (Figure 11 and Figure 12). Crayfish have never been documented from Shucking Tank.

Table 7. Fish Survey history for Presley Tank 1985 – 2009.

Year	Method	Species	Num.	TL (mm)
1985	Gill Net*	Channel catfish	12	300-350
1986	Gill Net / Seine	Largemouth bass	15	96-155
1987	Gill Net / Hoop Net / Electrofishing	Largemouth bass	9	110-160
		Channel catfish	10	221-417
1988	Hoop Net	Largemouth bass	5	165-210
		Bluegill	18	102-234
		Channel catfish	2	318-322
1989**	Hoop Net	Bluegill	1	127
1987	Hoop Net	Channel catfish	1	574
		Largemouth bass	1	350
		Green sunfish	32	129-191
		Bluegill	163	110-207
1998	Hoop Net	Largemouth bass	2	370-395
		Green sunfish	2	118-142
		Bluegill	323	103-200
2006	Gill Net / Hoop Net	Bluegill	2	220-235
		waterdogs	-	-
2009	Gill Net / Hoop Net	Bluegill	105	64-185

* Water Quality measurements taken
** Fishkill occurred earlier in the year

Consultation Species/Critical Habitat

There are no consultation species in the immediate vicinity of Presley Tank. Consultation species, including Gila Chub, found downstream in the Big Chino Wash, are discussed in the Big Chino Wash Complex Analysis section.

Stone Dam

Site Description

Stone Dam was built in 1910 and impounds, on average, 5 surface acres with a maximum 18 surface acres at spill level (Figure 6 and Figure 12). It is located approximately 5 miles east of the town of Ash Fork at an elevation of approximately 5,500 feet. Stone Dam is located on private land owned by the Ash Fork Development Association and is a popular fishery with anglers coming from the surrounding area. Stone Dam was originally developed by the Santa Fe Railroad to provide water for its steam engines. Angler access is by primitive roadway with a primitive boat launch located on the south west corner of the reservoir by the dam. Angler use is primarily by residents of Ash Fork and the surrounding communities.

Management of Water Body

Historically Stone Dam was not managed by the Department as a fishery, since it is located on private property. In June of 2003, local Wildlife Manager Tim Pender approached the Department's Region II fisheries staff to conduct a fish survey on the reservoir. The survey occurred concurrently with cleanup activities sponsored by the Ash Fork Development Committee as part of the Department's Adopt a Lake Program. Results from the survey indicated a fish community of black crappie, bluegill, largemouth bass, and golden shiners. The Ash Fork Development Committee agreed to let AGFD manage the water and the fishery for public use.

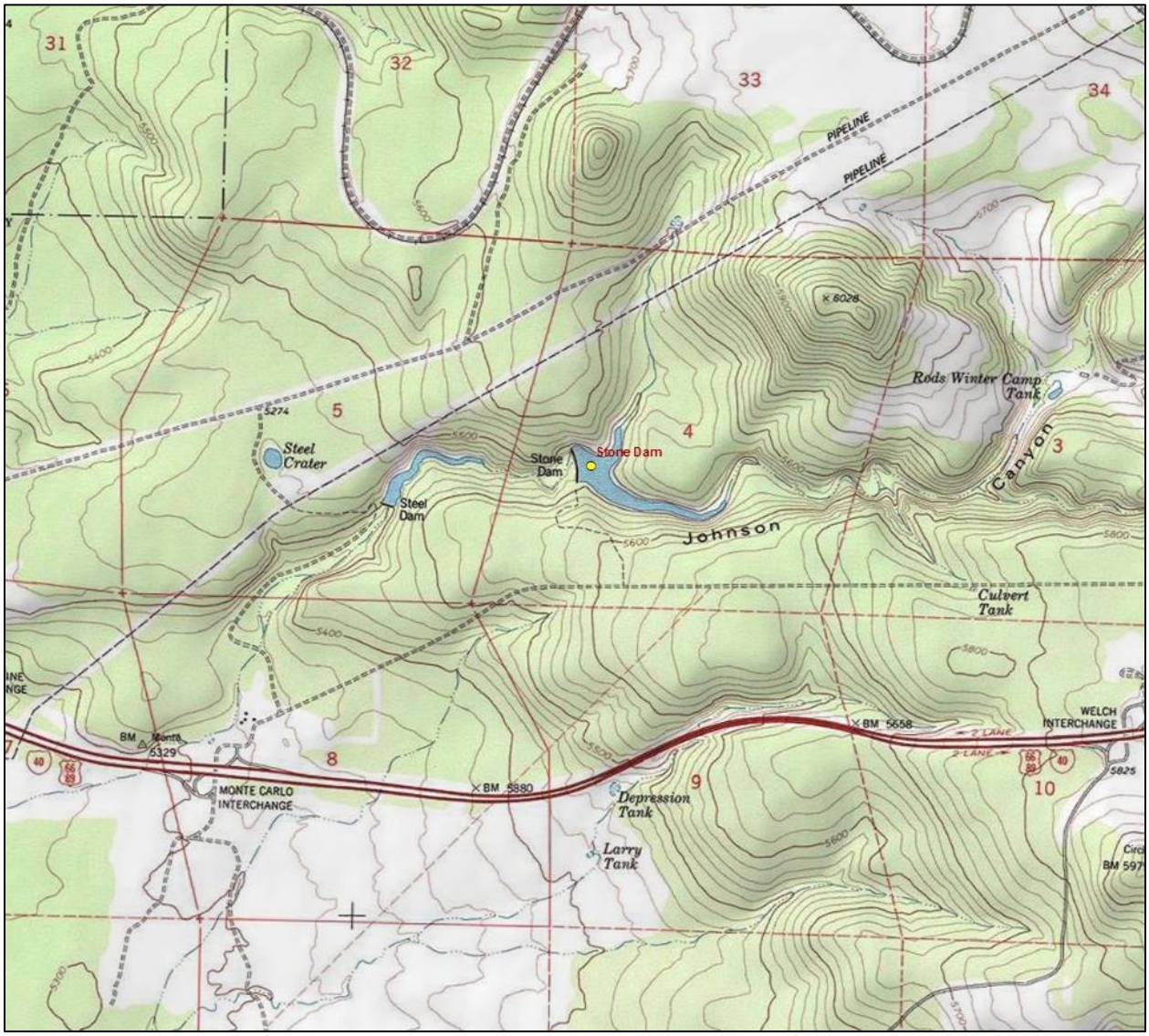

Figure 13. Stone Dam topographic map (ESRI ArcGIS Online and data partners including USGS and © 2007 National Geographic Society).

Stone Dam is currently managed primarily as a warm water put-and-take channel catfish fishery, with a self-sustaining warm water fishery for largemouth bass and bluegill (Table 8). Current management focuses on stocking catchable channel catfish during the spring and summer. Management of the self-sustaining warm water fishery may include periodic stockings of fingerling or catchable fish to maintain sizes usable to anglers.

Table 8. Stone Dam stocking history 2007 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Channel catfish	2007	2009	3	1,450
Total			3	1,450

Proposed action

The Department proposes to stock channel catfish, largemouth bass, redear sunfish, and bluegill sunfish for the period covered by this consultation.

Catchable channel catfish would be stocked from April to July each year; numbers of catchable channel catfish stocked may be from 0 - 1,500 annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables, catchables) would be stocked as needed at spring, summer, or fall to augment the warm water fishery, or to reestablish the fishery after catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution/Connectivity

Stone Dam (Figure 14) is separated from the upper Verde River by approximately 39 miles of ephemeral channels. The dam is located on Johnson Creek about 9.15 miles upstream from its confluence with Partridge Creek. Water enters the reservoir through intermittent snowmelt and thunderstorm runoff from ephemeral Johnson Creek. The headwaters of Johnson Creek originate on Hearst Mountain and travel 0.75 miles to Sereno Tank, which is less than an acre in size. From Sereno Tank, Johnson Creek continues 1 mile to Big Supai Tank, which is about 2.45 acres in size. Johnson Creek continues 1.69 miles to perennial McLellan Reservoir. A tributary on the south side of McLellan Reservoir collects water from the northwest facing slopes of Bill Williams Mountain about 3 miles to the east. The portion of the Bill Williams Mountain watershed that flows into McLellan Reservoir includes five small, less than 1 acre tanks: three unnamed tanks, Hat Tank, and Stump Tank, and 1 spring, Bard Spring. McLellan Reservoir is located approximately 9.5 miles upstream of Stone Dam and approximately 5 miles west of the city of Williams on Interstate 40.

The concrete dam on McLellan Reservoir is severely cracked across a large portion of the structure, about 2 feet down from the top of the dam (Figure 15). These cracks allow water to travel through the dam, as opposed to cresting the structure during most high flow events. Only during extreme runoff events will lake level crest and top the dam on McLellan Reservoir.

Figure 14. Stone Dam photo taken January, 2007.

Figure 15. Photo of the large cracks through McLellan Dam that allow water to pass through the structure; photo taken on February, 2009.

Outflow from Stone Dam exits the reservoir on the south side of the dam down a natural rock face. In the event of flooding, outflow from Stone Dam can flow down Johnson Creek 0.35 miles into Steel Dam Reservoir (Figure 16 and Figure 16). During intense runoff, flows may top the dam. Steel Dam is about 5 surface acres, and can reach a maximum of 10 surface acres when full. Steel Dam is constructed from 3/8 inch steel plates that are scallop-shaped and sloped downstream to allow flow to exit the reservoir over the top of the structure; no spill way exists, however it does appear to spill occasionally. The dam can withstand up to 6 feet of water topping the dam (Figure 18). When water does spill, there is a 46 ft drop.

From Steel Dam Reservoir, Johnson Creek continues 8.71 miles to Jumbo Tank, which has a maximum surface acreage of 33.66 acres when full. From Jumbo Tank it is about 0.1 miles to ephemeral Partridge Creek. See the Big Chino Complex section for discussion of downstream water distribution and connectivity for Partridge Creek downstream to Big Chino Wash and the Upper Verde River.

Figure 16. Steel Dam, located down ~0.35 miles downstream of Stone Dam on Johnson Creek. Photo taken January, 2007.

Figure 17. Photo of downstream side of Steel Dam taken January, 2007.

Figure 18. Photo of Steel Dam with debris indicating water flows over the top of the dam; photo taken August, 2009.

Fish Movement

The aquatic communities in the tanks upstream of McLellan Reservoir are unknown. There is potential, however, during wet climactic cycles, for fish from McLellan Reservoir to travel upstream into these small tanks, and or terminate in the headwaters of the drainage. Similarly, fish from these tanks could travel downstream into McLellan Reservoir. When McLellan Reservoir receives a significant enough precipitation event or series of events to cause the reservoir to spill through the cracks or over the top of the dam, there is potential for fish to be washed downstream into Stone Dam. Upstream movement of fish stocked in Stone Dam is limited to the 9.45 miles of Johnson Creek between Stone Dam and McLellan Reservoir, which serves as a barrier to upstream fish movement, since the vertical drop on the downstream side is 10-15 feet. When the reservoir tops, it flows over the middle of the dam, dropping vertically, preventing the upstream movement of fish (Figure 15). Downstream movement of stocked fish out of Stone Dam would only occur during extreme storm or run-off events when the reservoir fills and spills; typically during spring. There is a good chance McLellan Reservoir could fill and spill from snow-melt off the west and northwest side of Bill Williams Mountain without flowing through any tanks. This part of the drainage comes in from the south side of McLellan and contributes the bulk of its inflow. It generally takes multiple storm events in a row to saturate the stream channels upstream of the reservoir, to result in the dam topping sufficiently to move fish (Figures 4 and 5 and A. Clark pers. comm.). There are no known barriers to downstream fish movement from Stone Dam other than stocked fish would have to traverse Steel Dam, with a 46 foot drop, and Jumbo Tank, both of which are downstream of Stone Dam on Johnson Creek. Similarly the 46 vertical foot dam on Steel Dam acts a barrier to the upstream movement of fish from downstream sources.

Fish would likely not persist very long in ephemeral Johnson Creek or Partridge Creek, even if some did make it through Steel Dam and Jumbo Tank to where Johnson Creek joins Partridge Creek. Normally dry pinion-juniper woodland washes do not maintain water long enough for fishes to persist. Small, headwater channels of a drainage network are important in determining the amount of sediment transported downstream during storm events. This increased sediment load can have negative effects on channel stability, fish, invertebrates, and overall stream productivity. High sediment loads can often result in fish mortality as a result of decreased dissolved oxygen concentrations concurrent with increased suspended sediments (Bozek and Young 1994; Waters 1995; Rinne and Carter 2008). Fine clay sediments transported with runoff often prohibit fish survival in pools following runoff events.

Potential for fish movement from Partridge Creek, downstream to Big Chino Wash and subsequently the Upper Verde River will be discussed in the Big Chino Wash Complex section.

Community Description

Stone Dam was surveyed in 2003 by the Department using 6 hoop nets and 1 gill net (Table 9). A total of 69 fish were captured in the gill net over the 16 hours that it was set. The majority of the fish caught were golden shiners, with largemouth bass being the second most common. In the hoop nets, a total of 78 fish were captured in 80 hours of effort; the dominant species caught was bluegill, followed by black crappie; adult fish of both species were notably small in size. The results of the survey indicate a fish community dominated by stunted pan fish, bluegill and black crappie, and golden shiner. Green sunfish, northern pike, bullhead catfish of an unknown species have historically been present in Stone Dam, but were not detected in the most recent surveys.

The aquatic species compositions of the three reservoirs on Johnson Creek indicate that there is little to no movement of fish between these reservoirs. Species unique to McLellan Reservoir at the upstream end and Steel Dam at the downstream end suggest that fish movement is limited or non-existent. Certain fish species found in McLellan Reservoir are not found in downstream Stone or Steel Reservoir, and similarly certain species in Steel Reservoir are not found in upstream Stone or McLellan Reservoir. (Tables 9, 10, and 11)

Table 9. 2003 Fish captured in hoop nets and gill nets set in Stone Dam during a 2003 survey.

Year	Method	Species	Num.	TL (mm)
2003	Gill Net / Hoop Net	Black crappie	33	160-280
		Bluegill	48	91-168
		Largemouth bass	14	151.4 (mean)
		Golden shiner	52	163-204

Results of a survey conducted in 2009 by the Department on Steel Dam indicate a fish community dominated almost exclusively by green sunfish and golden shiner (Table 10). Two experimental 150’ 6 panel gill nets were set on the reservoir for a 24 hour period. Stunted green sunfish and large adult golden shiners dominated the system.

Table 10. Fish captured in gill nets set in Steel Dam during a 2009 survey.

Year	Method	Species	Num.	TL (mm)
2009	Gill Net	Green sunfish	172	66-157
		Bluegill	13	70-234
		Golden shiner	432	96-116

The Department conducted a fish survey of McLellan Reservoir in 2009 and found a fish assemblage of golden shiner, yellow perch, bullhead catfish, black crappie, bluegill, and

largemouth bass (Table 11). Three 150' 6-panel experimental monofilament gill nets were set for a 24 hour period. McLellan is not managed as a fishery by the Department; however, anglers have reported catching bluegill, green sunfish, bullhead catfish, yellow perch, and northern pike in the reservoir.

Table 11. Fish captured in gill nets set in McLellan Reservoir during a 2009 survey.

Year	Method	Species	Num.	TL (mm)
2009	Gill Net	Black crappie	7	175-214
		Bluegill	3	127-218
		Golden shiner	162	111-239
		Largemouth bass	1	97
		Yellow perch	14	180-232
		bullhead species	5	266-303

Consultation Species/Critical Habitat

There are no consultation species in the immediate vicinity of Stone Dam. Consultation species, Gila chub are found downstream in Big Chino Wash, and are discussed in the Big Chino Wash Complex Analysis section.

Granite Basin Lake

Site Description

Granite Basin Lake is a 2 acre impoundment at the headwaters of Mint Wash, an ephemeral stream northwest of Prescott (Figure 18) on the Prescott National Forest. The concrete dam forming the lake was built in 1939 by the Civilian Conservation Corps (CCC). Because of the lake's position between drainages and because it sits high in the Mint Creek drainage, Granite Basin Lake has a tendency to collect sediments from the surrounding mountains quickly, due to the steep gradients. Figure 19 provides an aerial photo of the watershed. Granite Basin Lake was dredged by the Department and the Prescott National Forest in 1992. The depth of the lake was approximately 22 feet after the project. Following the high flow event in February of 1993 the approximate depth was 19 feet; as of August 2008, the depth is estimated at less than 10 feet. Granite Basin is located within a Prescott National Forest Recreation site. Restrooms, picnic areas, and some camping sites are available. Access is available on paved road, and there is a boat ramp is available. Boats are restricted to a single motor only.

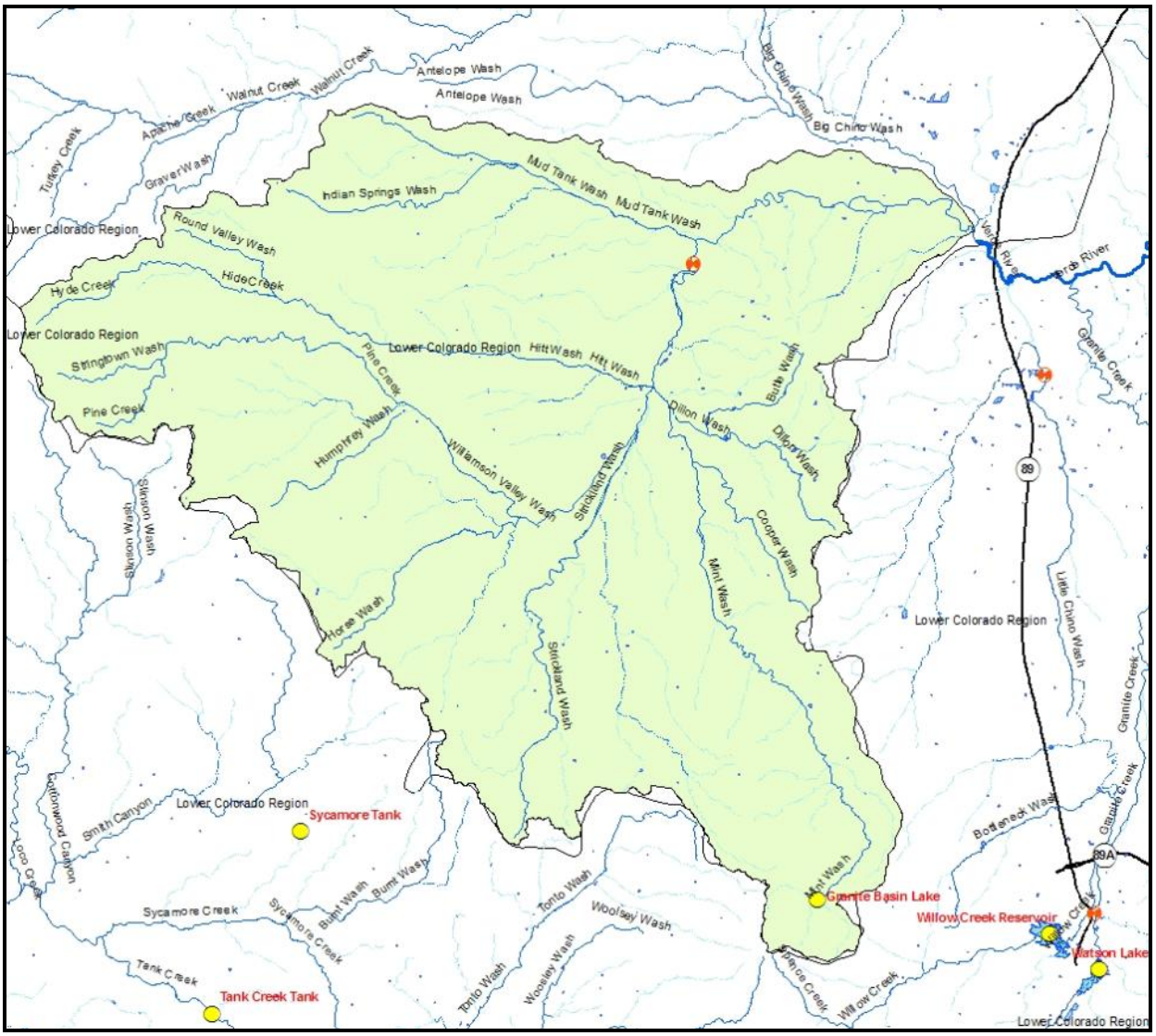

Figure 18. Williamson Valley Wash drainage flows into the Big Chino sub-watershed from the south just upstream from Sullivan Dam on the Upper Verde River.

Figure 19. Image of Granite Basin Lake (Copyright:© 2009 ESRI, i-cubed, GeoEye). Granite Basin Dam is at the upper right of the lake, water spilling over Granit Basin dam flows into Mint Wash.

Management of Water Body

Granite Basin Lake is managed as a self-sustaining warm water fishery for largemouth bass and bluegill. Sedimentation is slowly filling the lake, and aquatic weeds are problematic in low water years, as they will cover the entire surface of the lake. The Department has used a "weed harvester" boat to open up areas for boat launching and angling. Future management objectives will focus on providing stock sizes of largemouth bass and bluegill for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic

wildfire. Granite Basin angler use days in 2001 were estimated at 1,167 (Pringle 2004). Periodic sampling will be conducted using electrofishing or gill nets to monitor populations.

Table 12 provides a summary of stocking by AGFD in Granite Basin Lake.

Table 12. Stocking history for Granite Basin Lake, 1942 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1965	1966	4	5,600
Bluegill	1968	2001	3	12,049
Brown trout	1952	1953	4	2,300
Channel catfish	1965	1999	17	18,925
Largemouth bass	1950	1999	8	4,800
Rainbow trout	1942	1963	138	200,064
Tadpole	1968	1978	3	6,000
Total			177	249,738

Proposed Action

The Department proposes to stock bluegill and largemouth bass for the period covered by this consultation.

Supplemental stockings of fingerlings or catchables largemouth bass or bluegill sunfish may be conducted periodically as needed for augmentation of a self-sustaining bluegill and largemouth bass fishery or to reestablish the fishery after catastrophic events catastrophic events. Stockings would occur in spring, summer, or fall, depending on stock availability and costs. Numbers of fish stocked annually would not exceed 1,000 per acre for fingerlings and 100 per acre for catchables of each species.

Water Distribution/Connectivity

Granite Basin Lake is separated from the Upper Verde by 31 miles of mostly ephemeral stream channel. Granite Basin Lake is an impoundment on Mint Wash, an ephemeral stream northwest of Prescott. The wash drains 16 miles to Williamson Valley Wash, which is an interrupted perennial system that flows an additional 15 miles to the Upper Verde River. All of the tributaries to Mint Wash, including Jerome Canyon, Cooper Wash, Dillon Wash, and numerous unnamed tributaries, are ephemeral.

Spills over Granite Basin Dam have been observed in 2005 and 2008 (A. Clark, pers. comm.). Prior to these spills, documented spills have been rare to infrequent (A. Sillas, pers. comm.). In years with below normal snow and winter rains the lake will shrink and can be only 6-feet deep.

During the last 10 years, average lake levels have been several feet below the dam. Water spilling over the dam falls roughly 30 feet onto bedrock. The average elevation in the watershed is 5,800 feet above sea level. Snow accumulations are typically light, but heavy winter storms can occur. Spills, when they infrequently occur, are typically a result of spring run-off. The relatively small watershed area, 2,935 acres, above the lake, contributes high sediment loads typically during summer rain events. Water rights are held by the Prescott National Forest. Several large communities exist downstream on Mint Wash; American Ranch represents the largest.

Pine Creek, and the drainage containing Wickiup Canyon and Humphrey Creek, meet to form the headwaters of Williamson Valley Wash. Horse Wash flows into Williamson Valley Wash upstream of the confluence of Mint Wash and Williamson Valley Wash. Hitt Wash enters Williamson Valley Wash from the north in the same location Mint Wash enters from the south, and Mud Tank Wash meets Williamson Valley Wash downstream. Stringfield, Scissor, Twin Cedar, and Pemberton tanks exist in parallel drainages to Mint Wash, and the nature of these streams is unknown. Several large ponds exist on the Las Vegas Ranch and the Bar Cross Ranch near the confluence of Mint Wash and Williamson Valley Wash. These are on private land and the spill history and fish community presence/absence of these ponds is unknown.

USGS gauge 09502800 Williamson Valley Wash near Paulden, collects daily discharge and precipitation data (Figure 4; Figure 5) and is located on Williamson Valley Wash, approximately 12.5 miles upstream from its confluence with Big Chino Wash. This gauging station is one of only two gauges within the Big Chino Wash watershed, but the other (09502750 Walnut Creek near Ash Fork) was only operated for one year. Daily gauge discharge data from 1965 to 2009, and daily precipitation data from 2002 to 2009 at the Williamson Valley Wash gauge indicate that single precipitation events do not alone result in increases in discharge at the gauge location. Multiple storm events that occur close in time to one another to are more likely to result in the reservoir filling and spilling than single precipitation events unless except in extreme precipitation events.

Fish Movement

Escapement of stocked fish out of Granite Basin Lake is only possible when the lake spills, typically during spring. If Granite Basin were to spill, fish leaving the lake would fall 30 feet onto bedrock and move downstream via Mint Wash to Williamson Valley Wash, to Big Chino Wash, to Sullivan Lake. Because Granite Basin Lake sits at the upper-most end of the ephemeral Mint Wash drainage, and there are several sediments trap structures upstream of the lake, upstream movement of fish from Granite Basin Lake is unlikely. Even if they were able to move upstream, fish would not persist because the stream is ephemeral (Figure 20).

Downstream transportation of viable stocked sport fish species out of Granite Basin Lake may occur, but fish are not likely to persist in the ephemeral reaches downstream. Results from ten years of sampling the Upper Verde River from Granite Creek to Sycamore Creek and from available survey data from Williamson Valley Wash, indicate that the species proposed for stocking either don't access these areas or do not persist if they do. Mint Wash was sampled by Bagley (2002) immediately below Granite Basin Lake and at Mint Spring about 2 miles below the lake; no fish were collected at either location (Table 14). Below the lake, habitat was described as isolated intermittent plunge-pools; the largest was 2 meters x 2 meters x 1 meter deep. At Mint Spring, a few small plunge-pools were present, but most of the wash was dry, and Mint Spring was also dry. Bagley (2002) also sampled the cienega habitat at Williamson Valley Wash. The aquatic assemblage at that time consisted of Gila chub, longfin dace, fathead minnow, mosquitofish, and bullfrogs (Table 14). In January 2003, Gila chub were again documented in Williamson Valley Wash on private land by a private consultant. Longfin dace and mosquitofish were also reported. At that time, the surveyor made the following comment "Non-natives do not seem to be a problem. Flooding was the controlling factor for fishes in Williamson Valley Wash".

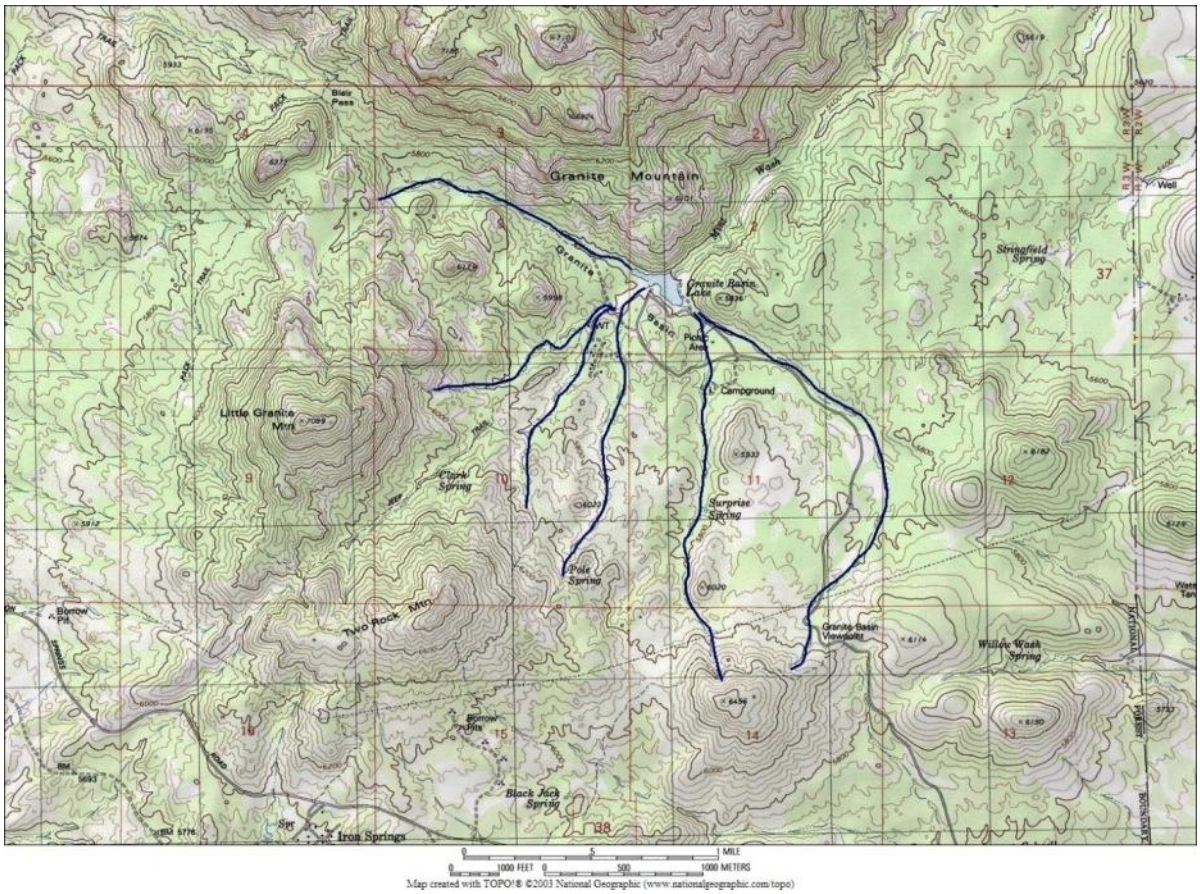

Figure 20. Topographic map of Granite Basin Lake drainage.

Community Description

Granite Basin Lake is a relatively small lake flanked on two ends by extensive cattail beds. In years with below normal snow and winter rains the lake will shrink and can be only 6-feet deep. Aquatic vegetation tends to take over in these conditions and fishing access is difficult. Waterfowl use the lake extensively in normal years but really become numerous in dry times. Bluegill and largemouth bass are the predominant species present at Granite Basin Lake (Table 13). Granite Basin Lake is typically surveyed by electrofishing. Because the lake is small, the entire shoreline is sampled. Only largemouth bass and bluegill have been captured in the electrofishing surveys, but yellow bullhead and channel catfish have been recorded by anglers.

Table 13. Number, relative abundance, relative biomass and catch per unit effort by electrofishing at Granite Basin Lake 2003 – 2007.

Survey Year: 2003						
Total=74	Total Weight=7732 grams			Total effort units = 32 minutes		
Common Name	# Sampled	# Measured	% of Total	CPUE	Weight Sampled (g)	% of Total
Largemouth Bass	33	33	45%	1.03	5741	74%

Bluegill	41	41	55%	1.28	1991	26%
Survey Year: 2004						
Total=46	Total Weight=14298 grams			Total effort units = 20 minutes		
Common Name	# Sampled	# Measured	% of Total	CPUE	Weight Sampled (g)	% of Total
Largemouth Bass	9	9	20%	0.45	3534	69%
Bluegill	37	37	80%	1.85	1591	31%
Survey Year: 2005						
Total=138	Total Weight=11677 grams			Total effort units = 15 minutes		
Common Name	# Sampled	# Measured	% of Total	CPUE	Weight Sampled (g)	% of Total
Largemouth Bass	29	29	21%	1.93	6473	71%
Bluegill	109	109	79%	7.27	2700	29%
Survey Year: 2006						
Total=53	Total Weight=2504 grams			Total effort units = 15 minutes		
Common Name	# Sampled	# Measured	% of Total	CPUE	Weight Sampled (g)	% of Total
Largemouth Bass	10	10	19%	0.67	1865	74%
Bluegill	43	43	81%	2.87	639	26%
Survey Year: 2007						
Total=51	Total Weight=4985 grams			Total effort units = 15 minutes		
Common Name	# Sampled	# Measured	% of Total	CPUE	Weight Sampled (g)	% of Total
Largemouth Bass	12	12	24%	0.80	3459	69%
Bluegill	39	39	76%	2.60	1526	31%

Consultation Species/Critical Habitat

Consultation species found in the immediate vicinity of Granite Basin Lake include bald eagle as discussed immediately below. Gila Chub found downstream in the Williamson Valley Wash are discussed in the Big Chino Wash Complex Analysis section.

Bald Eagle

Potential Impacts

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant

BIG CHINO WASH COMPLEX ANALYSIS

Water distribution and connectivity, fish movement and aquatic community descriptions were discussed for Stone Dam, Garrett, Shucking and Presley tanks up to the point where they flow into Partridge Creek, and for Granite Basin Lake up to the point where Williamson Valley Wash meets Big Chino Wash. Downstream connectivity for Partridge Creek to Big Chino Wash and the Upper Verde River is discussed below.

Impacts to sensitive species in the Big Chino Wash Complex are also discussed below and impacts to sensitive species in the Upper Verde River from proposed sport fish stockings in the Big Chino Complex are discussed comprehensively in combination with Granite Creek and Sycamore Creek complexes in the Upper Verde Complex Analysis.

Water Distribution/Connectivity

Water from Garrett Tank flows to the southwest down an access road roughly one-quarter mile before reaching an unnamed wash; water continues 6.8 miles into Pineveta Wash, then 5.4 miles along Pineveta Wash, through Little Pineveta Tank, 8.5 miles downstream from Garrett Tank on Pineveta Wash, and Williscraft Tank, 0.75 miles upstream from its confluence with Partridge Creek, into Partridge Creek. From that point water would flow 13.2 miles down intermittent and ephemeral Partridge Creek into Big Chino Wash and then 26.5 miles along ephemeral Big Chino Wash to Sullivan Lake at the upstream end of the Upper Verde River. Water from Shucking and Presley Tanks must flow 41.5 and 37 miles respectively down Partridge Creek before reaching Big Chino Wash.

Water from Stone Dam must flow approximately 9 miles down Johnson Creek, through Steel Dam Reservoir and Jumbo Tank before reaching Partridge Creek. From this point it is 18.58 downstream to the confluence with Big Chino Wash.

Partridge Creek has both intermittent and ephemeral reaches, with isolated shallow pools that persist during years with average precipitation, and no pools in years with below average precipitation, and a channel that is typically dry (Figure 20). These pools are not known to support any aquatic vertebrates (AGFD Memo, T.A. Liles to K. Young, June 2, 1998); however, recent surveys to look for pools have not been conducted, since the stream channel is typically dry (A. Clark, pers. comm.) Very little aquatic vegetation is present in the Partridge Creek drainage because of lack of consistent water. Mud, Field Dam, Buster Brown Tank, Sixshooter Tank, Presley Tank, Seven Ranch Tank, Flagstone Tank, Grove, Goldtrap Tank, Heifer, Jumbo and multiple other downstream tanks exist on side channels that flow in to Partridge Creek or are on Partridge Creek itself. All of these tanks are known to dry during arid periods.

Figure 20. Partridge Creek looking upstream from Interstate 40 crossing, April 2009.

From the confluence with Partridge Creek, Big Chino Wash continues approximately 29.5 miles to Sullivan Lake. Big Chino Wash is mostly ephemeral with a few isolated off-channel pools and ponds throughout this stretch to Sullivan Lake on the Upper Verde River.

Spills originating from Granite Basin Lake would flow down Mint Wash 16 miles to Williamson Valley Wash, which is an interrupted perennial system that flows an additional 15 miles to the Upper Verde River. Mint Wash has both canyon-bound reaches and wide alluvial reaches in the 16 miles upstream of Williamson Valley Wash. Spills have been observed in 2005 and 2008 at Granite Basin Lake. Spills typically occur during spring months and result from snow runoff.

During winter to spring, when flows in Big Chino Wash and Williamson Valley Wash connect, they tend to disperse and braid and spread into an alluvial fan rather than channelize. Both washes flow through very wide valley floodplains with sandy alluvial soils and low gradients. During the winter of 2004-2005, Partridge Creek, Big Chino Wash (Figure 21), Williamson Valley Wash (Figure 22), and the upper Verde River were hydrologically connected for a short period of time. Figure 23 depicts the February 2005 combined flows from the Big Chino and Williamson Valley Wash, topping Sullivan Dam at the upstream end of the Upper Verde reaches. Flows at the stream gauge on the Verde River near Paulden peaked on January 12, 2005 at 12, 300 cfs. On February 12, 2005, a peak stream flow was recorded at 8,340 cfs at the Williamson Valley gauge. Sullivan Lake on average covers about 14 surface acres. Outflow from Sullivan Lake continues about 2 miles down Spring Canyon to the headwaters of the Verde River. On

August 24-25, 2009, over 3 inches of rainfall fell in localized areas between Chino Valley and the upper Verde River. Readings at the Paulden gauge peaked at 2,610 cfs following that event (Figure 24; Figure 25). No other gauges in the area recorded higher stream flows. Of the several events that occurred between July 2009 and May 2010, only the extremely large event that occurred during February 2010 was either large enough in magnitude or spatial coverage to result in a discharge sufficient to detect a flow response at both the Paulden and Williamson Valley Wash gauges. These data further indicate the localized nature of flooding in the Verde River drainage.

Figure 21. Confluence of Partridge Creek (on right) and Big Chino Wash, December 2004.

Figure 22. Confluence of Big Chino Wash (flowing left to right) and Williamson Valley Wash (bottom flow coming from left), December 2004.

Figure 23. Sullivan Dam downstream from the confluence of Big Chino Wash (flowing left to right) and Williamson Valley Wash at the upstream end of the Upper Verde reach, February 2005.

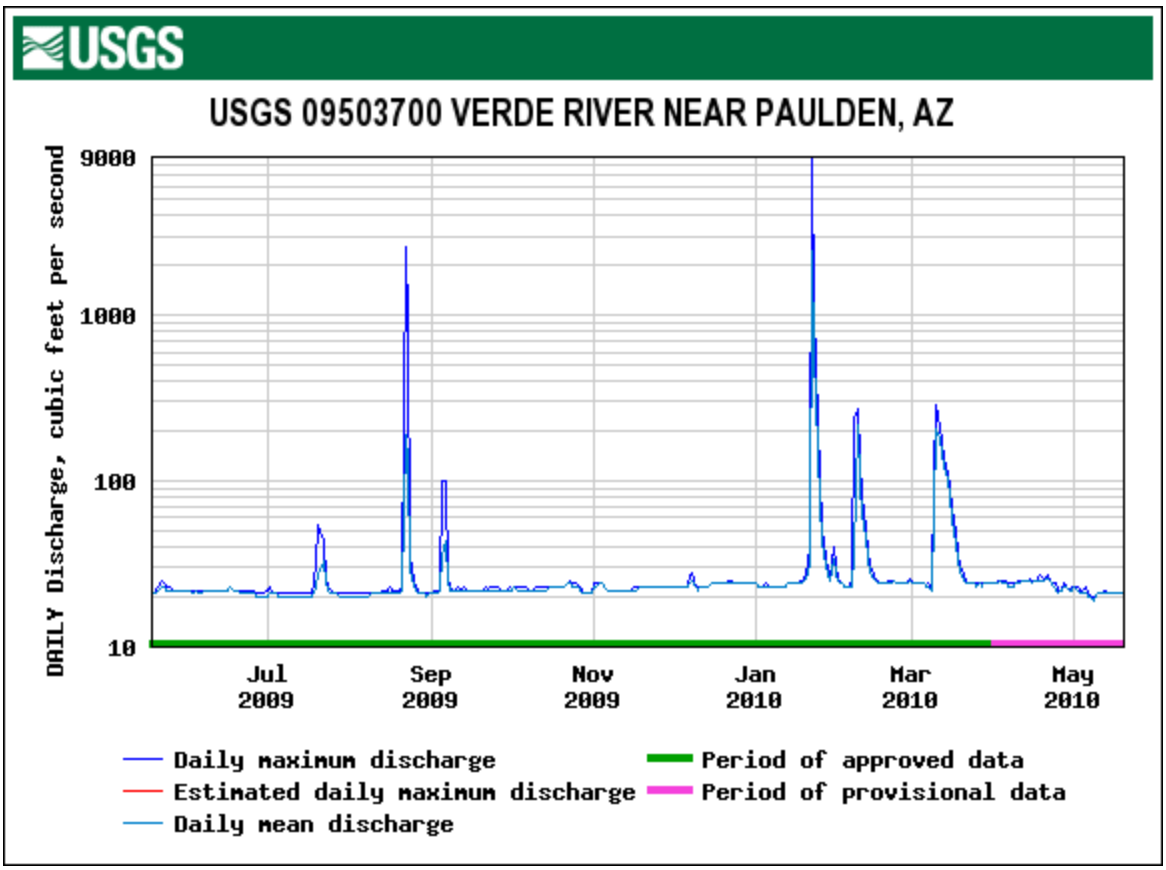

Figure 24. Discharge data from USGS gauge 09503700 located on the Verde River near Paulden, Arizona depicts high discharge events in August 2008 as well as during spring 2010.

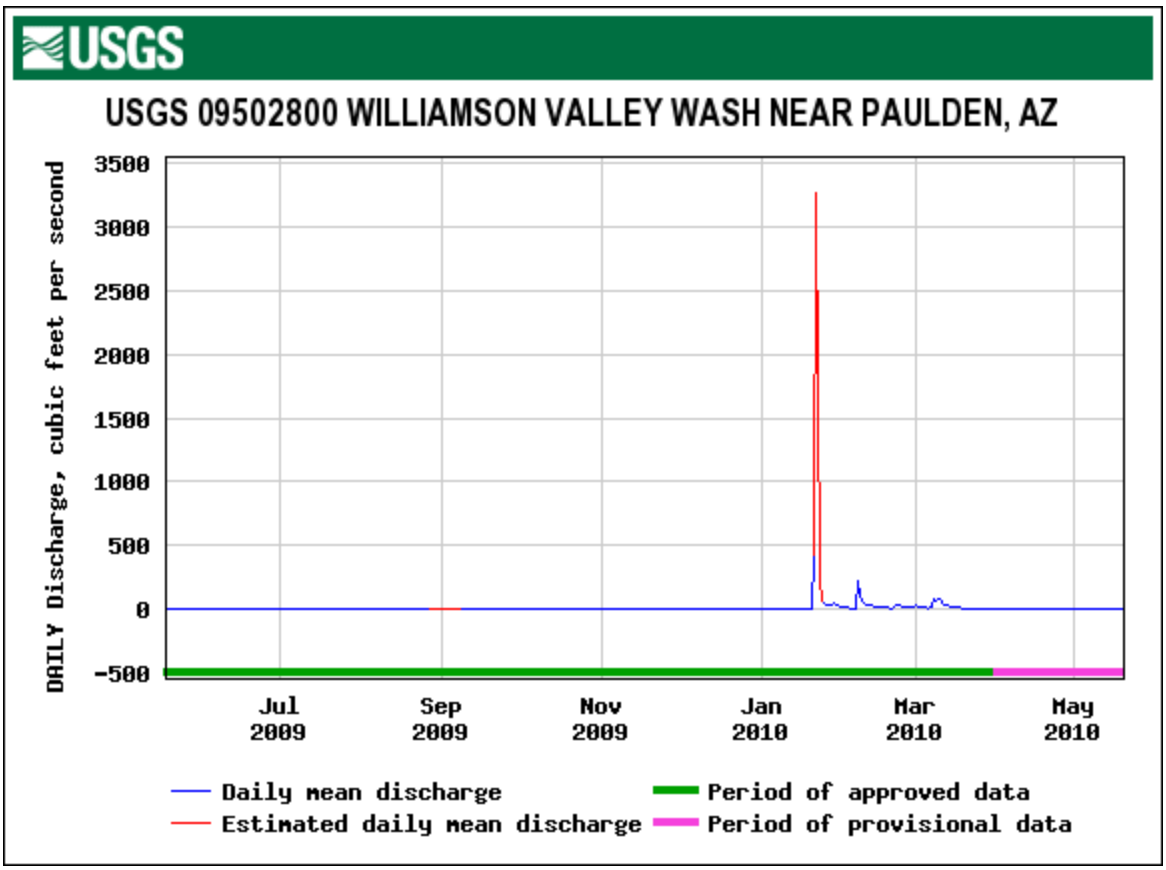

Figure 25. Discharge data from USGS gauge 09502800 located at Williamson Valley Wash near Paulden, Arizona indicates that no discharge was registered at the gauge during August 2009.

Fish Movement

Movement of stocked fish out of the five reservoirs can only occur when the reservoirs spill, which only happens infrequently after sustained high precipitation events, typically during spring. In addition, it generally takes multiple and consecutive storm events that saturate stream channels to result in flow events sufficient to both result in measurable stream discharges and to move fish (Figures 4 and 5 and pers. com. Andy Clark). Fish being transported downstream in these events could persist in downstream tanks or pools as long as they held water, and in some instances could serve as a downstream source of fish to the upstream tanks.

When Partridge Creek flows, it is assumed the flows could carry fish that have escaped upstream stocking locations, downstream to where Partridge Creek joins Big Chino Wash and on downstream to the Upper Verde River. Most of the smaller tanks in the area completely dry with some frequency; however, fish washed downstream in flood events could persist in tanks as long

as they maintain water. It is unlikely fish would persist in Partridge Creek outside of the various tanks in the watershed, because normally dry pinion-juniper woodland washes do not maintain water long enough for fishes to persist; but it is unknown if any perennial pools persist year round.

If stocked fish escape from tanks in the Partridge Creek drainage and are transported downstream in a flow event that connects to Big Chino Wash, they could then move upstream or downstream, accessing other tributaries of Big Chino Wash such as Williamson Valley Wash. However, it is more likely that fish would be washed downstream into Sullivan Lake. There are no known barriers to upstream movement of fish in Williamson Valley Wash during times when the stream connects to Big Chino Wash. Transportation of viable stocked sport fish species to the Upper Verde River may possibly occur during persistent and extreme precipitation events. However, with the exception of channel catfish, which maintains an existing reproducing population in upper reach of the Verde River, results from ten years of sampling the Upper Verde River from Granite Creek to Sycamore Creek show that the proposed stocked species either do not access the Upper Verde River, or if they do, they do not persist (See Upper Verde Impacts Assessment).

Community Description

No recent surveys have been done in Partridge Creek or Big Chino Wash because there is no evidence of fishes moving into the Upper Verde to support priority for a survey to be conducted. The only time these drainages have water to support fishes is during persistent, high precipitation events resulting in runoff. These events are infrequent, and conducting surveys that coincide with surface flow is extremely difficult due to lack of instantaneous information on when such flows exist, difficulty sampling effectively during high flow conditions, sediment loads that make it difficult to discern fish, and concern for survey crew safety.

Other tanks exist on channels that flow into Partridge Creek; for example, Seven Ranch, Flagstone, Goldtrap, Heifer, Cable, Cow Crossing Buck, Garden tanks, Williscraft, Jumbo, and others. These tanks are located primarily on private and State Trust Land, are not stocked by the Department, and there is no information on whether or not they have fish present. Of the multiple tanks located on Partridge Creek and its tributaries, the Department only stocks Garrett Tank, Shucking Tank, Presley Tank, and Stone Dam. Other tanks are known to dry periodically, but fish presence is unknown

Fish species collected at various locations within the Verde River drainage, AZ, as reported by Bagley (2002) are indicated in Table 14.

Table 14. Fishes collected from the Verde drainage in 2000-2001. Streams are identified from south to north along the east side of the Verde drainage, then north to south along the west side.

*Locations within one stream are listed from downstream to upstream. Native species are indicated by *.*

Location	**Species**												
	Brown trout	**Gila chub***	**Longfin dace***	**Speckled dace***	**Red shiner**	**Fathead minnow**	**Sonora sucker***	**Desert sucker***	**Yellow bullhead**	**Mosquitofish**	**Smallmouth bass**	**Green sunfish**	**NO FISH**
Oak Creek @ Cave Spring Campground	X			X									
West Fork Oak Creek ½ mi above Oak Creek	X			X				X					
West Fork Oak Creek @ FS Rd 231													X
Lockwood Spring (West Fork Oak Creek)													X
West Fork Oak Creek @ Flag Tank													X
Spring Creek @ Willow Point Road		X	X	X			X	X					
Sycamore Creek Verde-Parsons Spring							X	X	X		X	X	
Grindstone Wash T20N R1E Sec 34													X
Bear Canyon @ Road 71													X
Bear Canyon @ Road 354													X
Bear Canyon @ Bear Springs													X
Williamson Valley Wash, Simmons		X	X			X				X			
Apache Creek @ Walnut Creek				X									
Apache Creek @ 4 mi from Walnut Creek				X									

Location	Species												
	Brown trout	Gila chub*	Longfin dace*	Speckled dace*	Red shiner	Fathead minnow	Sonora sucker*	Desert sucker*	Yellow bullhead	Mosquitofish	Smallmouth bass	Green sunfish	NO FISH
Apache Creek @ Apache Springs													X
North Fork Walnut Creek @ Apache Creek				X									
North Fork Walnut Creek @ South Fork Walnut Creek				X									
North Fork Walnut Creek above South Fork													X
South Fork Walnut Creek ½ mile above North Fork				X									
Mint Wash @ Mint Spring													X
Mint Wash below Granite Basin Lake													X
Granite Creek 1 mile above Verde River			X		X	X	X			X		X	

The only known occurrences of listed fish species in the Big Chino sub-watershed is the endangered Gila chub population located in a small reach on Williamson Valley Wash, approximately 15 miles upstream from its confluence with Big Chino Wash, that supports perennial surface flow and cienega habitat. Gila chub critical habitat is designated along Williamson Valley Wash for a 4 mile stretch between the confluence of Mint Wash and Mud Tank Wash.

The nearest documented occurrence of Gila chub to one of the five proposed stocking locations is about 17 miles downstream of Granite Basin Lake in Williamson Valley Wash. In 1990, Dave Gori with TNC surveyed pools and cienega-type habitat in Williamson Valley Wash and collected Gila chub (139+31 juveniles), longfin dace (79), fathead minnow(3) and green sunfish (1) (HDMS 2009). Williamson Valley Wash was again sampled in 1992 by Rob Bettaso and Allison Anderson to collect genetic samples for Dean Hendrickson at the University of Austin.

The only fish reported from those collection attempts was Gila chub; however, collection of other species was not reported or recorded (Weedman et al. 1996). Gila chub were also detected within Williamson Valley Wash in June 2001 (Bagley 2002); other species captured included longfin dace, fathead minnow, mosquitofish and bullfrogs. In January 2003, Gila chub were again documented in Williamson Valley Wash on private land by a private consultant. The data is privately kept and unavailable for inclusion in this document. None of the sport fish proposed to be stocked into any of the five locations in the Big Chino watershed have been detected in the portion of Williamson Valley Wash inhabited by Gila chub.

The South Fork of Walnut Creek and the mainstem Walnut Creek are tributaries to Big Chino Wash, and speckled dace have been documented in both since 2000 (Morgan 2000; Bagley 2002). Granite Creek from its mouth to 1 mile upstream is mostly perennial, and is inhabited by longfin dace, Sonora and desert sucker, green sunfish, and bullfrogs (Bagley 2002; see Granite Creek Complex). There have been no surveys in the Big Chino upstream from the confluence of Walnut Creek. The Department's Region 3 indicated that surveys have not been conducted because the system is dry outside of run-off and extreme storm events (A. Clark, pers. comm.).

Consultation Species and/or Critical Habitat
Gila chub and bald eagle are the only listed species with occurrences in the Big Chino Sub-Watershed. Potential impacts to bald eagles are addressed in the Granite Basin Lake site analysis. Impacts to listed species such as spikedace, razorback sucker, and garter snakes that occupy areas in the Upper Verde River and/or downstream, are addressed in the Upper, Middle and Lower Verde River Analyses.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Gila Chub
A Gila Chub population exists in a small reach on Williamson Valley Wash, approximately 15 miles upstream from its confluence with Big Chino Wash. This reach supports perennial surface flow and cienega habitat and is located on private property.

Gila chub critical habitat is designated on along Williamson Valley Wash for a 4.4 mile stretch between the confluence of Mint Wash and Mud Tank Wash (from the gauging station in T17N, R3W, sec. 7 SE\1/4\ upstream to the crossing of the Williamson Valley Road in T17N, R4W, sec. 36 NE\1/4\). Within the critical habitat areas, the primary constituent elements identified are the following:

(i) Perennial pools, areas of higher velocity between pool areas, and areas of shallow water among plants or eddies all found in small segments of headwaters, springs, or cienegas of smaller tributaries;

(ii) Water temperatures for spawning ranging from 17 to 24° C (62.6 to 75.2° F), and seasonally appropriate temperatures for all life stages (e.g. varying from approximately 10°C to 30°C);

(iii) Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g. ranging from 6.5 to 9.5), dissolved oxygen (e.g. ranging from 3.0 to 10.0) and conductivity (e.g. 100 to 1000 mmhos);

(iv) Food base consisting of invertebrates (e.g., aquatic and terrestrial insects) and aquatic plants (e.g., diatoms and filamentous green algae);

(v) Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, and a high degree of streambank stability and healthy, intact riparian vegetative community;

(vi) Habitat devoid of nonnative aquatic species detrimental to Gila chub or habitat in which detrimental nonnatives are kept at a level that allows Gila chub to continue to survive and reproduce; and

(vii) Streams that maintain a natural flow pattern including periodic flooding.

Potential impacts

Potential impacts to Gila chub could result if stocked fish species escape from Granite Basin Lake, and less likely, Garrett Tank, Shucking Tank, Presley Tank, or Stone Dam. There is a low possibility stocked fish could be transported during flood flows through the ephemeral Mint Wash or Partridge Creek and then move upstream into Williamson Valley Wash. Impacts could occur if they occupy for a time, or become established in the occupied or designated critical habitat. Of the species proposed to be stocked, channel catfish are the only species likely to establish in a riverine environment, and are in fact already established in the Verde River. Channel catfish are not proposed for stocking at Granite Basin Lake, but they are proposed at the remaining 4 stocking locations in the Partridge Creek drainage. Potential impacts could include predation of adult catfish on Gila chub (all life stages), and competition for food and/or for space between small catfish and chub in the limited aquatic habitats that would remain after flooding ceased could occur.

Spills are infrequent at Granite Basin Lake but do occur, and could result in largemouth bass escapement. Only small sizes of bass would likely to survive the fall of 30 feet to bed rock below the dam. Plunge pools predominate for several miles below the dam and surveys of these habitats did not detect bass or channel catfish (Bagley 2002). This habitat could facilitate bass movement through a system but is not conducive to largemouth bass survival. Plunge pools typically are deep cold habitats with little vegetation. Frequency of flows would have to be consistent in order to transport bass out of these pools and down Mint Wash. High flows during flood events tend to reduce non-native fish numbers in other places in Arizona (Minckley et al. 1986). Largemouth bass would have to survive 4 miles of wide sandy wash with extensive braiding to Gila chub occupied areas of Williamson Valley Wash. The likelihood of stocked fish movement is very small because largemouth bass have been present in Granite Basin Lake since at least 1950 despite numerous high flow events between 1950 and 2009; established largemouth bass populations have not been detected anywhere in the Big Chino Complex or the upper Verde River. The only locations largemouth bass maintain viable populations are Granite Basin Lake and Presley Tank. It is unlikely largemouth bass washing into Mint Wash from Granite Basin during flood events would survive, because they do not in most other stream areas of Arizona. Potential impacts from largemouth bass could include predation of adult bass on Gila chub (all life stages), and competition for food and/or for space between small bass and chub in the limited aquatic habitats that would remain after flooding ceased could occur. Bluegill sunfish are not expected to survive transport downstream from Granite Basin as they are more suited to lacustrine systems, and would not be likely to survive transport though sediment laden waters; no impacts are anticipated from bluegill sunfish.

The cienega habitats that contain Gila chub in Williamson Valley Wash are on private lands and access has been denied. It is unclear how flood flows interact with this chub occupied habitat. Mint Wash is a narrow canyon for the first several miles, then draining into wide alluvial grassland. While individual bass may occasionally overcome the obstacles and reach the Gila chub occupied areas of Williamson Valley Wash to have direct impacts through predation or indirect impacts through competition and crowding to Gila chub, it is unlikely these isolated effects will result in the decline of Gila chub in the complex due to short duration and low frequency of this occurring. Of the species proposed to be stocked into the five locations, channel catfish are the only species that are likely to persist and become established in a riverine environment. However, in the 44 years since channel catfish were first stocked into any of the five locations (1965 in Granite Basin Lake), none have ever been recorded in Williamson Valley Wash.

Bluegill sunfish, redear sunfish, black crappie, and rainbow trout proposed for stocking in the Partridge Creek sub-drainage are not expected to survive transport from stocking locations to the confluence of with Williamson Valley wash, then upstream (Stone Dam – approximately 37

miles; Garrett Tank – approximately 50 miles; Presley Tank – approximately 67 miles, Shucking Tank – approximately 71 miles), then upstream Williamson Valley wash, approximately 11 miles to critical habitat, and occupied habitat. Timing of transport would be during high flow/runoff events where by increased sediment load would be expected to result in fish mortality as a result of decreased dissolved oxygen concentrations, concurrent with increased suspended sediments (Bozek and Young 1994; Waters 1995; Rinne and Carter 2008). Fine clay sediments transported with runoff often prohibit fish survival in pools following runoff events. It would be more likely for transported fish to be washed downstream with the flows rather than back upstream into Williamson Valley Wash into occupied Gila chub habitat.

Critical habitat

If stocked fish were to be exposed to the Williamson Valley wash designated critical habitat principal component elements (iv) and (vi) may be affected. Stocked fish species may compete for food including aquatic invertebrates and terrestrial and aquatic insects if the food base is in limitation. Also, presence of non-native stocked species results in habitat that is not devoid of non-native species; however given the long history of stocking non-native fish in 5 proposed stocking locations, and the continued persistence of Gila Chub in Williamson Valley wash it is assumed that any exposure of non-native fishes to date has and would likely continue to be kept at a level that allows Gila chub to continue to survive and reproduce.

GRANITE CREEK COMPLEX

Granite Creek has a drainage area of 359 square miles (approximately 229,829 acres) and drains into the upper Verde River approximately 2 miles downstream from Sullivan Dam, the upstream end of the Upper Verde River reach (Figure 26). The drainage begins at 6,237 feet in elevation along the northeast slopes of the Sierra Prieta range, southwest of Prescott and flows northeast towards the Verde River. Of the three stocked drainages in the Upper Verde sub-watershed, the Granite creek drainage covers the smallest area and its headwaters originate just southwest of Prescott, AZ.

Granite Creek runs exclusively in response to snowmelt runoff or large runoff events and is typically wetted from March to June annually. During drought periods the creek may be dry to intermittent. The only major tributary, greater than 10 miles in length, is Willow Creek. Willow Creek courses 10.5 miles from the slopes of the Sierra Prieta Mountains until it hits Willow Creek Dam, forming Willow Creek Lake, or Willow Lake. There are three discharge gauges in the Granite Creek drainage; historical discharge frequency and magnitude is discussed in further detail in the Granite Creek complex analysis below.

The Granite Creek Complex contains 3 lakes proposed for stocking sport fish (Figure 27), all in close proximity to the City of Prescott. Watson Lake is located on Granite Creek, Goldwater

Lake is located on Bannon Creek, a tributary to Granite Creek upstream from Watson Lake, and Willow Lake is a located on a Willow Creek, which flows into Granite Creek just downstream from Watson Lake.

Goldwater Lake

Site Description

Goldwater Lake is the most upstream of the three proposed stocking locations in the Granite Creek complex (Figure 27). Created in the 1930's as a water supply reservoir for the City of Prescott (City), Goldwater Lake sits at approximately 6,800 feet in elevation nearly 4 miles south of downtown Prescott (Figure 28). Two dams situated in the headwaters of Granite Creek on a drainage known as Bannon Creek create an upper 22 acre reservoir and a lower 8.5 acre reservoir.

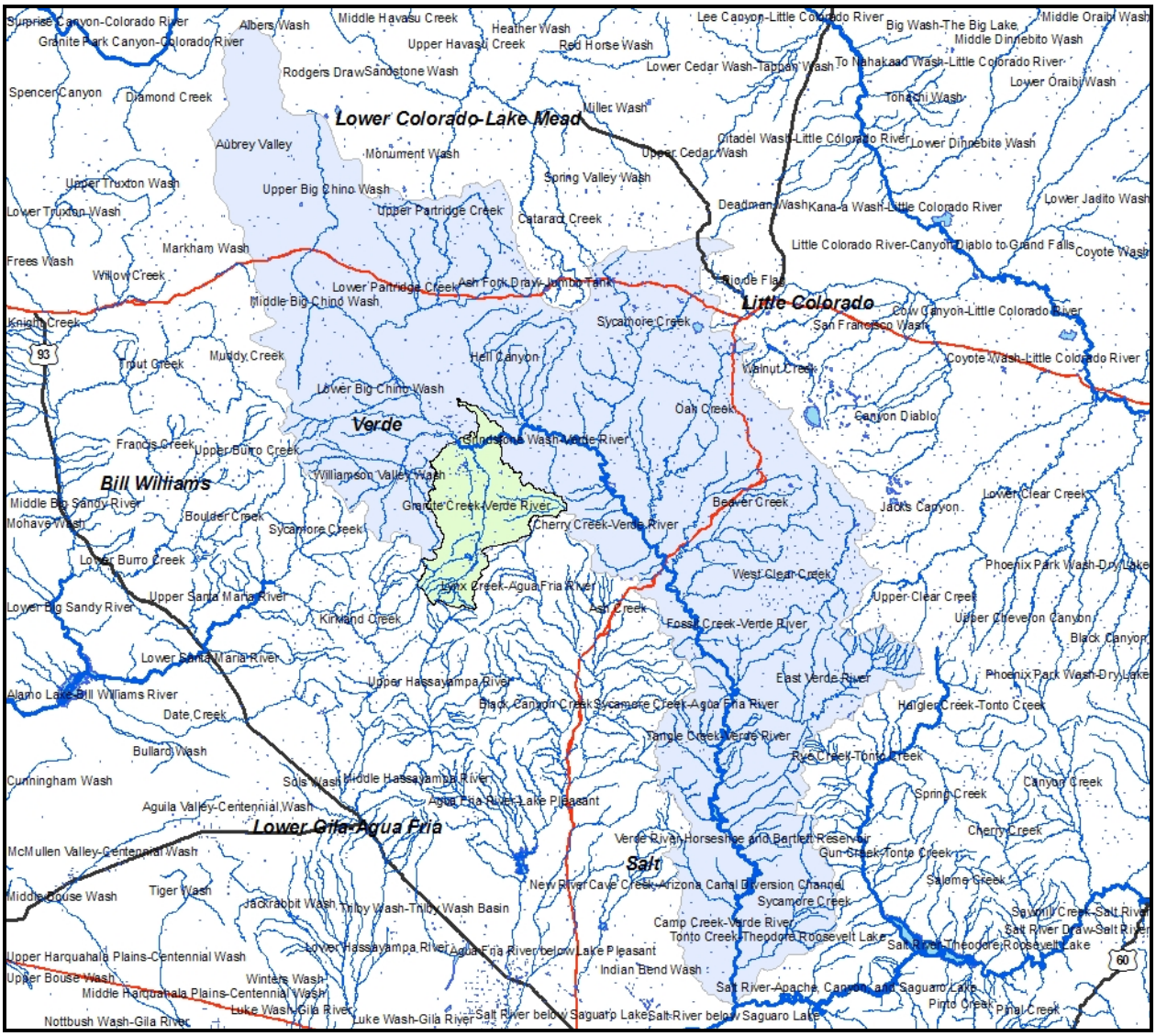

Figure 26. Granite Creek sub-watershed location within the Verde River watershed.

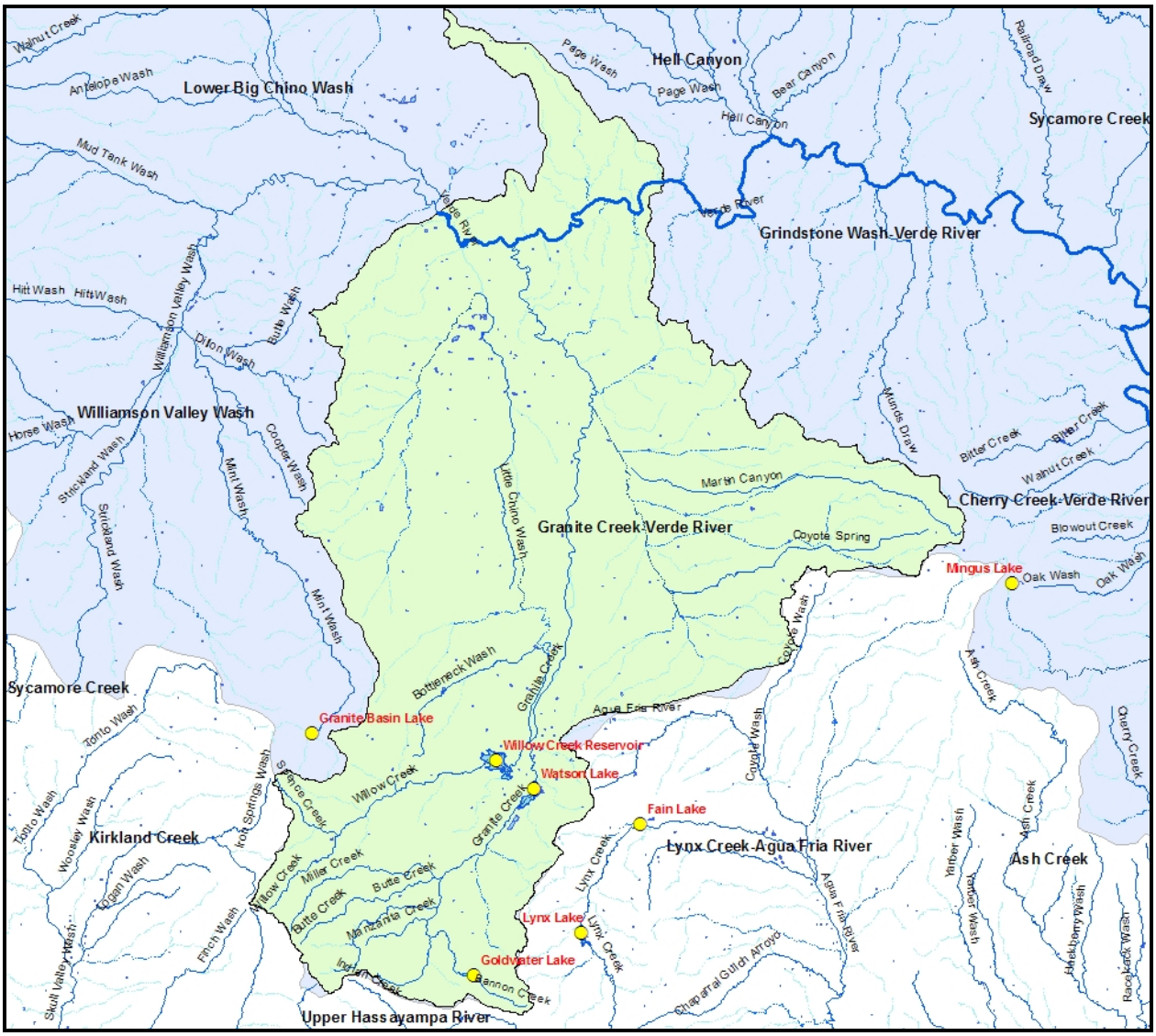

Figure 27. Granite Creek sub-watershed and proposed stocking locations.

Figure 28. Image of upper (right) and lower (left) Goldwater lake (Copyright:© 2009 ESRI, i-cubed, GeoEye).

In 1976, the City created a day-use recreation area at the upper lake. As a result of this development, the Arizona Game and Fish Department (Department) began managing the upper lake as an intensive use, warm water recreational fishery with an emphasis on sunfish and catfish. By the late 1990's, Goldwater offered a launch ramp and two fishing piers located on the southeast side of the lake. Goldwater Park currently offers a trail enabling anglers to access almost the entire lake. Operated as a City Park, Goldwater offers picnic areas, restrooms and a group site. Only boats with a single electric motor are allowed.

Management of Water body

Prior to 2003 Goldwater Lake was managed solely as an intensive use warm water recreational fishery with an emphasis on sunfish and catfish. In 2003, the Department changed the emphasis of the fishery to a "two-story" concept to provide both a warm and cold water fishery and began stocking catchable sized rainbow trout (Table 14). This change was done in response to the increasing population of the area and low catch rates. No fish have been stocked by the Department in the lower lake since it is not open to the public; however, populations of largemouth bass, bluegill, and black crappie are known to persist in the lower lake even though the lower lake has not been sampled (A. Clark pers. comm.).

During most months, angler comments point to Goldwater Lake being the most popular trout fishery in the Region; a year-long creel survey is underway to quantify angler use. The 2001 statewide angler use survey based on angler license sales estimated that Goldwater Lake supported 7,230 angler use days (Pringle 2004). Historically, trophy sized largemouth, state record bluegill and redear sunfish bass have been found at this lake. The City of Prescott houses an employee at the lake; this employee spends some amount of time each year trapping and removing crayfish.

Table 14. Stocking history of Goldwater Lake, 1976 - 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1978	1995	2	2,565
Bluegill	1994	2008	6	6,760
Channel catfish	1976	2008	12	24,271
Largemouth bass	1977	2008	2	264
Rainbow trout	2003	2007	89	112,020
Redear sunfish	1978	1995	5	19,590
Tadpole	1978	1978	1	2,000
Total			75	126,370

The Department plans to manage Goldwater Lake primarily as a year round self-sustaining largemouth bass (average size of not less than 12 inches), bluegill sunfish and black crappie (feature species) fishery, and secondarily as a spring through fall intensive use, put-and-take rainbow trout fishery. Stocking would consist of adult bass typically in the spring months. Since largemouth bass prey on crayfish, future management actions include attempts to reduce the crayfish population by stocking 12-14 inch largemouth bass.

The Department plans to manage for a self sustaining bluegill population that offers anglers an average size of not less than 6 inches. If results of netting and/or electrofishing surveys detect a lower average size, surveys would be scheduled for the next season or the following year to confirm a possible problem. If subsequent surveys confirm low average size, supplemental stockings would be considered.

A self-sustaining black crappie population that offers anglers an average size of not less than 10 inches is desired. If results of netting and/or electrofishing surveys detect a lower average size, surveys would be scheduled for the next season or the following year to confirm a possible problem. If subsequent surveys confirm low average size, supplemental stockings would be considered. Black crappie stockings would consist of adult black crappie typically in the summer months. Need would be determined by angler and netting surveys as previously described.

Triggers that may result in supplemental stockings of largemouth bass, bluegill, black crappie may include: a trend of low catch rates of a certain species in population surveys or creel surveys, fish kills, low numbers or quality of prey species, or significant increases in angler utilization.

Proposed Action

The Department proposes to stock largemouth bass, bluegill sunfish, rainbow trout and black crappie for the period covered by this consultation.

Subcatchable and catchable largemouth bass would be stocked during the spring; numbers of fish stocked would be from 0 - 50 fish per acre annually.

Catchable bluegill would be stocked during summer months; numbers of fish stocked would be from 0 - 10 fish per acre annually.

Catchable black crappie would be stocked during summer months; numbers of fish stocked would be from 0 - 100 fish per acre annually.

Catchable rainbow trout would be stocked bi-monthly from February through November; numbers of fish stocked would be 0-400 fish per acre per stocking event.

Water Distribution / Connectivity

Bannon Creek upstream of Goldwater Lake is the only inflow, and only flows in response to run-off events. The City of Prescott does not keep formal records of Goldwater Lake spill events, and the spill frequency of upper or lower Goldwater Lakes is not known; however Department personnel observations suggest that spills of the upper lake do occur, however at low frequency (A. Clark pers. comm.). The watershed collected by Goldwater Lake is small (Figure 27). Water sources are limited to run-off following extreme storm events. Water spilling from upper

Goldwater is captured by lower Goldwater Lake (Figure 29 and Figure 30). A large dam and spillway backs up lower Goldwater Lake and spills would involve sheet flow and again are infrequent (Figure 31, Figure 32 and Figure 33). Bannon Creek downstream of upper Goldwater Lake, through lower Goldwater Lake, has ephemeral water flow for 2.5 miles, into Granite Creek. From this point Granite Creek has ephemeral water flow for 6 miles into Watson Lake (Figure 34). Manzanita Creek, Aspen Creek, Butte Creek and Miller Creek all flow into Granite Creek downstream from the Bannon Creek confluence. Prescott Reservoir and several other smaller water bodies exist on Aspen Creek. See the water distribution/connectivity section under Watson Lake for Granite Creek water distribution and connectivity downstream of Watson Lake.

Figure 29. Dam at upper Goldwater Lake, April 2004.

Figure 30. Spillway below dam at upper Goldwater Lake, December 2009.

Figure 31. Spillway at lower Goldwater Lake, December 2009.

Figure 32. Spillway at lower Goldwater Dam, December 2009.

Figure 33. Culvert at below spillway at lower Goldwater Dam, December 2009.

Figure 34. Bannon Creek below spillway at lower Goldwater Lake, December 2009.

Fish Movement

Movement of stocked fish would only occur during years of heavy snowfall and previous year conditions allowed both lakes to remain relatively full. Spills out of upper and lower Goldwater would typically be in spring. Water spilling over either dam would involve sheet flow and include large drops into altered streambeds. It generally takes multiple storm events in a row fill both reservoirs and saturate stream channels to result in flow events sufficient to move fish.

It is unknown if fish move out of upper Goldwater Lake into lower Goldwater when the reservoir spills; however, a netting survey of lower Goldwater Lake in August 2009 yielded no fish. Largemouth bass were visually documented in lower Goldwater Lake just weeks before this survey by the Department's Regional Fish Program. If fish did escape the upper lake during run-off events, they would move into the lower lake. A visual survey of Granite Creek in May of 2007 near Miller Valley Road did not detect any fish and habitat was primarily riffles and small shallow pools (Chmiel 2007b). If stocked fish escaped the lower lake, they could travel approximately 2.5 miles downstream Bannon Creek to Granite Creek, then an additional approximately 6 miles downstream to Watson Lake. Normally dry pinion-juniper woodland

washes do not maintain water long enough for fishes to persist. Small, headwater channels of a drainage network are important in determining the amount of sediment transported downstream during storm events. This increased sediment load can have negative effects on channel stability, fish, invertebrates, and overall stream productivity. High sediment loads can often result in fish mortality as a result of decreased dissolved oxygen concentrations, concurrent with increased suspended sediments (Bozek and Young 1994; Waters 1995; Rinne and Carter 2008). Fine clay sediments transported with runoff often prohibit fish survival in pools following runoff events. Given the number of additional streams that would flow into Granite creek below Goldwater Lake it is likely that during run-off events significant enough to result in stream flow, the water flows would have high sediment loads that would likely decrease fish survival during transport, particularly for stocked rainbow trout. See the fish movement section under Watson Lake for movement of fish out of Watson Lake into downstream Granite Creek, and the upper Verde River.

Community Description

The fishery at Goldwater Lake has the potential to offer outstanding angling opportunities. Water quality and chemistry are both conducive to trout survival and good sunfish growth. Oxygen levels are low during summer months, but limited data collected shows it stays above lethal levels (A. Clark pers. comm.). Factors limiting the fishery in the past have been a very large population of crayfish and a growing transient population of double-crested cormorants.

Of the 8 fish species captured in recent surveys in Goldwater Lake, largemouth bass, channel catfish and green sunfish are the predominant species (Table 15). Goldwater Lake does not host any fish species not found in Watson Lake downstream. Crayfish are very abundant.

The relatively low incidence of small age classes of largemouth bass in samples prior to 2009 suggests the crayfish are preying on eggs and harassing spawning adults. One hundred one-pound average largemouth bass were stocked in late summer 2008. This stocking may have produced enough reproducing bass to account for the large numbers of young bass sampled in September 2009 (Table 15). The crayfish are obvious prey items for adult bass but are in such great numbers that recruitment of young size classes may be hampered. The effects of large numbers of crayfish may have an even higher impact on recruitment of bluegill and green sunfish populations since abundance of sunfishes seems lower than expected given the available habitat. A sharp decline in green sunfish is noted between the 2000 and 2003 surveys. Rocky habitats are favored by both sunfishes and crayfish, and crayfish may be competing better than bluegill and green sunfish for available space. Angling pressure and no supplemental stockings since 2001 may have contributed to declines in sunfishes.

Aquatic plant abundance and diversity is low, with only two species, Eurasian water milfoil and northern water milfoil being recorded in a 2004 survey (Robinson et al. 2007). Rooted aquatic vegetation can be troublesome for anglers during summer months, but most likely is quality habitat used by bass and sunfishes. Observations made in July 2005 indicated much of the area around the piers was denuded of vegetation, presumably by crayfish. As one walks along the shoreline in between the piers, the bottom moves as hundreds of crayfish flee to deeper water. As of summer of 2009, aquatic vegetation continues to be limited around the lake (A. Clark pers. comm.). Crayfish trapping by the Department and by the City has been successful on a small scale; however, these activities are time consuming and must be done on a long term and consistent basis to be effective. Re-building a population of largemouth bass large enough to limit the crayfish population may be a better solution.

There are no endangered, threatened or candidate fish species or critical habitat in Granite Creek above Watson Lake. Goldwater Lake is located in the bald eagle DPS. Goldwater Lake is located within Mexican spotted owl critical habitat.

Table 15. Species, number, relative abundance, size range and catch per unit effort of fish surveys by electrofishing at Goldwater Lake.

June 2000					
N= 70.0	Total Weight (grams)= 29,820			Total effort units (minutes) = 29	
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Size Range (mm)**
Black Crappie	16	16	9.41%	0.12	56-100
Golden Shiner	1	1	0.59%	0.01	111
Largemouth Bass	28	28	16.47%	0.22	175-460
Bluegill	2	2	1.18%	0.02	65-207
Green Sunfish	110	110	64.71%	0.85	54-200
Channel Catfish	12	12	7.06%	0.09	153-542
Goldfish	1	1	0.59%	0.01	180
June 2001-target Largemouth bass collected for ADEQ contaminants study					
N=5	Total Weight=3083			Total effort units (minutes) = 18	
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Size Range (mm)**
Largemouth Bass	5	5	100	.27	310-415
June 2003					
N=11	Total Weight=7807			Total effort units (minutes) = 46	

Common Name	Num. Sampled	Num. Measured	% of Total	CPUE	Size Range (mm)
Largemouth Bass	6	6	54.55%	0.13	410-470
Green Sunfish	5	5	45.45%	0.11	80-95
May 2006					
N=137	Total Weight=22209			Total effort units (minutes) = 45	
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Size Range (mm)**
Black Crappie	1	1	0.73%	0.02	95
Rainbow Trout	20	20	14.60%	0.44	185-315
Largemouth Bass	5	5	3.65%	0.11	375-535
Green Sunfish	109	109	79.56%	2.42	80-155
Channel Catfish	2	2	1.46%	0.04	620-625
May 2007					
N=95	Total Weight=14985			Total effort units (minutes) = 42	
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Size Range (mm)**
Rainbow Trout	20	20	21.28%	0.48	220-280
Largemouth Bass	2	2	2.13%	0.05	420-470
Bluegill	1	1	1.06%	0.02	185
Green Sunfish	70	70	74.47%	1.67	52-183
Channel Catfish	1	1	1.06%	0.02	770
Goldfish	1	1	1.06%	0.02	402
September 2008					
N=421	Total Weight=21533			Total effort units (minutes) = 30	
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Size Range (mm)**
Rainbow Trout	8.00	8.00	1.90%	0.27	228-375
Largemouth Bass	0.00	0.00	0.00%	0.00	0
Bluegill	7.00	7.00	1.66%	0.23	125-155
Green Sunfish	404.00	404.00	95.96%	13.47	52-175
Channel Catfish	2	2	0.48	.07	755-840
September 2009					
N=159	Total Weight=18073			Total effort units (minutes) = 30	

Common Name	Num. Sampled	Num. Measured	% of Total	CPUE	Size Range (mm)
Rainbow Trout	6.00	6.00	3.77%	0.20	235-257
Largemouth Bass	93.00	4.00	58.49%	3.10	100-349
Bluegill	0.00	0.00	0.00%	0.00	0
Green Sunfish	50.00	4.00	31.45%	1.67	100-180
Channel Catfish	8.00	8.00	5.03%	0.27	426-616
Smallmouth Bass	1.00	1.00	0.63%	0.03	280
Red Shiner	1	0.00	0.63%	0.03	>100

Consultation Species or Critical Habitat

Potential impacts to bald eagle and Mexican spotted owl and critical habitat are discussed immediately below. Consultation species and critical habitats potentially impacted downstream are located in the Upper Verde River and are addressed in the Upper Verde River analysis. Northern Mexican and narrow-headed gartersnakes are analyzed within the Granite Creek Complex analysis and also addressed in the Upper Verde River analysis.

Bald Eagle

Lynx Breeding Area is located approximately 4.2 miles from Goldwater Lake and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2001 and were last observed 21 May, 2009. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. Observed prey in 2006 included: birds (17.1%), fish (14.3%), mammals (14.3%), carrion (5.7%), and unknown (48.6%). No prey items could further be identified. Lynx Breeding Area productivity data show that the nest has been successful in 2007, 2008, and 2009 (Jacobson et al 2006, 2007; McCarty and Jacobson 2008, 2009).

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. Goldwater Lake has monofilament bins present currently.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally

move between available sites so the reduction in use of a particular stocking site may not be significant.

Mexican Spotted Owl
This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts
The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Watson Lake
Site Description
Watson Lake is a 200 surface-acre reservoir located on Granite Creek approximately 9 miles downstream of Goldwater Lake (Figure 27). Watson Lake was created in 1912 on land acquired by the Arizona Land and Irrigation Company in the early 1900's. The dam took 2-years to complete and Watson Lake filled for the first time in 1915. The Arizona Land and Irrigation Company transferred all of its rights, title and interest in Watson Lake to the Hassayampa Alfalfa Farms in 1914. The entity that was Hassayampa Alfalfa Farms became the Chino Valley Water District (CVID) in 1925.

Historically both Willow Lake and Watson Lake were used for agricultural purposes around the town of Chino Valley. In December of 1998, the City of Prescott (City) purchased both reservoirs and the water rights, to provide recreation to area residents (Figure 35). In addition to recreation, the city now uses water in Watson and Willow to help achieve aquifer recharge goals that could factor into future "safe-yield" determinations as part of the Prescott Active Management Area (AMA). The capacity of Watson Lake is 4,600 acre-feet. Storage beyond this capacity is to be released into Willow Lake between April and October annually to meet aquifer recharge goals and from spilling into Granite Creek. A 4-inch pipe aqueduct exists that can

divert water from Watson to Willow Lake. The spillway elevation at Watson Lake is considered by the City to be equivalent to the 100-year floodplain. The City of Prescott (City) is anticipating keeping the level of water at Watson Lake as full as possible at its conservation pool or greater which is 5,161 feet above mean sea level (Logan Simpson Design 2000). This elevation is the same as the spillway elevation.

Watson Lake is a popular city park with restroom, picnic, playground, and other recreational facilities available to visitors (Figure 36). The City has invested significant resources into installing a second boat launch and floating mooring pier associated with the launch. Parking areas for boaters have also been expanded and improved. There are no motor restrictions on this lake.

Figure 35. Aerial satellite image of Watson Lake and Willow Creek Lakes (Copyright:© 2009 ESRI, i-cubed, GeoEye).

Figure 36. Aerial satellite image of Watson Lake through which Granit Creek flows (Copyright:© 2009 ESRI, i-cubed, GeoEye). The dam is located at the north end of the reservoir.

Management of Water Body

Currently, Watson Lake is managed as a self-sustaining warm water fishery with largemouth bass, black crappie, channel catfish, and bluegill. The Department hatchery program has stocked fish into Watson Lake for more than 60 years; 9 fish species have been stocked, including black crappie, bluegill, and rainbow trout (Table 16). Trout stockings have been sporadic and typically associated with high water events. Watson Lake was historically operated as a water retention basin for Chino Valley Irrigation District (CVID), so water conditions were frequently lethal to fish. Water releases from Watson Lake to the CVID was through a series of canals that often transported fish down into areas around Chino Valley and Paulden (N. Freeman, pers. comm.). Stockings were either to reestablish populations of warm water species or for short-term put-and-take trout fisheries. High numbers of these species have been stocked in the past, few individuals of stocked species have been found in downstream reaches of the Verde River since 1998 when the City acquired the lakes (AGFD Nongame database records; A. Clark, pers. comm.). This suggests a lack of suitable habitat in the Verde River as high water temperatures likely limit trout

persistence, minimal lentic habitat needed to support black crappie, bluegill, or largemouth bass is eliminated when flooding events scour the channel, and lack of connection due to the City's typical management of the lakes. Because of water recharge efforts as well as sand and gravel operations in Granite Creek, water does not typically flow from Watson Lake to the Verde River during most years.

Creel surveys have not been conducted at Watson Lake; however, the 2001 statewide angler use survey based on angler license sales estimated that Watson Lake supported 4,196 angler use days (Pringle 2004).

Table 16. Stocking history of Watson Lake 1941 – 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Black crappie	1967	1997	4	3,288
Bluegill	1941	1997	11	79,205
Channel catfish	1960	1998	14	96,366
Gila topminnow	1970	1970	1	1,360
Largemouth bass	1941	1999	15	60,438
Plains red shiner	1958	1958	1	1,800
Rainbow trout	1961	1962	12	12,000
Redear sunfish	1949	1967	2	10,570
Tadpole	1968	1973	3	22,000
Threadfin shad	1958	1973	4	5,100
Total			67	292,127

Future management objectives would center on infrequent stockings of stock sizes of black crappie and bluegill to augment self-reproducing populations. This most often would involve adult-sized fish. A seasonal rainbow trout put-and-take fishery would also be established. Winter-time stockings of catchable-sized rainbow trout would be utilized to increase angler opportunity in the Prescott area since the growing population has resulted in growing demand for angling opportunities. Rainbow Trout are not expected to reproduce in Watson Lake due to thermal limitations and predator loads. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic flooding events. Periodic sampling to monitor populations would occur to evaluate what species are in need of augmentation.

Proposed Action

The Department proposes to stock bluegill sunfish, black crappie and rainbow trout for the period covered by this consultation.

Catchable sized rainbow trout would be stocked in winter months, typically for November to March annually; number of trout stocked would be from 0 - 15,000 fish annually.

Bluegill (fingerling, catchable) and black crappie (fingerling, catchable) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fingerling bluegill would be from 0 - 200,000 fish annually; numbers of catchable bluegill would be from 0 – 2,000 fish annually. Numbers of fingerling black crappie would be from 0 - 200,000 fish annually; numbers of catchable black crappie would be from 0 – 2,000 fish annually.

Water Distribution / Connectivity

Water flows into Watson Lake following storm events extreme enough to result in runoff. Often multiple successive storm events are required before flows sufficient to connect to Watson Lake occur. Several streams flow into Granite Creek downstream of its confluence with Bannon Creek (upon which Goldwater Lake is located); these include Manzanita Creek, Aspen Creek, Butte Creek and Miller Creek as well as 2 unnamed streams. Runoff also flows directly into Watson Lake from a small tributary to the southeast. The Sun Dog Water Treatment facility is located just upstream of Watson Lake adjacent to Granite Creek. Settling ponds associated with this facility are fed by municipal sewer water and are not known to contribute fishes or aquatic life to Granite Creek or Watson Lake.

Releases to meet City recharge objectives do not flow down Granite Creek proper except briefly, immediately below Watson Dam to just upstream of where Willow Creek flows into Granite Creek (also upstream of USGS gauge 09503300, Figure 42, Granite Creek below Watson Lake near Prescott, AZ). Water spilling over the dam at Watson falls roughly 8 feet onto rocks before continuing downstream to a diversion dam.

In agreements with Salt River Project, Arizona Department of Water Resources and Chino Valley Water District, water may be released from Watson Lake via release valve or spill annually between April and October to meet water recharge objectives for the City; these releases are captured by open canal via a diversion dam (Figure 37) and carried by culverts to the water recharge facility near the Prescott Airport. Because the City manages Watson Lake at or near conservation pool, typically lake levels are within several feet of the dam. Water has spilled at Watson recently in 2005 and 2008 (C. Dotseth, pers. comm.). If spills over the dam occur outside of the April to October window, flow does not count toward the City's recharge objectives. This credit is extremely important to the area because it could help determine further "safe yield" determinations by the Arizona Department of Water Resources. Spills occurring outside of the City's releases must overcome the city diversion structures, sand and gravel pits

and other modifications to the Granite Creek streambed to reach the upper Verde River. This has been known to occur in 1993 and 2005.

An in-depth analysis of Granite Creek flow and connectivity downstream of Watson Lake to the upper Verde River is discussed in the Complex Analysis section.

Figure 37. Diversion Dam at UTM 12S 370118 mE 3830219mN (NAD27), USGS gage 09503300. Picture is from City's diversion canal.

Fish Movement

During runoff events sufficient enough to result in Granite Creek connecting to Watson Lake, fish in Watson Lake could move upstream into Granite Creek. Watson and Willow Lakes are directly in or adjacent to the stream course of Granite Creek. This placement makes them more prone to contributing non-native fishes to the upper Verde. City water management strategies result in maintenance of water levels for both reservoirs within several feet of their spillways and may make flooding more common. The city stands to lose a great deal, however, if any water is allowed to flow very far down Granite Creek below Watson Lake. Some flexibility does exist in the management of these reservoirs. Changes in water release since the City acquired these lakes may make downstream movement of fishes less likely than in years prior to 1998, when open canals carried water and fish from Watson Lake to the Chino Valley area into close proximity to

the upper Verde. Recipients of Watson and Willow Lake releases were agricultural in nature and had less control over where water ended up in the Chino Valley/Paulden area. Now, the City measures and monitors release in order to maximize the water recharge credits (C. Dotseth personnel comm.). Various private farm ponds harbored non-native fishes from Watson and Willow Lakes in the past. Many of these ponds are not in use today because agricultural uses have been reduced and water that used to be available is now used by Prescott.

The Granite Creek and Willow Creek watersheds are similar but distinct. Willow Lake is much larger than Watson yet its watershed is much smaller. Currently, water can be diverted from Watson to Willow in order to lower levels in Watson and prevent spilling through an aqueduct between the two. Three sand and gravel facilities operate in Granite Creek. One of these facilities is located upstream of Watson Lake and two are located just downstream of Watson Lake, one in the vicinity of the Prescott Airport (Hansen Materials), and one downstream of the town of Chino Valley. Settling ponds are present at all three facilities. These ponds could harbor non-native fish populations but no data are available to confirm this. Prescott receives credit for ground water recharge in the vicinity of the Prescott Airport. There is also a water treatment plan as well as a town park located upstream of Watson Lake.

Granite Creek has flooded to a sufficient magnitude to allow transport of fishes to the upper Verde River several times in the past 30 years (Clark 2003b). There are no known City records of spill events to indicate how often Watson Lake spills. Because the 23-miles of Granite Creek below Watson Lake is a wide sandy alluvium containing two sand and gravel operations which impede flow, and because the City of Prescott will keep as much water as possible, escapement of fish out of Watson Lake, through Granite Creek to the upper Verde River is only likely to occur during large high flow events.

See the Granite Creek Complex Analysis for a description and evaluation of fish movement from Watson Lake into downstream Granite Creek downstream.

Community Description

Watson Lake has two distinct regions; the inflow from Granite Creek is marked by a huge stand of cottonwood trees dubbed “Watson Wood”. This southern portion of the lake is shallow, weedy, and typically is home to millions of small bodied fishes such as red shiner, golden shiner, fathead minnow, and some longfin dace (A. Clark, pers. obs.). Hundreds of various bird species frequent this area as well. The northern region of Watson is characterized by the “Granite Dells” area. Huge boulders of granite are evident in this deeper part of the lake. Of the ten fish species captured in recent surveys, largemouth bass, yellow bullhead, and green sunfish are the predominant species (Table 17).

See the Granite Creek Complex analysis for a description of aquatic community assemblage in Granite Creek downstream from Watson Lake.

Watson Lake is within the bald eagle distinct population segment (DPS).

Table 17. Number, relative abundance, relative biomass and catch per unit effort of sampling at Watson Lake.

July 1999 (electrofishing)						
N= 37	Total Weight= 3050			Total effort units = 88 min.		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Green Sunfish	34	34	92%	0.39	2290	75.08%
Largemouth Bass	1	1	3%	0.01	710	23.28%
Fathead Minnow	1	1	3%	0.01	30	0.98%
Yellow Bullhead	1	1	3%	0.01	20	0.66%
Bluegill	100's	0				
Red Shiner	1000's	0				
May 2000 (electrofishing)						
N=339	Total Weight=27350			Total effort units = 171 min		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Fathead Minnow	1	1	0%	0.01	30	0.11%
Yellow Bullhead	4	4	1%	0.02	1470	5.37%
Green Sunfish	170	170	50%	0.99	13730	50.20%
Bluegill	76	76	22%	0.44	2670	9.76%
Largemouth Bass	18	18	5%	0.11	6840	25.01%
Golden Shiner	70	70	21%	0.41	2610	9.54%
June 2003 (electrofishing)						
N=387	Total Weight=3988			Total effort units = 171 min		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Green Sunfish	67	67	89%	1.49	1181	29.61%
Largemouth Bass	314	2	3%	0.04	1263	31.67%
Yellow Bullhead	6	6	8%	0.13	1544	38.72%
June 2005 (electrofishing)						
N=65	Total Weight=6858			Total effort units = 45 min		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Yellow Bullhead	7	7	10.77%	0.16	1148	16.74%

Red Shiner	1	1	1.54%	0.02	8	0.12%
Channel Catfish	1	1	1.54%	0.02	4794	69.90%
Green Sunfish	29	29	44.62%	0.64	516	7.52%
Bluegill	1	1	1.54%	0.02	9	0.13%
Largemouth Bass	23	23	35.38%	0.51	326	4.75%
Golden Shiner	2	2	3.08%	0.04	27	0.39%
Black Crappie	1	1	1.54%	0.02	30	0.44%
April 2007 (electrofishing)						
N=75	Total Weight=6801			Total effort units = 47 min		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Black Bullhead	15	15	20%	0.32	3307	48.63%
Green Sunfish	53	53	70.67%	1.13	1649	24.25%
Bluegill	1	1	1.33%	0.02	56	0.82%
Largemouth Bass	6	6	8%	0.13	1789	26.30%
September 2008 (Fishes < 100mm TL were counted, but not measured.)						
N=331	Total Weight=29653			Total effort units = 46 min		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Yellow Bullhead	42	42	12.69%	0.91	11985	40.42%
Green Sunfish	28	15	4.53%	0.61	563	1.90%
Bluegill	12	12	3.63%	0.26	476	1.61%
Largemouth Bass	380	243	73.41%	8.26	15609	52.64%
Golden Shiner	8	8	2.42%	0.17	326	1.10%
Black Crappie	14	11	3.32%	0.30	694	2.34%
October 2008 (electrofishing)						
N=36	Total Weight=694			Total effort units =36 min		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Weight Sampled (g)**	**% of Total**
Black Crappie	24	24	66.67%	0.30	256	36.89%
Yellow Bullhead	3	3	8.33%	0.04	235	33.86%
Largemouth Bass	3	3	8.33%	0.04	61	8.79%
Green Sunfish	6	6	16.67%	0.07	142	20.46%

Consultation Species or Critical Habitat

Potential impacts to bald eagle and Western yellow-billed cuckoo are discussed below. Consultation species and critical habitats potentially impacted downstream are located in the

Upper Verde River and are addressed in the Upper Verde River analysis. Northern Mexican and narrow-headed gartersnakes are analyzed within the Granite Creek Complex analysis and also addressed in the Upper Verde River analysis.

Bald Eagle

Lynx Breeding Area is located approximately 5.3 miles from Watson Lake and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2001 and were last observed 21 May, 2009. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. Observed prey in 2006 included: birds (17.1%), fish (14.3%), mammals (14.3%), carrion (5.7%), and unknown (48.6%). No prey items could further be identified. Lynx Breeding Area productivity data show that the nest has been successful in 2007, 2008, and 2009 (Jacobson et al 2006, 2007; McCarty and Jacobson 2008, 2009).

Sullivan Breeding Area is approximately 15.6 miles from Watson Lake and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2007 and were last observed at the breeding area in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Sullivan Breeding Area productivity data show that the nest failed in 2007, failed in 2008, and failed again in 2009 with one nestling gone 11 April, 2009-21 April, 2009 before they were 3 weeks old. The second nestling dies in the nest at 4-5 weeks old (Jacobson et al 2006, 2007; McCarty and Jacobson 2008, 2009). Watson Lake does have monofilament bins present.

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Western Yellow-Billed Cuckoo

A documented occurrence was recorded in Granite Creek over 4 miles south of the lake in 1991. Documented occurrences have been recorded in the Upper Verde River.

Potential Impacts

There may be some limited amount of habitat degradation and some amount of disturbance to nesting cuckoos from anglers using or creating new trails to access the stocking site.

Potential impacts to migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance.

Willow Creek Reservoir

Site Description

Willow Creek Reservoir, locally known as just Willow Lake, was impounded in 1936 by the Chino Valley Water District (CVID) and is located in Prescott, AZ. The far eastern portion of the lake is privately owned. Willow Lake is located in close proximity to Watson Lake (Figure 35).Willow Lake dam impounds Willow Creek, creating the reservoir, which drains into Granite Creek 1.3 miles downstream of the Watson Lake spillway (Figure 38).

Historically both Willow Lake and Watson Lake were used for agricultural purposes around the town of Chino Valley. In December of 1998, the City of Prescott (City) purchased both reservoirs and the water rights, to provide recreation to area residents. In addition to recreation, the city now uses water in Watson and Willow to help achieve aquifer recharge goals that could factor into future “safe-yield” determinations as part of the Prescott Active Management Area (AMA). Willow Lake’s storage right capacity is 5,980 acre-feet. The spillway pool elevation is 5,140.5 feet above sea level, providing approximately 342 surface-acres of water storage. The conservation pool level is at 5,136 feet. The spillway elevation at both lakes is currently considered to be equivalent to the 100- year floodplain limit. Willow Lake can be filled by a 4-inch pipe aqueduct that can divert water (operating one way) from Watson to Willow Lake. Watson is at a higher elevation, but Willow Lake has a larger basin and often can take excess water from Watson. Willow Lake is relatively shallow with an average depth of less than 15-feet. The City is anticipating keeping the level of water at both of these lakes at their conservation pool elevation or greater (Logan Simpson Design 2000).

The City of Prescott has invested significant resources into installing a boat launch and floating pier associated with the launch. Parking areas for boaters have also been expanded and improved.

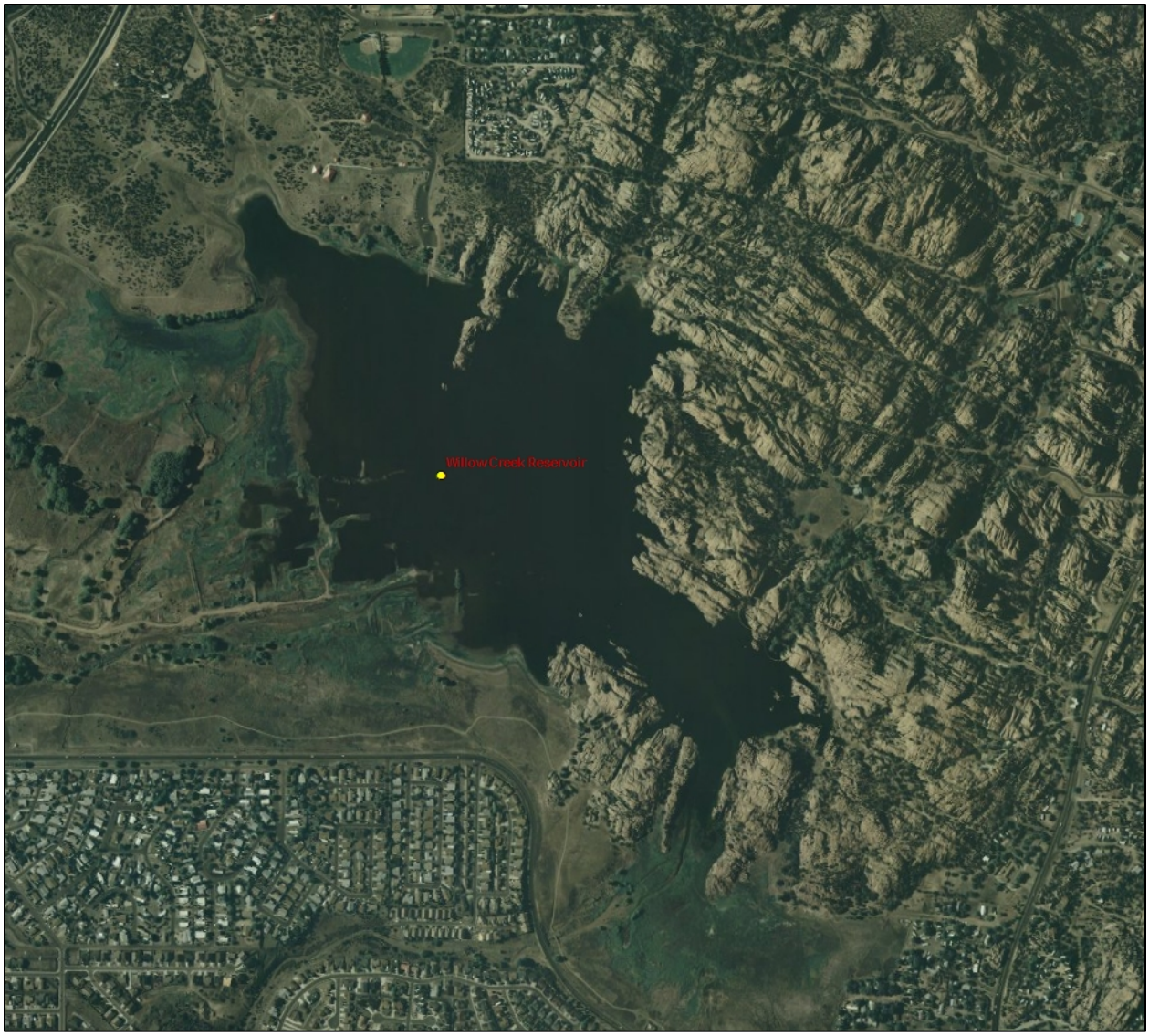

Figure 38. Image of Willow Lake (Copyright:© 2009 ESRI, i-cubed, GeoEye). The dam and flow is from lower left to upper right with Willow Creek coming in just above the lower subdivision.

Management of Water Body

Currently Willow Lake is managed as a self-sustaining warm water fishery with largemouth bass, black crappie, channel catfish, and bluegill. The Department's hatchery program has stocked fish into Willow Lake for more than 60 years; 5 fish species have been stocked, including brook trout and rainbow trout (Table 18). The City has stocked additional species, including black crappie, channel catfish, and bluegill in the past. Trout stockings have been sporadic and typically associated with high water events. Because Watson and Willow Lakes were historically operated as a water retention basin for Chino Valley Irrigation District, water

conditions were frequently lethal to fish. Water releases from Watson Lake to the CVID was through a series of open canals and culverts that often transported fish (N. Freeman pers. comm.; see Watson Lake section for detailed description). Stockings were either to reestablish populations of warm-water species, or for short-term put-and-take trout fisheries.

Willow Creek Reservoir currently has an aquatic weed problem that makes boating and fishing very challenging. From late April through October floating mats of pondweed, as well as a dozen other weed species, dominate the lake (Robinson 2005). Like Watson Lake, the inflow area is shallower and altered by sand and gravel operations and other developments. The deeper parts of the lake are near the dam. This area is the only place with open water during summer months.

Creel surveys have not been conducted at Willow Lake; however, the 2001 statewide angler use survey based on angler license sales estimated that Willow Lake supported 65,090 angler use days (Pringle 2004).

Future management objectives will center on infrequent stockings of stock sizes black crappie, and bluegill to augment self-reproducing populations. A seasonal rainbow trout put-and-take fishery would also be established. Winter-time stockings of catchable-sized rainbow trout would be used to increase angler opportunity in the Prescott area since the growing population has resulted in growing demand for angling opportunities. Rainbow trout are not expected to reproduce in Willow Lake due to thermal limitations and predator loads. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic flooding events. Periodic sampling to monitor populations would occur to evaluate what species are in need of augmentation.

Table 18. Stocking history for Willow Creek.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook trout	1978	1995	44	339,057
Brown trout	1977	1995	40	600,020
Cutthroat trout	1972	1995	15	495,706
Rainbow trout	1968	2007	798	3,134,732
Largemouth Bass	1939	1999	10	58,475
Total			907	4,627,990

Proposed Action

The Department proposes to stock bluegill sunfish, black crappie and rainbow trout for the period covered by this consultation.

Catchable sized rainbow trout would be stocked in winter months, typically for November to March annually; number of trout stocked would be from 0 - 15,000 fish annually.

Bluegill (fingerling, catchable) and black crappie (fingerling, catchable) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fingerling bluegill would be from 0 - 200,000 fish annually; numbers of catchable bluegill would be from 0 – 2,000 fish annually. Numbers of fingerling black crappie would be from 0 - 200,000 fish annually; numbers of catchable black crappie would be from 0 – 2,000 fish annually.

Water Distribution / Connectivity

Willow Creek courses 10.5 miles from the slopes of the Sierra Prieta until it hits Willow Creek Dam. It is an ephemeral waterway flowing only in response to spring runoff or large storm events. Willow Lake impounds approximately 13 miles of Willow Creek. Below Willow Lake Dam, Willow Creek and enters Granite Creek 1.3 miles downstream of the Willow Lake spillway. Water will flow over the spillway of Willow Dam, either from summer or winter precipitation. The City of Prescott does not keep formal records of Willow Lake spill events, and the spill frequency is not known; however Department personnel observations suggest that spills of the lake do occur (A. Clark pers. com.). The City of Prescott's Master Plan defines conservation pool (ideal) water elevations for both lakes. The conservation pools elevation is 5,136 feet above sea level. This results in about 4 feet between the spillway elevation and conservation pool. Water spilling over the spillway at Willow Lake falls 8 to 10 feet onto rocks before continuing down to Granite Creek. Once at Granite Creek flow must overcome the city diversion structures, sand and gravel pits and other modifications to the Granite Creek streambed to reach the upper Verde River. This has been known to occur in 1993 and 2005.

Records indicate Granite Creek has flooded to a sufficient magnitude to allow transport of fishes to the upper Verde River several times in the past 30 years (Clark 2003b). Water topped the Willow and Watson dams during the flood events of December 2004-January 2005 when Granite Creek flowed all the way to the Verde River.

Watson and Willow Lakes are directly in or adjacent to the stream course of Granite Creek which makes them more prone to contributing non-native fishes to the upper Verde. The City plans to continue to maintain water elevations of both reservoirs within several feet of their spillways making spilling and downstream flooding more common. The city stands to lose a great deal, however, if any water is allowed to flow very far down Granite Creek below Watson Lake. Prescott receives credit for ground water recharge in the vicinity of the Prescott Airport. This credit is extremely important to the area because it could help determine further "safe yield" determinations by the Arizona Department of Water Resources.

Some flexibility does exist in the management of these reservoirs. Changes in water release since the City acquired these lakes may make downstream movement of fishes even less likely than in years prior to 1998. Changes in water release since the City acquired these lakes may make downstream movement of fishes less likely than in years prior to 1998, when open canals carried water and fish from Watson Lake to the Chino Valley area into close proximity to the upper Verde. Recipients of Watson and Willow Lake releases were agricultural in nature and had less control over where water ended up in the Chino Valley/Paulden area. Now, the City measures and monitors release in order to maximize the water recharge credits (C. Dotseth personnel comm.). Various private farm ponds harbored non-native fishes from Watson and Willow Lakes in the past. Many of these ponds are not in use today because agricultural uses have been reduced and water that used to be available is now used by Prescott.

The Granite Creek and Willow Creek watersheds are similar but distinct. Willow Lake is much larger than Watson, yet its watershed is much smaller. In order to lower water levels in Watson and prevent spilling, diversion of water to Willow Lake can occur through an aqueduct between the two reservoirs. Fishes of various life stages can be transferred to Willow Lake from Watson Lake via this aqueduct. This is a one way transfer as the nature of the pipe and culvert does not allow transport of fishes back up to Watson from Willow. Water is transferred when City Officials deem it beneficial to capture water from Watson before it spills especially outside of the April to October release window (C. Dotseth personnel comm.).

An in-depth analysis of Granite Creek flow and connectivity downstream of Willow Lake to the upper Verde River is discussed in the Complex Analysis section.

Fish Movement

During runoff events sufficient enough to result in Willow Creek connecting to Willow Lake, fish in Willow Lake could move upstream into Willow Creek.

When Willow Lake spills, fish can escape and be transported downstream in Granite Creek. Watson and Willow Lakes are directly in or adjacent to the stream course of Granite Creek. This placement makes them more prone to contributing non-native fishes to the upper Verde. City water management strategies result in maintenance of water levels for both reservoirs within several feet of their spillways and may make flooding more common. The city stands to lose a great deal, however, if any water is allowed to flow very far down Granite Creek below Watson Lake. Some flexibility does exist in the management of these reservoirs. Changes in water release since the City acquired these lakes may make downstream movement of fishes even less likely than in years prior to 1998. Changes in water release since the City acquired these lakes may make downstream movement of fishes less likely than in years prior to 1998, when open canals carried water and fish from Watson Lake to the Chino Valley area into close proximity to

the upper Verde. Recipients of Watson and Willow Lake releases were agricultural in nature and had less control over where water ended up in the Chino Valley/Paulden area. Now, the City measures and monitors release in order to maximize the water recharge credits (C. Dotseth personnel comm.). Various private farm ponds harbored non-native fishes from Watson and Willow Lakes in the past. Many of these ponds are not in use today because agricultural uses have been reduced and water that used to be available is now used by Prescott.

Granite Creek has flooded to a sufficient magnitude to allow transport of fishes from Watson or Willow Lakes to the upper Verde River several times in the past 30 years (Clark 2003b). There are no known City records of spill events to indicate how often Watson Lake spills. Since the 23 miles of Granite Creek downstream of where Willow Creek flows into Granite Creek is wide sandy alluvium and contains two sand and gravel operations that impede flow, and the City of Prescott minimizes loss of water as much water as possible, escapement of fish out of Willow Lake, through Granite Creek to the upper Verde River is only likely to occur during large high flow events.

Refer to the Granite Creek Complex Analysis for a description and evaluation of fish movement from Willow Lake into downstream Granite Creek downstream.

Community Description
Of the 9 fish species captured in recent years, in Willow Lake, largemouth bass, bluegill sunfish, and green sunfish are the predominant species at Willow Lake (Table 19). Black crappie were historically numerous, but have not been collected during surveys in the last 10 years.

See the Granite Creek Complex analysis for a description of aquatic community assemblage in Granite Creek downstream from Willow Lake.

Willow Lake is within the bald eagle distinct population segment (DPS).

Table 19. Number, relative abundance, size range and catch per unit effort of sampling by electrofishing at Willow Lake 2000-2008.

May 2000						
N= 35	Total Weight= 5755			Total effort units = 77		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Length Range (mm)**	
Golden Shiner	1	1	3%	0.01	100	
Largemouth Bass	5	5	14%	0.06	165-490	

Redear Sunfish	3	3	9%	0.04	190-199	
Green Sunfish	26	26	74%	0.34	60-168	
June 2001						
N=5	Total Weight= 4315			Total effort units = 0		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Length Range (mm)**	
Largemouth Bass	5		100%	5	320-465	
June 2005						
N=187	Total Weight= 4857			Total effort units = 47		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Length Range (mm)**	
Mosquitofish	1	1	0.53%	0.02	55	
Green Sunfish	150	150	80.21%	3.19	58-127	
Largemouth Bass	34	34	18.18%	0.72	58-404	
Fathead Minnow	2	2	1.07%	0.04	46-54	
May 2006						
N=38	Total Weight= 3209			Total effort units =45		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Length Range (mm)**	
Golden Shiner	2	2	1%	0.04	130	
Largemouth Bass	15	15	42%	0.33	175-395	
Green Sunfish	21	21	57%	0.47	45-180	
April 2007						
N=33	Total Weight= 16213			Total effort units =45		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Length Range (mm)**	
Largemouth	21.00	21.00	64%	0.47	130-480	

Bass						
Green Sunfish	9.00	9.00	27%	0.20	55-180	
Golden Shiner	2.00	2.00	6%	0.04	115-130	
Black Bullhead	1.00	1.00	3%	0.02	280	
April 2008						
N=25	Total Weight= 2352			Total effort units =44		
Common Name	**Num. Sampled**	**Num. Measured**	**% of Total**	**CPUE**	**Length Range (mm)**	
Largemouth Bass	Largemouth Bass	14.00	14.00	56%	91-396	
Green Sunfish	Green Sunfish	4.00	4.00	16%	67-110	
Golden Shiner	Golden Shiner	6.00	6.00	24%	100-155	
Red Shiner	Red Shiner	1.00	1.00	4%	114	

Consultation Species or Critical Habitat
Potential impacts to bald eagle and Western yellow-billed cuckoo are discussed below. Consultation species and critical habitats potentially impacted downstream are located in the Upper Verde River and are addressed in the Upper Verde River analysis. Northern Mexican and narrow-headed garter snakes are analyzed within the Granite Creek Complex analysis and also addressed in the Upper Verde River analysis.

Bald Eagle
Lynx Breeding Area is located approximately 6.9 miles from Willow Creek Reservoir and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2001 and were last observed 21 May, 2009. Nest watchers were able to observe the prey types and in some cases species that were delivered to the nest by the eagles. Observed prey in 2006 included birds (17.1%), fish (14.3%), mammals (14.3%), carrion (5.7%), and unknown (48.6%). No prey items could further be identified. Lynx Breeding Area productivity data shows that the nest has been successful in 2007, 2008, and 2009 (Jacobson et al 2006, 2007; McCarty and Jacobson 2008, 2009).

Sullivan Breeding Area is approximately 14.7 miles from Willow Creek Reservoir and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2007 and were last

observed at the breeding area in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Sullivan Breeding Area productivity data shows that the nest failed in 2007, failed in 2008, and failed again in 2009 with one nestling gone 11 April, 2009-21 April, 2009 before they were 3 weeks old. The second nestling dies in the nest at 4-5 weeks old (Jacobson et al 2007; McCarty and Jacobson 2008, 2009). Willow Creek Reservoir does have monofilament bins present.

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Western Yellow-Billed Cuckoo
A documented occurrence was recorded in Granite Creek over 7 miles south of Willow Lake in 1991. Documented occurrences have been recorded in the Upper Verde River.

Potential Impacts
There may be some limited amount of habitat degradation and some amount of disturbance to nesting cuckoos from anglers using or creating new trails to access the stocking site.

Potential impacts to migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance.

GRANITE CREEK COMPLEX ANALYSIS
Water Distribution / Connectivity
Granite Creek is an ephemeral stream that courses over 37 miles through Yavapai County to its mouth at the Verde River. A mostly dry streambed runs approximately 10 miles until Watson Dam, forming Watson Lake, interrupts it. In this first 10 miles it is characterized by high gradients and rapid runoff soils on the watershed (Wendt 1976). The watershed is shallow (Wirt 2000) and only a few tributaries add runoff to Granite Creek in this upper stretch. Granite Creek has 8 minor tributaries and all feed it in this upper 10 miles. The only major tributary, greater

than 10 miles in length, is Willow Creek. Willow Creek courses 10.5 miles from the slopes of the Sierra Prieta Mountains until it hits Willow Creek Dam, forming Willow Creek Lake, or Willow Lake.

Granite Creek downstream of Watson Lake is much different than upstream of the lake. The mouth of Willow Creek is 1.6 miles downstream of the Watson spillway. From this point, the next 14.5 miles of Granite Creek is ephemeral and is characterized by low grades of 1% and sandy alluvial soils that dissipate flow energy (Wendt 1976). In this stretch, several sand and gravel operations further inhibit water flow (Figure 39). Granite Creek drops 286 feet (20 feet per mile) from the mouth of Willow Creek to just downstream of the town of Chino Valley. In contrast, the remaining 8.8 miles of Granite Creek drops 486 feet to the Verde River, or 55 feet per mile. No other significant tributaries enter Granite Creek below Willow Creek. Therefore, a flood event would have to be sufficient enough to top either Watson or Willow lakes and retain enough flow to make it through 14.5 miles of wide, sandy alluvium while transporting fishes.

Water can go over the spillways of both Willow and Watson dams, either from summer or winter precipitation. Water topped both dams during the flood events of December 2004-January 2005, and Granite Creek flowed all the way to the Verde River. Some of the water does get captured at the large Hansen sand and gravel mining operation along Granite Creek near SR89A, before flowing northbound towards the Verde River (Figure 40). The City of Prescott's Master Plan defines conservation pool (ideal) water elevations for both lakes. This is important because it means the City intends to keep both lakes as full as possible or practicable in order to maximize its ability to recharge the Little Chino Aquifer and maintain a safe yield determination for the Prescott AMA. The Utilities Division releases water from both lakes and sends it through an aqueduct to the City's aquifer recharge facility near the Prescott Airport (E. Smith, pers. comm.; Figure 41).

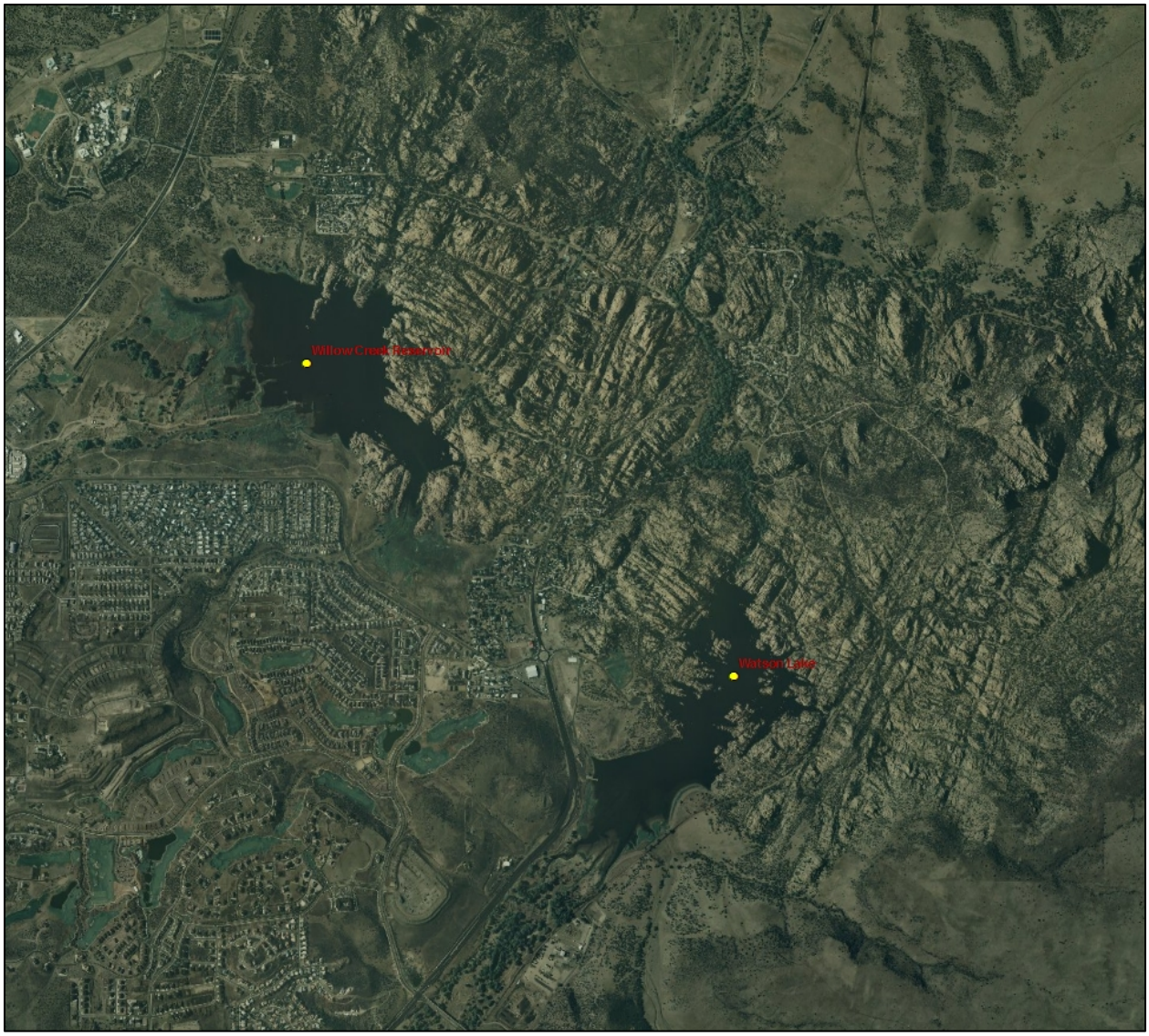

Figure 39. Satellite view of Willow Lake (left), Watson Lake (right) and Granite Creek (Copyright:© 2009 ESRI, i-cubed, GeoEye).

Highways are in red with Highway 89 up and down, and 89A running from left to right. Note water retention/recharge basin just upstream of Highway 89A crossing and Antelope Hills Golf Course.

Figure 40. Hansen Materials on Granite Creek downstream of Highway 89A crossing, adjacent to Antelope Hills Golf Course.

Figure 41. Granite Creek water recharge basin upstream of Highway 89A crossing. The Granite Dells near Watson Lake can be seen on the skyline right.

These releases are timed and monitored to ensure credit. All impoundments in the Prescott Valley spill infrequently and typically in response to extreme, geographically broad precipitation events. Factors effecting spills, and more importantly corresponding flows down Granite Creek, are complex. Some of the water from infrequent spills does get captured, at the large Hansen sand and gravel mining operation along Granite Creek near SR89A, before flowing northbound towards the Verde River. The Utilities Division releases water from both lakes through valves on the dams and sends through an aqueduct to City's aquifer recharge facility near the Prescott Airport (E. Smith, pers. comm.). These releases utilize the same series of canals and culverts as were used when CVID used them; however, fish must survive barriers at the recharge facility as well as the Hansen Materials site. Historical canals are used to deliver water from Watson and Willow Lakes to meet additional downstream water rights in Chino Valley. These canals are not in the flood plain of Granite Creek and terminate in Chino Valley (C. Dotseth, pers. comm.).

Examination of flow records from the USGS gauge on Granite Creek just upstream of Watson Lake indicates that floods greater than 400 cfs have occurred eight times, and floods greater than 600 cfs have occurred two times since October 1994 (Figure 42), but it is unknown how many of those resulted in water spilling out of Watson Lake. In addition, examination of the USGS gauge below Watson Lake reflects the 2005 flood event (Figure 43). This gauge has a short period of record beginning in 1999, the year the City acquired both Watson and Willow Lakes. Local residents of Chino Valley recall Granite Creek flowing "bank to bank" three times in the last 25 to 30 years (D. Rees, pers. comm.). Those events occurred in the early 1980s and the winter of 1993.

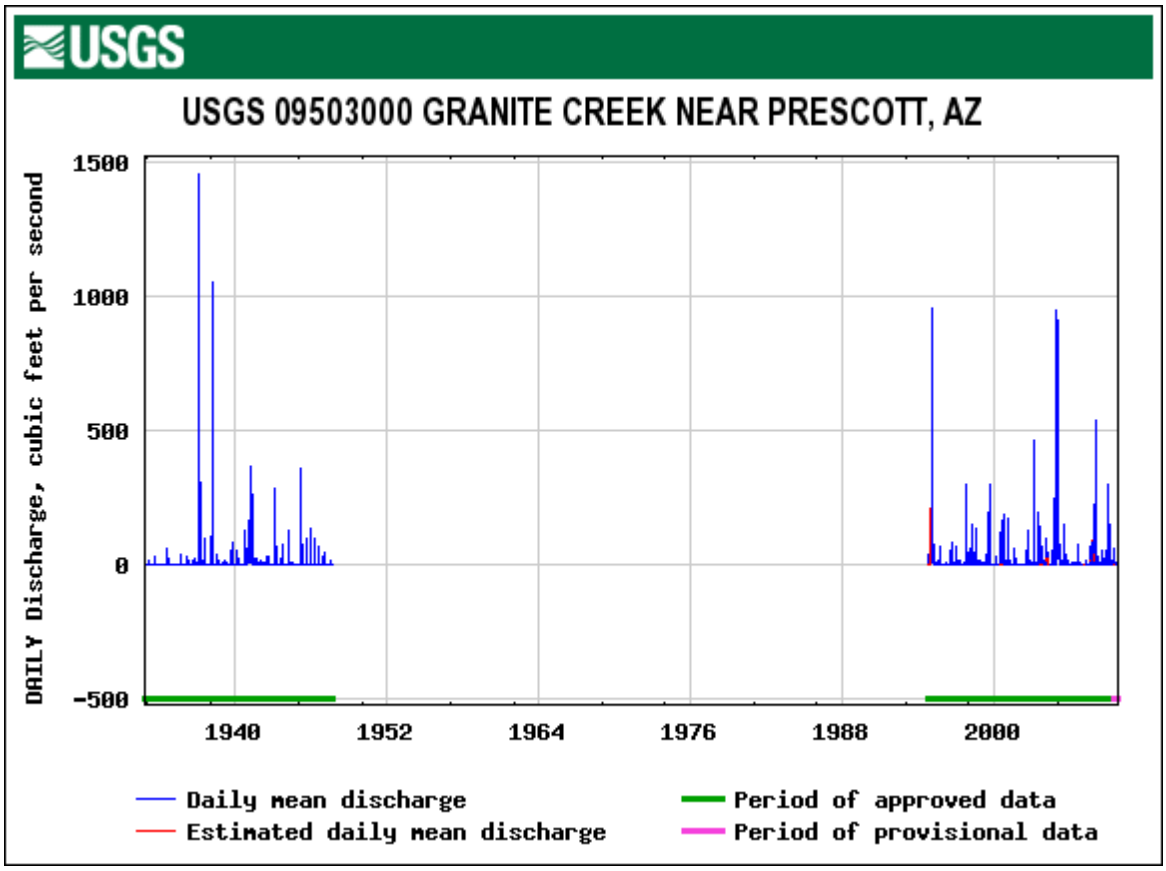

Figure 42. Discharge measured at USGS stream on Granite Creek just upstream of Watson Lake during 1932-1947 and 1994-2009.

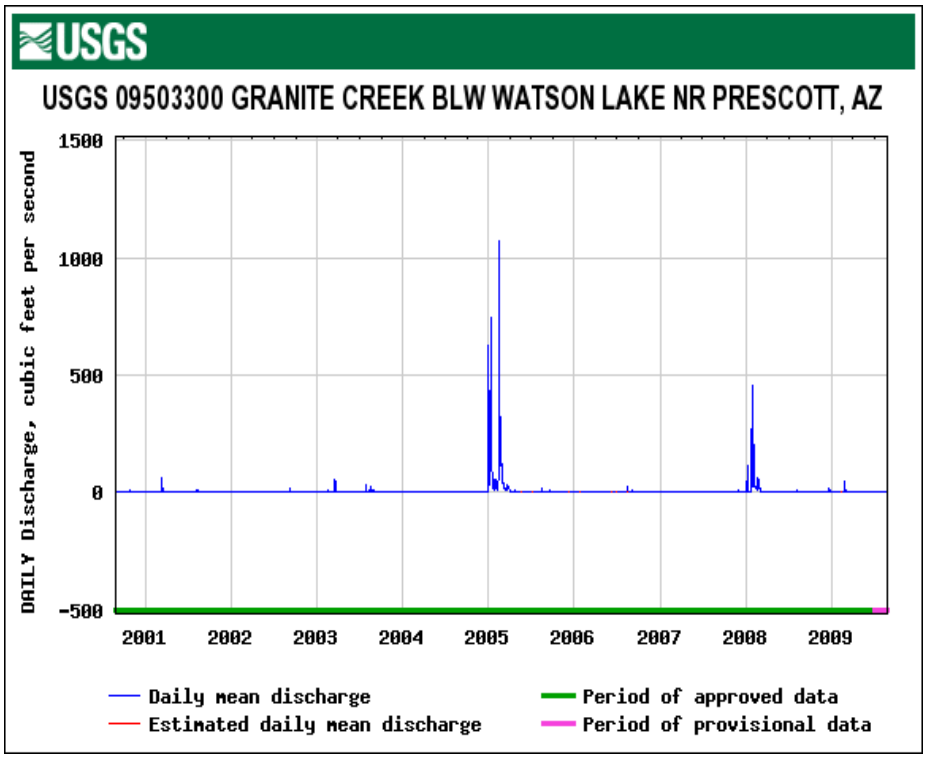

Figure 43. Discharge measured at USGS stream gage on Granite Creek approximately 1.5 miles downstream of Watson Reservoir during 2000-2009.

Fish Movement

While the minimum flow needed to transport fish cannot be determined, the data suggest these infrequent high flow events may move fish downstream. Lower Granite Creek 1 mile upstream of its confluence with the Verde contains green sunfish and shiners, with persistent water.

The high flow events of 1980, 1983, 1993, and 2005 also severely impact downstream habitat for fishes. Extreme flooding events entrain sediment, alter channel bed form and floodplain topography, and may remove vegetation, which in the short-term may reduce fish densities (Rinne 1996). Studies also indicate floods like these reduce all fish numbers temporarily (Rinne et al. 1998). The likelihood of stocked largemouth bass (which are only proposed for stocking in Goldwater Lake), bluegill sunfish or black crappie escapement and transport from upper Goldwater to lower Goldwater to Bannon and Granite Creeks (collective 8.5 miles) to Watson lake is unknown (see Goldwater Lake fish movement section).

Granite Creek has flooded to a sufficient magnitude to allow transport of fishes from Watson or Willow Lakes to the upper Verde River several times in the past 30 years (Clark 2003b). There are no known City records of spill events to indicate how often Watson Lake spills. Since the approximately 23 miles of Granite Creek downstream Watson and Willow lakes is wide sandy

alluvium and contains two sand and gravel operations that impede flow, and the City of Prescott minimizes loss of water as much water as possible, escapement of fish out of Watson and Willow Lakes via Granite Creek to the upper Verde River is only likely to occur large high flow events. The warm water species proposed for stocking in all three lakes prefer, if not require, slow-moving lentic habitats, including vegetated banks and pools in order to persist. During large flood events, these types of habitats are typically removed, which lessens the chance the fish would persist in the upper Granite Creek or Verde River.

Winter trout stockings in Watson and/or Willow Lakes would be focused on a high rate of return. Relatively small numbers of trout would be stocked at either lake relative to their size. Trout would not be expected to persist in either lake beyond summer months due to lethal temperatures and predation by largemouth bass and channel catfish. Trout that may escape from spills during winter flood events and make it to the upper Verde River may persist for some period until summer water temperatures and predation would all but eliminate them. Transport of trout through Granite Creek would not be expected due to high sediment loads and high physical abuse of surviving a flood event.

Community Description

Non-native species such as largemouth bass, black crappie, bluegill, rainbow trout, and golden shiner have been present in the Granite Creek watershed since the late 1930's. High numbers of trout and moderate numbers of largemouth bass have been stocked into all three proposed stocking locations over the past 20 years, and in some cases dating back more than 40 years. Since the City of Prescott acquired the Watson and Willow lakes, very few have been collected in downstream reaches of the Verde River (see Upper Verde River analysis; AGFD Nongame database records; A. Clark pers. comm.). Razorback suckers were stocked into the lower end of Granite Creek just above its confluence with the Verde River in 1988. Surveys of Granite Creek 1 mile upstream from the confluence with the Verde River in 1999 and 2003 did not detect any razorback suckers or any of the species proposed for stocking. The habitat in lower Granite Creek is not suitable for razorback sucker and stockings were of fingerling sized fishes in hopes they would distribute downstream into the mainstem Verde River.

Stocked rainbow trout, largemouth bass, bluegill sunfish and black crappie have not become established in Granite Creek downstream from Watson and Willow lakes and the upper Verde River (see Upper Verde River analysis for a detailed discussion). Largemouth bass, black crappie and bluegill sunfish are not adapted to lotic habitats and are not likely persist in stream habitats, especially those that are typically dry outside of run-off events unless there are perennial pools along the stream channel sufficient in size to support individuals. Studies suggest that high magnitude flood events reduce all fish numbers temporarily (Rinne et al. 1998). Any fish that would get transported in high flow events are not likely to persist due to lack of suitable habitat

in the Verde River, high water temperatures that limit trout persistence, elimination or severe reduction of lentic habitat when flooding events scour the channel, and lack of frequent water connectivity connection along the 16 miles between the reservoirs and the upper Verde River due to the City's management of the lake water levels and releases.

Largemouth bass are only proposed to be stocked in to Goldwater Lake; however there are other potential sources of largemouth bass and sunfish in the Granite Creek drainage. A pond used to be located at Del Rio Springs Ranch and supported populations of largemouth bass and sunfish; Department personnel recall catching fish at the pond in the late 1980's and early 1990's at the invitation of the land owner (R. Aikens, pers. comm.). The pond was still in existence through at least 2003, but according to more recent aerial photos of the area taken in 2009, the pond is no longer in existence (Figure 44). The linear distance from the pond at Del Rio to Stillman Lake in the upper Verde River is 3.8 miles. This pond could have been an additional potential source for largemouth bass collected over the years from the upper Verde River in Stillman Lake and is closer geographically than the lakes proposed for stocking in the headwaters area of Granite Creek. Del Rio Springs also has a USGS stream gauge on it. According to USGS data, the gauge measures run-off from a 40 square mile area (Figure 45). During salvage activities in Stillman Lake in summer of 2009, no largemouth bass were collected from the lake despite a moderately high flow event in Granite Creek in 2008 (Figure 43). Sensitive or imperiled aquatic species do not occur in habitats in the Granite Creek drainage, but are found further downstream in the upper Verde River.

The stocking history in the proposed lakes and knowledge of occurrence of largemouth bass and other species at un-stocked waters in the Granite Creek drainage (i.e. Del Rio Springs), and downstream sampling records from Granite Creek and the upper Verde River support the observation and assertion that the Granite Creek watershed may contribute species including red shiner, fathead minnow or green sunfish, but are not likely contributors of those species proposed to be stocked in Goldwater, Watson and Willow lakes.

Figure 44. Del Rio Springs Ranch Pond 2009 (Copyright:© 2009 ESRI, i-cubed, GeoEye).

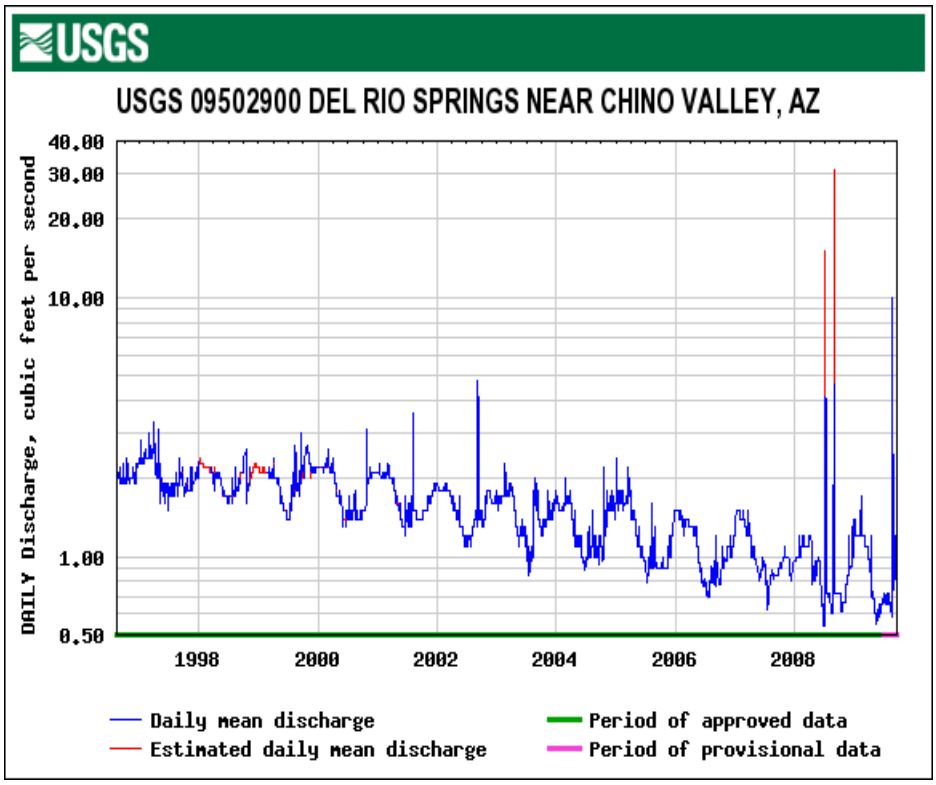

Figure 45. Discharge measured at USGS stream gage at Del Rio Spring during 1997-2009.

Table 20. Numbers of species and relative abundance sampled by backpack electrofishing from 1 mile of Granite Creek above confluence with the Verde River, April 1999 and May 2003.

Species	1999		2003	
	Num. Sampled	Rel. Abundance	Num. Sampled	Rel. Abundance
Common carp	1	7%	_	_
Desert Sucker	_	_	20	17.1%
Fathead minnow	13	22.2%	25	21.3%
Green sunfish	4	21.3%	8	7%
Longfin dace	1098	27.3%	26	22.2%
Mosquitofish	_	_	6	5.1%
Smallmouth bass	4	17.1%	_	_
Sonora Sucker	_	_	32	27.3%

Species	1999		2003	
	Num. Sampled	Rel. Abundance	Num. Sampled	Rel. Abundance
Sucker sp.(yoy)	_	_	2	_

Consultation Species or Critical Habitat
There are no endangered, threatened, candidate species or critical habitat in Granite Creek except for records of razorback suckers stocked into the lower end of the creek, just above its confluence with the Verde River in 1988 as discussed in the Upper Verde River Complex analysis. Potential impacts on consultation species downstream in the Verde River including: razorback sucker and critical habitat, Colorado pikeminnow, roundtail chub, spikedace and critical habitat are discussed in the Upper Verde River Complex analysis. Northern Mexican and narrow-headed gartersnakes are analyzed below along with discussion in the Upper Verde River Complex analysis.

Northern Mexican and narrow-headed gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican Gartersnake
Stocking complex analysis: There is a single historical northern Mexican gartersnake record (ca. 1900) from Granite Creek (HDMS). There are no other records of the species from this part of the watershed, although no systemic surveys for gartersnakes have been conducted in this area, and it is unlikely that they occupy the Granite Creek Complex. The presence of non-native warm water fishes in Goldwater Lake, Watson Lake, and Willow Creek Reservoir makes this habitat less suitable for the species, as do the crayfish in Goldwater Lake. Therefore, it is

unlikely that northern Mexican gartersnakes would be exposed to fish stocked into the Granite Creek Complex.

Downstream analysis: Northern Mexican gartersnakes occupy the Middle Verde River, downstream of Pecks Lake. There are multiple records of the species from near Cottonwood on the Verde River, approx. 2.8 river mi downstream of Pecks Lake, including one from 2003 and one from 2004 (Holycross et al. 2006, HDMS). The presence of crayfish and non-native fish within the Verde River make the habitat less suitable for northern Mexican gartersnakes, but the species appears to persist (Holycross et al. 2006). If stocked sport fish escape from Watson Lake, Goldwater Lake and Willow Creek Reservoir and disperse into the Upper Verde River and then move downstream into the Middle Verde River, there is a likelihood of exposure to northern Mexican gartersnakes.

Narrow-headed gartersnake

Stocking complex analysis: Although the area has not been systematically surveyed for gartersnakes, narrow-headed gartersnakes are not expected to occupy the Granite Creek Complex because Goldwater, Watson and Willow Creek Reservoirs do not provide suitable habitat for the snakes. Therefore, it is unlikely that narrow-headed gartersnakes would be exposed to fish stocked into these sites. The presence of warm water spiny-rayed fishes in the three lakes also makes the habitat less suitable for the species.

Downstream analysis: Narrow-headed gartersnakes currently occupy the Upper Verde River. There are recent records from Bear Siding (1996, 2000) and Mormon Pocket (2001) and farther downstream within the vicinity of Clarkdale (1988). The presence of crayfish and non-native fish, including spiny-rayed fishes, within the Verde River reduce the suitability of the habitat for narrow-headed gartersnakes, but the species appears to persist (Holycross et al. 2006). Narrow-headed gartersnakes also occupy the Middle and Lower Verde River, though likely in low numbers. If stocked sport fish escape from Goldwater Lake, Watson Lake, and Willow Creek Reservoir and disperse into the Upper Verde River, there is a likelihood of exposure to narrow-headed gartersnakes.

SYCAMORE CREEK COMPLEX

Physical Geographic Description

Sycamore Creek has a drainage area of 477 square miles (approximately305,500 acres) and drains into the upper Verde River approximately 37 miles downstream from Sullivan Dam, the upstream end of the Upper Verde River reach (Figure 46). Of the three Upper Verde River drainages that are stocked, the Sycamore Creek drainage confluence is the furthest downstream. Sycamore Creek headwaters originate at Dow and L.O. Springs, which sit at an elevation of approximately 7,000 feet. From this point, the creek flows through a canyon that drops nearly

1,000 feet over 27 miles at an average gradient of 37 feet per mile. Perennial flow in Sycamore Creek begins at Parsons Spring about 4 miles upstream from the Verde River. Sycamore Creek above the lower perennial reach runs exclusively in response to snowmelt runoff or large runoff events and is typically wetted from March to June annually. During drought periods the creek may be dry to intermittent. There are no known discharge gauges in the Sycamore Creek drainage. The closest gauge is located just downstream of where Sycamore Creek enters the Upper Verde River (USGS gauge 09504000 Verde River near Clarkdale, AZ).

Drainage area and elevations

Sycamore Canyon receives runoff from four major tributaries, from upstream to downstream they are: Big Spring Canyon, Volunteer Canyon, Little L.O. Spring Canyon, and Tule Canyon (Figure 47). Of these tributaries, stocking sites are located on Big Spring Canyon, an unnamed tributary to Sycamore Creek, and Tule Tank Wash. Like Sycamore Creek these major tributaries only run in response to snowmelt runoff or large runoff events and are typically dry most of the year, especially in drought years. All of the sites in this drainage proposed for stocking freeze during winter, typically from December through February, although the freeze and thaw dates vary from year to year. In some years stocking sites have not thawed until late March (M. Rinker, pers. comm.).

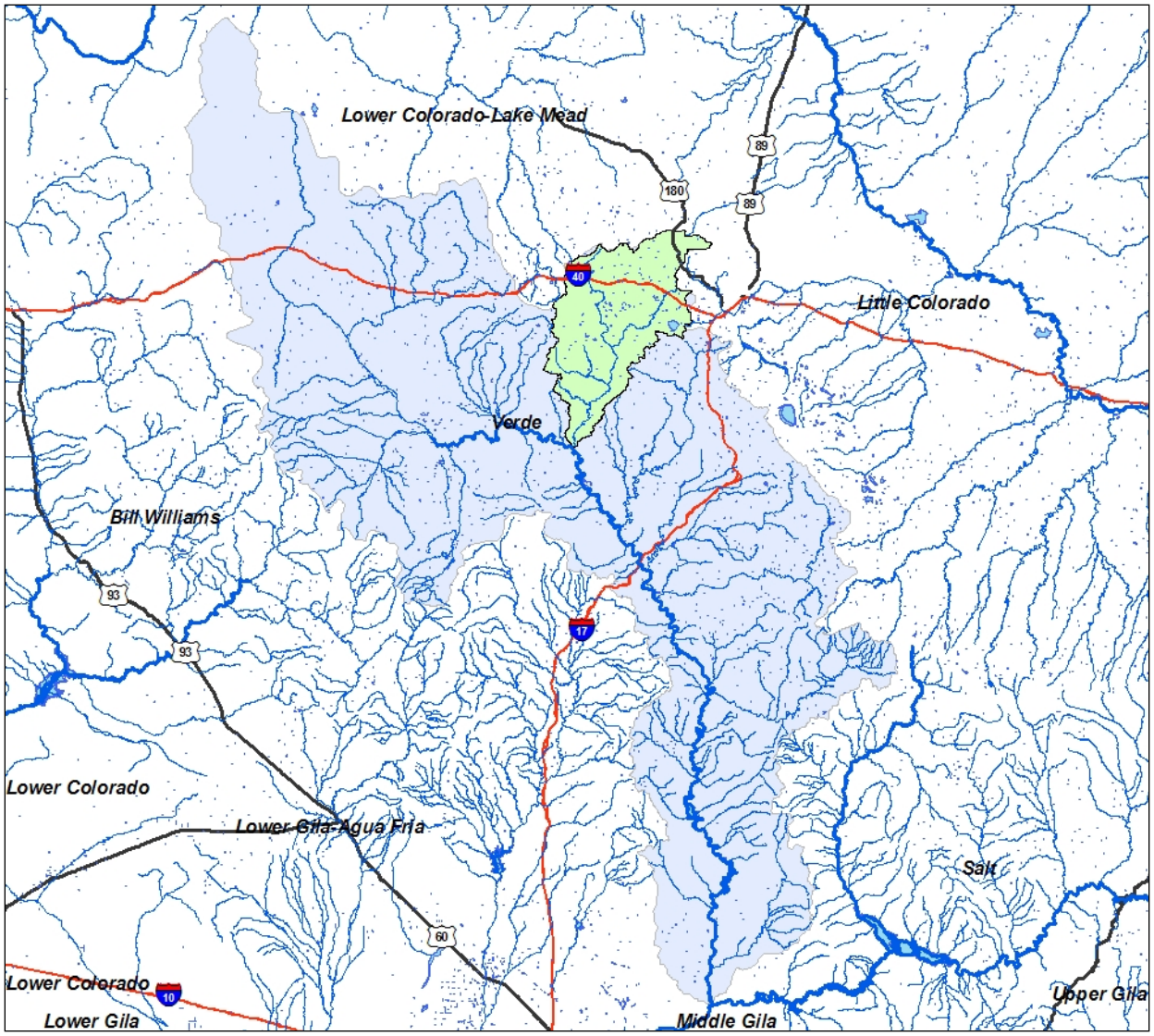

Figure 46. Overview of Verde River watershed highlighting the Sycamore Creek drainage.

The Sycamore Creek Complex contains 5 stocked sport fishing reservoirs that are managed by the AZ Game and Fish Department (Figure 48). Perkins Tank, White Horse Lake, Elk Tank, Middle Tank, and J.D. Dam Lake all lie in tributaries of Sycamore Creek on its west side. Perkins Tank lies in the headwaters of Big Springs Canyon, a major tributary to the headwaters of Sycamore Creek. White Horse Lake sits in an unnamed side canyon of Sycamore Creek just downstream from the confluence of Sycamore Canyon and Big Springs Canyon. Elk Tank, Middle Tank, and J.D. Dam Lake are impoundments of J.D. Wash which drains into Tule Canyon, a tributary of Sycamore Creek. Elk Tank is the upstream most of the three tanks, then

Middle Tank and J.D. Dam Lake at the downstream-most point. All 5 impoundments are on the Kaibab National Forest.

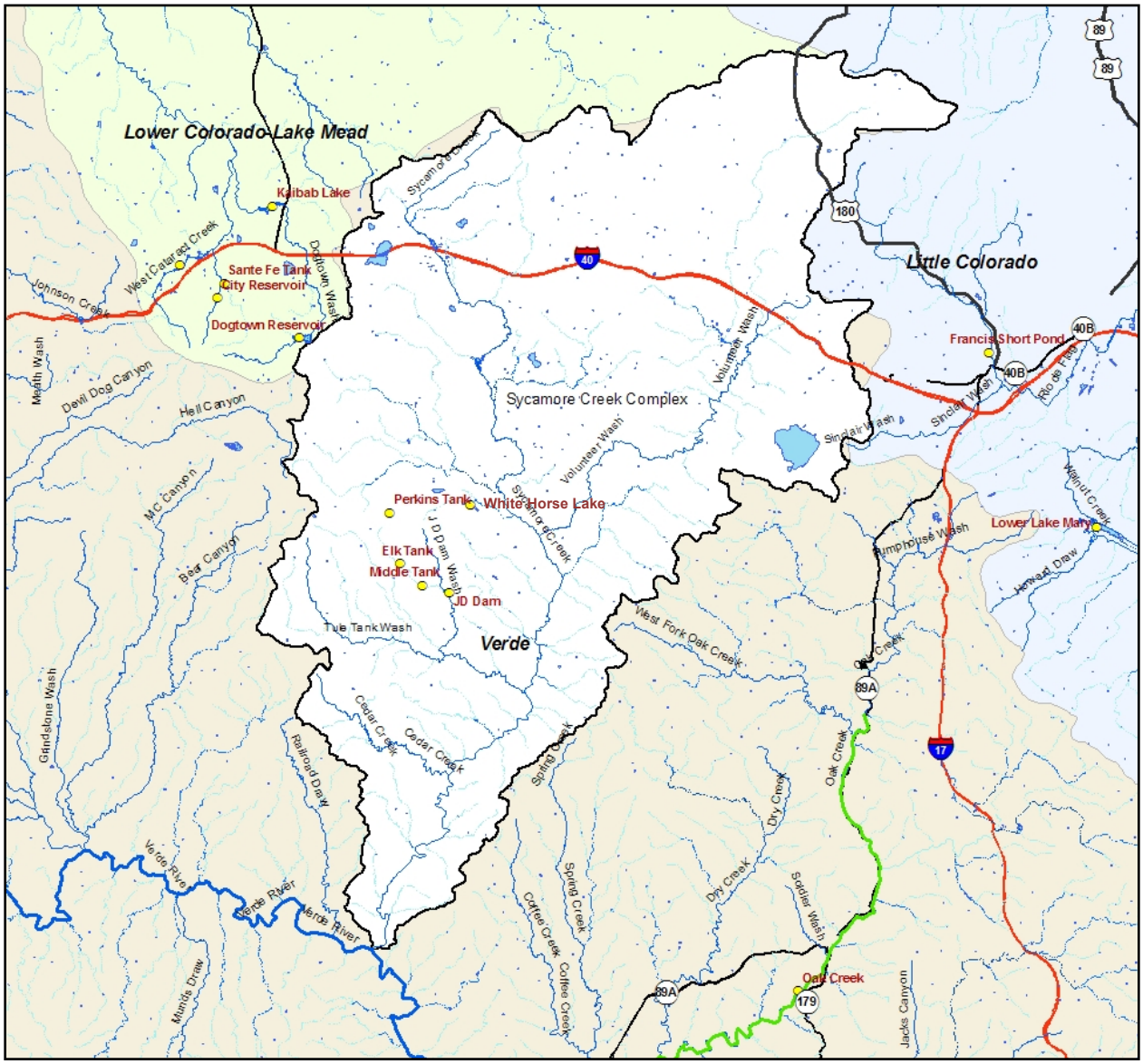

Figure 47. Sycamore Creek drainage.

Perkins Tank, Elk Tank, Middle Tank, and J.D. Dam Lake are managed as special regulation catch-and-release waters featuring an artificial fly and lure-only single barbless hook regulation. White Horse Lake is managed as a put-and-take rainbow trout fishery. Management of these impoundments is part of an ongoing effort from the Arizona Game and Fish Department (the

Department) and the Northern Arizona Flycasters (NAF) to provide trophy catch-and-release trout fisheries near Flagstaff and Williams. The members of the NAF have spent a significant amount of time, money, and effort to renovate and maintain these tanks as fisheries.

Over the years a desire to stock brown trout into the special regulation waters of Perkins Tank, White Horse Lake, Elk Tank, Middle Tank, and JD Dam Lake have been expressed by members of the NAF and the general public. Stocking brown trout into Elk tank, Middle Tank, and JD Dam Lake would satisfy the desire expressed by the public to "stock brown trout into JD Dam Lake, Perkins Tank, Elk Tank, Middle Tank, and Whitehorse Lake" in the Region II 2003 fisheries questionnaire, where 83.5% of the 678 total respondents supported the development of such fisheries.

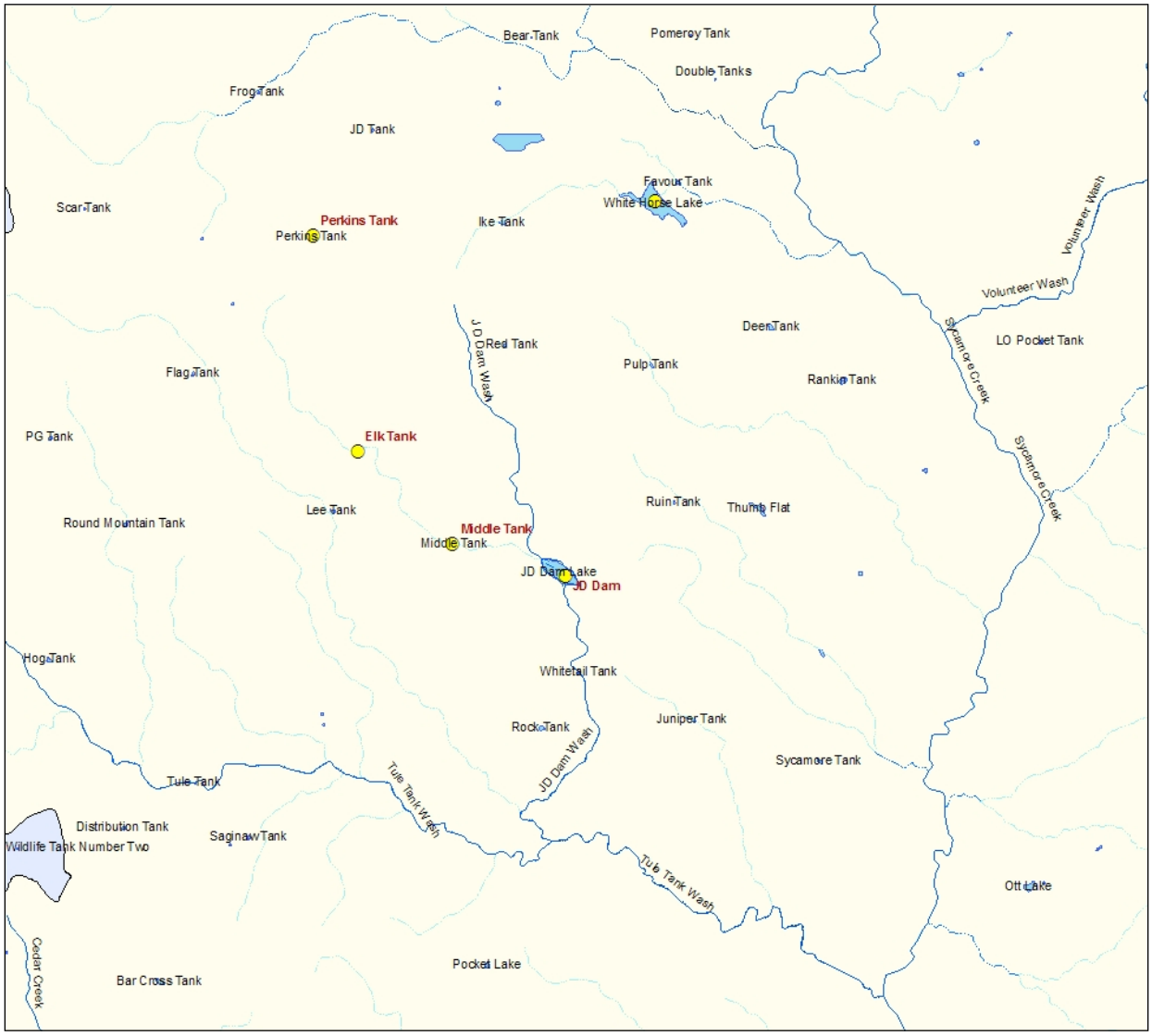

Figure 48. Sycamore Creek Complex.

Perkins Tank

Site Description

Perkins Tank is located approximately 15 miles southeast of the City of Williams off Forest Service Road 110 on the Kaibab National Forest; it is a popular catch-and-release trout fishery for the local flyfishing anglers of Williams, Flagstaff, and the surrounding area. Perkins Tank, with a lake elevation of 6,800 feet, on average is about 10 feet deep with a maximum depth of 16 feet, and is approximately 3.5 surface acres when fully watered.

Management of Waterbody

Perkins Tank is primarily managed as a special regulation cold water catch-and-release fishery. Recent management has emphasized the stocking of catchable and sub–catchable rainbow trout as well as sub-catchable and fingerling brook trout and arctic grayling. There are no creel surveys for Perkins Tank; however, the 2001 statewide angler use survey based on angler license sales estimated that Perkins Tank supported 2,402 angler use days (Pringle 2004). Perkins Tank is currently approved to stock rainbow, brown trout, brook trout, and arctic grayling. Brown trout have not been stocked into Perkins Tank since 1995 (Table 21).

Perkins Tank was pumped dry in 2001 in an effort to eliminate illegally introduced green sunfish. In July of 2007 there was a fish kill at Perkins Tank due to low dissolved oxygen levels resulting from an algal bloom and subsequent monsoon storms (Rinker 2007b). A spot check for water quality indicated very low dissolved oxygen condition, and 128 dead trout were removed. It is not known if the kill was complete; however, crayfish were observed dying, and the survey crew expects the kill was significant (M. Rinker, pers. comm.).

Table 21. Perkins Tank stocking history from 1968 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1978	1995	8	5,994
Arctic Grayling	2008	2008	1	350
Rainbow trout	1968	2009	43	31,056
Brook trout	1978	2008	9	7,852
Total			61	45,252

Proposed Action

The Department proposes to stock rainbow trout, brown trout, brook trout, and Arctic grayling for the period covered by this consultation.

Sub-catchable and catchable rainbow trout would be stocked multiple times per season, from March to November annually; numbers of rainbow trout stocked may be from 0 – 3,000 fish annually.

Sub-catchable and catchable brown trout would be stocked from September to November annually; numbers of brown trout stocked may be from 0 – 750 annually.

Sub-catchable and fingerling brook trout would be stocked opportunistically when available from March to June annually; numbers of brook trout stocked may be 0 – 1,000 annually.

Sub-catchable and fingerling Arctic grayling would be stocked opportunistically from March to June annually; numbers of arctic grayling stocked may be 0 – 1,000 annually.

Water Distribution / Connectivity

Perkins Tank is located on a small unnamed ephemeral drainage, that when spilling, flows through JD Tank onto Sunflower Flat. Sunflower Flat drains into Big Spring Canyon, a tributary of Sycamore Creek (Figure 49). When it overflows, the water goes through a broad shallow valley and eventually into a 6-mile long ephemeral drainage that drops nearly 800 feet over the last two miles into Sycamore Canyon. From this point, it is 24 miles of intermittent flow followed by 4 miles of perennial flow to the confluence with the Verde River.

Holloway Tank is a small earthen tank approximately 1 mile upstream of Perkins Tank. During storm events, or spring run-off events, Holloway Tank can fill and spill, and flow downstream into Perkins Tank. Perkins Tank spills approximately one out of every six years into the unnamed ephemeral drainage.

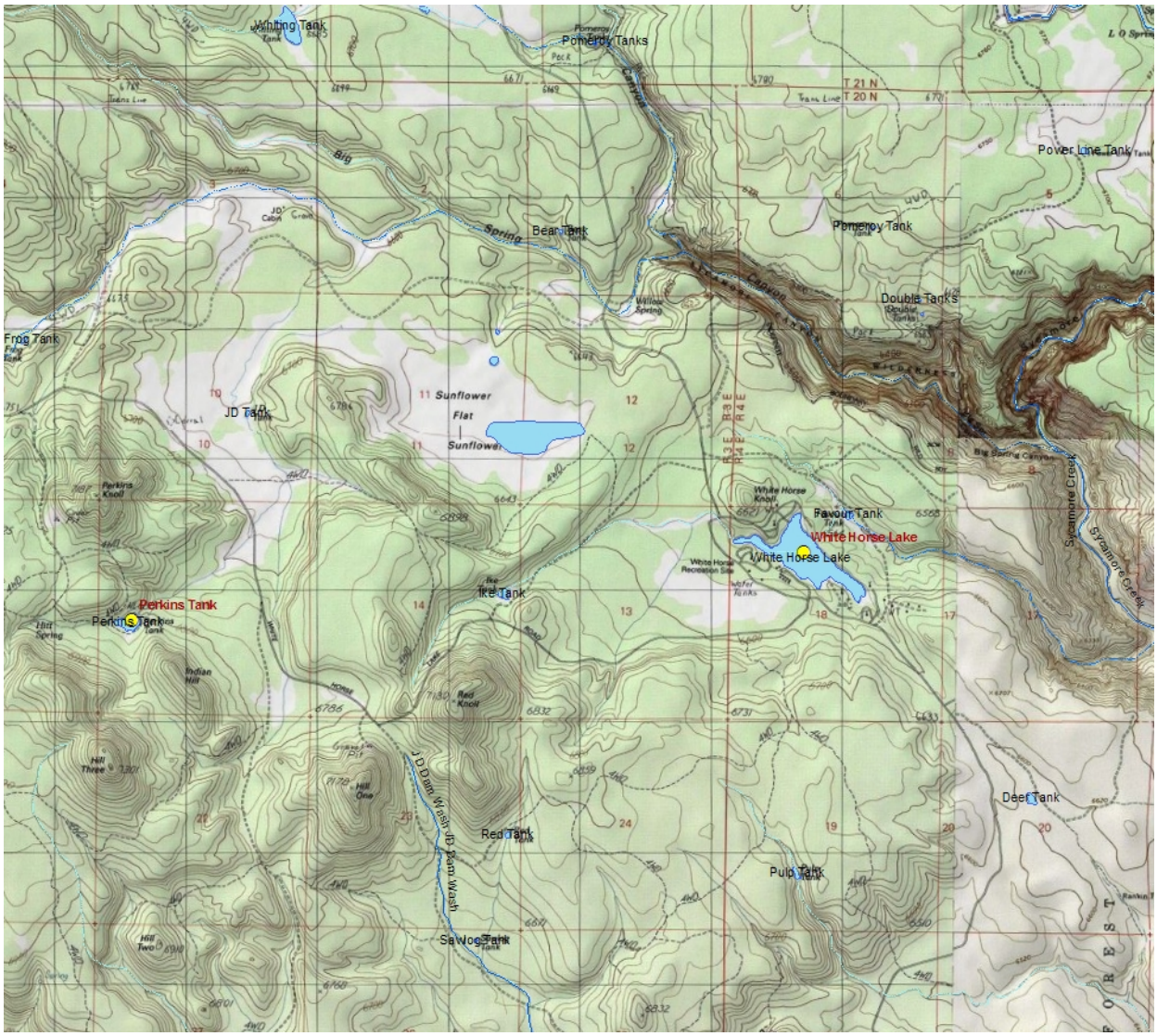

Figure 49. Topographic map depicting Perkins Tank, which if it spills, would flow into Sunflower Flat and in turn Big Spring Canyon, and finally Sycamore Creek.

From Perkins Tank it is 1.09 miles to another unnamed ephemeral drainage that continues 0.39 miles to JD Tank. From JD Tank the drainage continues 0.71 miles to Sunflower Flat. In order for the flow to continue down the drainage, Sunflower Flat, which is 280 surface acres, has to fill and spill. Sunflower Flat has not filled since 1993 and is typically reduced to a small tank on the north side of the flat (Figure 50). Only during multiple extreme precipitation events will Sunflower Flat receive enough water to spill downstream. Sunflower Flat then drains 0.63 miles down an unnamed ephemeral drainage to Willow Spring. From Willow Spring it is 0.42 miles before descending over a 70 foot drop (Figure 51 and Figure 52) followed by a 125–150 foot

drop into Big Spring Canyon (Figure 53 and Figure 54). Big Spring Canyon travels 2.84 miles to its confluence with Sycamore Canyon. From this point, it is 24 miles of intermittent flow followed by 4 miles of perennial flow to the confluence with the Verde River.

Figure 50. Sunflower Flat.

Figure 51. Initial drop into Big Spring Canyon (approximately 70 foot Vertical Drop).

Figure 52. Initial drop into Big Spring Canyon (approximately70 Foot Vertical Drop).

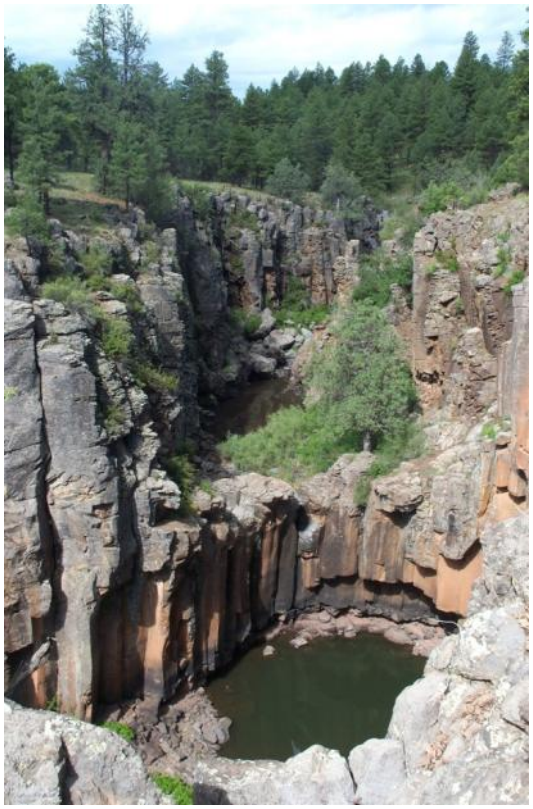

Figure 53. Photo depicting approximately125-150 foot vertical drop within Big Spring Canyon.

Figure 54. Plunge pool below the Big Spring Canyon drop (approximately 125-150 foot vertical drop).

Fish Movement

Stocked fish could move upstream to Holloway Tank during storm events. Existence of a fish community in this tank is unknown, but unlikely given its small size and likelihood for drying on a frequent basis, as do other tanks in the area. During precipitation events large enough to cause Perkins Tank to fill and spill, fish could potentially escape downstream into JD Tank and then into Sunflower Flat. Flood events sufficient to fill Sunflower Flat and spill towards Willow Spring are rare. Sunflower Flat has not filled since 1993 and is typically reduced to a small tank on the north side of the flat (Figure 55). Only during multiple extreme precipitation events will Sunflower flat receive enough water to spill downstream. Any trout escaping from Sunflower Flat would be subjected to a 70 foot drop followed by a 125–150 foot drop into Big Spring Canyon just to reach Sycamore Canyon. Trout are not expected to survive these drops. If any

did, they would then have to survive the harsh environmental conditions of the 32 miles of ephemeral/intermittent flow to reach the Verde River. For these reasons Perkins Tank is considered a closed system.

Figure 55. Aerial photo of Sunflower Flat (taken from World Imagery coverage layer).

Community Description

Perkins Tank was pumped dry in 2001 to remove illegally introduced green sunfish, and consequently all fish species present in the tank were removed. Fish surveys have not been conducted at Perkins Tank since 2001; however, based on stocking records, rainbow trout, brook trout, and arctic grayling are assumed to currently exist within the tank. In addition, crayfish and bullfrogs currently inhabit the tank. Northern leopard frogs were observed at Perkins Tank in 1972 (J.E & A.L. Platz-ASU from AGFD Ranid frog database).

Consultation Species & Critical Habitat

Perkins Tank, including Sunflower Flat, is a closed system. There are no endangered, threatened or candidate fish species present within this system. Potential impacts to northern leopard frogs, Mexican spotted owl and its critical habitat are discussed below.

Northern Leopard Frog

Local Analysis: Although Perkins Tank and the Sycamore Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Perkins Tank is moderate. There is a 1972 northern leopard frog record from Perkins Tank, but leopard frogs were not observed during a 1992 survey (HDMS, AGFD Riparian Herpetofauna Database) or while pumping the tank dry in 2001. In addition, crayfish and bullfrogs have been documented at the tank, making it less suitable leopard frog habitat. There have been 57 surveys at 30 sites within the buffered stocking complex between 1967 and 2000 (Figure 56, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs from Deadman Pocket Tank were released by the Department at Unnamed Tank (=16 Tank) in 1996 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). This Unnamed Tank was surveyed 4 times post-release: 1997 (n=1) and 1998 (n=3) and northern leopard frogs were not observed during these surveys. However, given that this site and immediate area have not been adequately surveyed, northern leopard frogs may occupy the area (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm is low, because the drainages into which the fish would disperse are below the minimum elevational range for the northern leopard frog in the Verde River Watershed (approximately5300 feet) (Sredl 1997) and there are no historical records for frogs in these downstream drainages (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

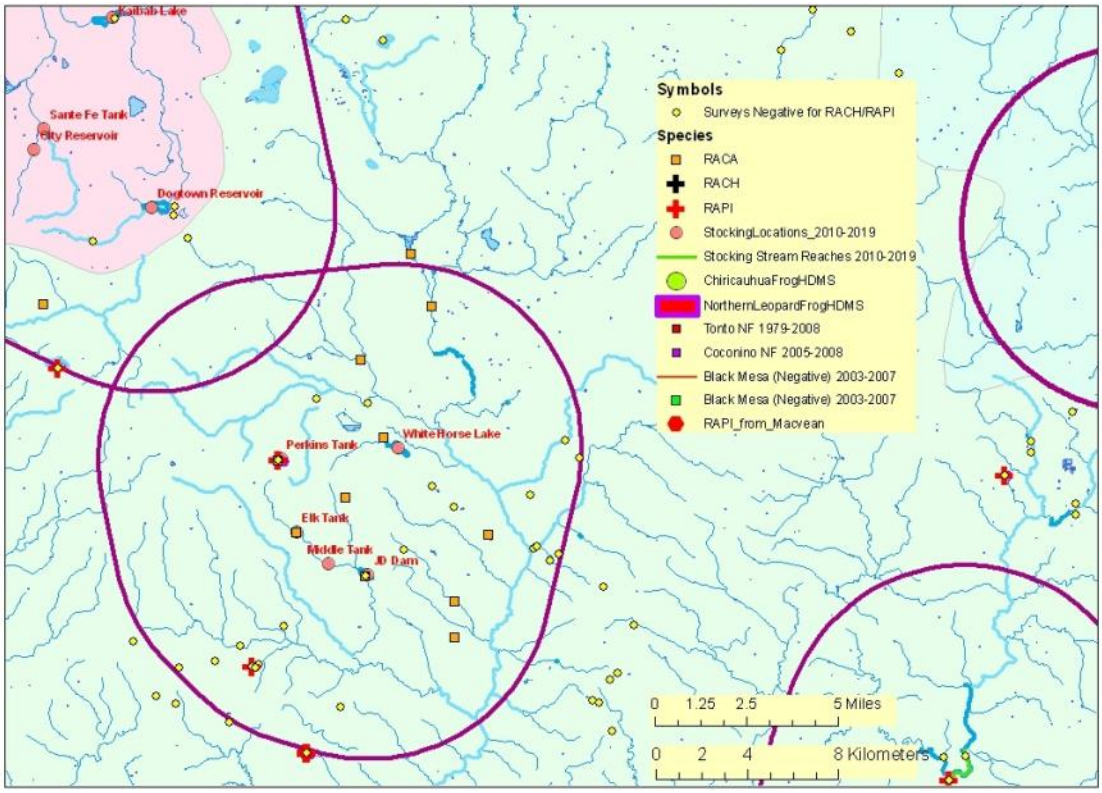

Figure 56. Map of Sycamore Creek buffered stocking complex.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Mexican Spotted Owl

This stocking location is within critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring

restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

White Horse Lake

Site Description

White Horse Lake is located on the Kaibab National Forest approximately 10 miles south of Interstate 40 on Forest Service road 109. White Horse Lake is located 15 miles from Williams and 55 miles from Flagstaff (Figure 48). White Horse Lake on average covers 30 surface acres, with a 46 surface acre maximum capacity and an elevation of 6,551 feet (Figure 57). The lake is 12 to 15 feet deep on average and has maximum depths of up to 20 feet. White Horse Lake is a popular summertime camping and fishing location. The dam at White Horse was renovated in 1961, 1963, and 1978.

A large Forest Service campground is located on the lake and the area is managed by the Kaibab National Forest. Boats are restricted to a single electric motor only. Access is via an improved gravel road. There are no concessions available at the lake.

Figure 57. Aerial photo of White Horse Lake (World Imagery).

Management of Water Body

White Horse Lake is managed primarily as a high intensity cold water put-and-take rainbow trout fishery. Recent management has focused on catchable rainbow trout stocked in the spring, summer, and fall. Brook trout and brown trout have been stocked historically, but have not been stocked since 1986 and 1995 respectively (Table 22). The Department would like to have the opportunity to stock brown trout once again in White Horse Lake, in response to angler requests, and also to provide angling opportunity when water quality prohibits survival of rainbow trout.

Since high water temperature in summer can preclude stocking rainbow trout, stocking brown trout is an alternative because brown trout has higher temperature tolerance than rainbow trout. Warm water species including channel catfish, largemouth bass, redear sunfish, and bluegill have been stocked in the past, but not since 1990. Creel has not been conducted at White Horse Lake; however the 2001 statewide angler use survey based on angler license sales estimated that the lake supported 11,255 angler use days (Pringle 2004). 2001 was a drought year in northern Arizona and the forest was closed much of the summer. White Horse Lake is currently approved for stocking rainbow trout.

Table 22. White Horse Lake stocking history from 1936 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook Trout	1965	1986	11	56,083
Rainbow Trout	1954	2009	543	1,255,106
Brown Trout	1971	1995	29	168,523
Channel Catfish	1957	1990	14	31,844
Largemouth Bass	1936	1990	11	76,274
Bluegill	1936	1944	4	15,480
Redear Sunfish	1989	1989	1	6,510
Total			613	1,609,820

White Horse Lake is characterized by a shallow shoreline around most of its perimeter; problems with warmer water temperatures during summer months are typical. In recent years rainbow trout have been stocked from April to June and then again from late August to October when water quality permits. Late season fish are typically stocked in response to monsoonal patterns.

Proposed Action

The Department proposes to stock rainbow trout and brown trout for the period covered by this consultation.

Sub-catchable and catchable rainbow trout would be stocked multiple times during spring summer and fall annually; numbers of rainbow trout stocked may be from 0 – 53,000 annually.

Sub-catchable and catchable brown trout would be stocked multiple times during the fall annually; numbers of brown trout stocked may be from 0 – 20,000 annually.

Water Distribution / Connectivity

White Horse Lake is located on an unnamed tributary 2 miles upstream from its confluence with Sycamore Creek. Ike Tank is a small tank upstream from White Horse Lake. During storm events, or spring run-off events, Ike Tank can fill and spill, and flow downstream into White

Horse Lake. In the event of flooding, outflow from the White Horse Lake Lake would travel across the concrete spillway located on the north side of the lake, travel 0.24 miles to Favour Tank in an unnamed ephemeral drainage. From Favour Tank the drainage continues 0.50 miles to a 30 foot drop into a tributary of Sycamore Canyon (

Figure 58). The ephemeral tributary continues 1.97 miles over a series of falls, the largest 30 feet tall, and down a high gradient slope of about a 900 foot drop in 1.2 miles (Figure 59 and Figure 60) characterized by large boulders to Sycamore Canyon. Once at Sycamore Canyon it is 24 miles of ephemeral / intermittent channel followed by 4 miles of perennial flow to the confluence of Sycamore Creek and the upper Verde River.

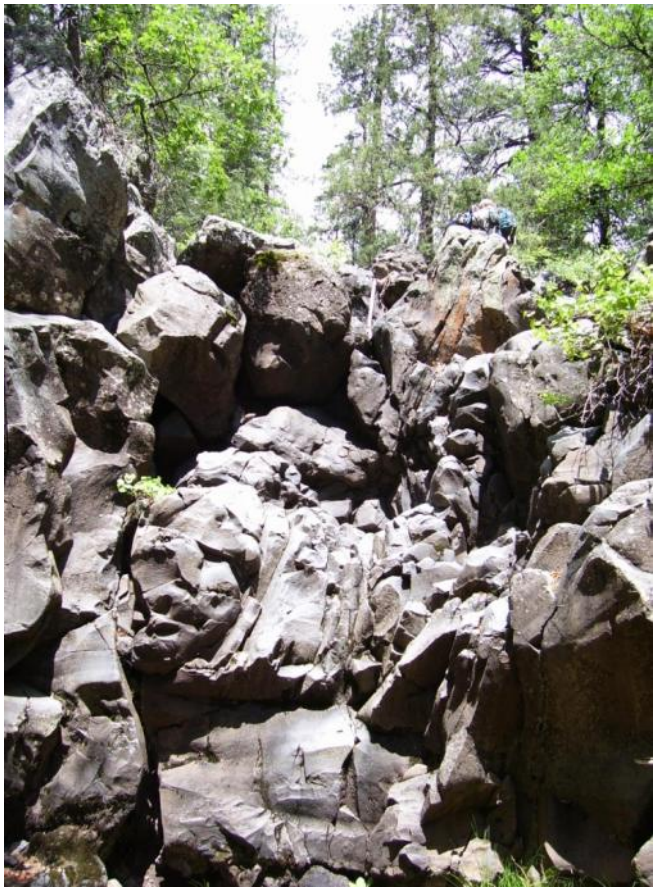

Figure 58. Photo depicting the canyon drop (approximately30 foot) approximately 0.5 miles below Favour tank over which water flows before reaching Sycamore Canyon.

Figure 59. High gradient slope of unnamed tributary flowing into Sycamore canyon (approximately900 ft. drop in 1.2 miles).

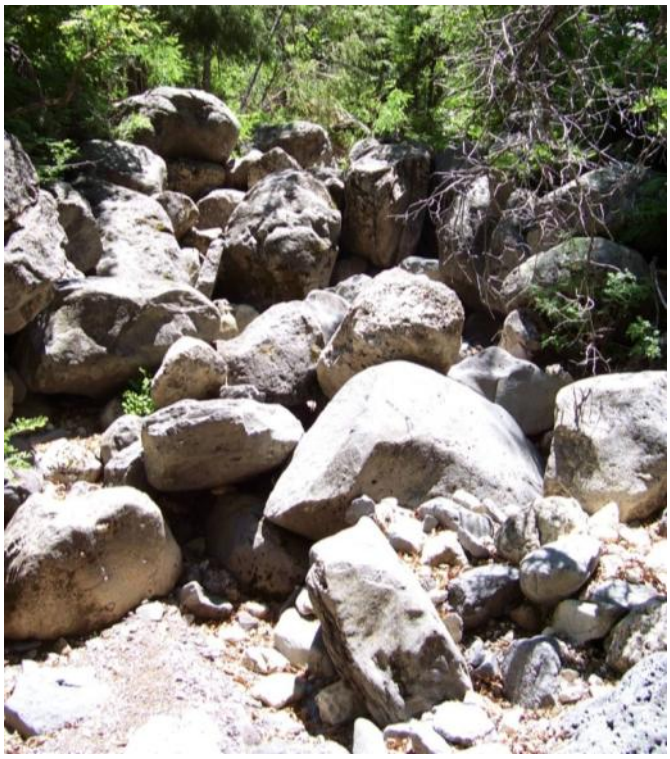

Figure 60. Steep canyon slope of tributary to Sycamore Canyon.

Fish Movement
Stocked fish could move upstream to Ike Tank in extreme storm events. Existence of a fish community in this tank is unknown, but unlikely because of its small size and because it dries frequently, as do other tanks in the area. White Horse Lake spills exclusively in response to snowmelt runoff or high runoff events, and typically has low water levels in most years. In the event of precipitation events significant enough to cause White Horse Lake to fill and spill, fish could escape downstream into Favour Tank, and continue down the unnamed ephemeral channel over a series of falls, the largest 30 feet tall, and down a high gradient slope of about a 900 foot drop in 1.2 miles, characterized by large boulders to Sycamore Canyon.

The lake's substrate is composed primarily of small cinders and the sediment associated with runoff events collected from its drainage upstream. During spring runoff events significant enough to cause White Horse Lake to spill, the outflow is extremely sediment-laden, causing low visibility and low oxygen levels. A high level of stream sediment, severe vertical drops and large boulders on a steep decline creates an environment difficult for fish to survive during flood events.

For this reason, White Horse Lake downstream to the confluence if the unnamed tributary and Sycamore Creek is considered a closed system.

Community Description
Recent fish surveys have not been conducted at White Horse Lake; however, based on stocking records and angler reports, rainbow trout, black crappie, non-native crayfish, and non-native bullfrogs are present in the lake. Black crappie was not stocked by the Department. The species was detected in White Horse Lake in approximately 1999. In January 2003 an unsuccessful attempt was made to pump the lake dry to remove black crappie. When the lake refilled in 2004, black crappie was still present in the reservoir. The crayfish population of White Horse Lake is abundant. A Department crayfish trapping clinic in 2006 captured 5 gallons of crayfish over the course of a 6 hour period, using 4 baited crayfish traps and 10 baited minnow traps.

Consultation Species or Critical Habitat
White Horse Lake downstream to the confluence with Sycamore Creek is a closed system. There are no endangered, threatened, or candidate fish species or critical habitat present within this system. Potential impacts to northern leopard frogs are discussed below.

Northern Leopard Frog
Local Analysis: Although White Horse Lake and the Sycamore Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in White Horse Lake is low. There are no records for northern leopard frogs from White Horse Lake. There have been 57 surveys at 30 sites within

the buffered stocking complex between 1967 and 2000 (Figure 56, AGFD Riparian Herpetofauna Database). Northern leopard frogs were observed at 2 of these sites, Perkins Tank in 1972 and Unnamed Tank (=16 Tank) in 1996 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs from Deadman Pocket Tank were released by the Department at Unnamed Tank (=16 Tank) in 1996 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Perkins Tank was surveyed in 1992 and Unnamed Tank was surveyed 4 times post-release: 1997 (n=1) and 1998 (n=3). Northern leopard frogs were not observed during these surveys and likely do not occupy the area, because crayfish and bullfrogs have been documented at the area, making it less suitable leopard frog habitat. (AGFD Riparian Herpetofauna Database, Sredl, pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached dam at White Horse Lake is low, because the drainages into which the fish would disperse are below the minimum elevational range for the northern leopard frog in the Verde River Watershed (approximately5300 feet) (Sredl 1997) and there are no historical records for frogs in these drainages (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Elk Tank

Site Description

Elk Tank is the upstream-most impoundment on JD Wash (Figure 48) and is located 18 miles southeast of the City of Williams and 4 miles southwest of White Horse Lake on the Kaibab National Forest. The tank is 0.89 surface acres when full (Figure 61) and has a depth of 30 feet.

Elk Tank is a popular catch-and-release fishery for the local fly fishing anglers of Williams, Flagstaff, and surrounding areas.

Elk Tank is a walk-in only fishery with a small parking pullout and kiosk located off of Forest Road 11.

Management of Water Body

Elk Tank is managed primarily as a special regulation cold water catch-and-release trout fishery featuring artificial flies and lures only, with a single barbless hook regulation (Table 23).

Figure 61. Photograph of Elk Tank.

Table 23. Elk Tank stocking history from 1989 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Rainbow trout	1989	2009	22	9,302
Total			22	9,302

In May of 2006, AGFD pumped Elk Tank dry to allow the Kaibab National Forest to repair erosion damage to the dam caused by extreme runoff events of spring 2005 (Figure 62). During the pumping efforts 100 rainbow trout were collected, and in addition, large populations of bullfrogs were removed from the tank. Rainbow trout were restocked in 2008 after repairs were made and the tank refilled. It took the tank almost two years to refill after repairs were made to the dam (Figure 63). Despite the small surface acreage, the tank is incredibly deep at approximately 30 feet. Creel surveys have not been conducted at Elk Tank; however, the 2001 statewide angler use survey based on angler license sales estimated that Elk Tank supported 714 angler use days (Pringle 2004). Elk Tank is currently approved for stocking of rainbow trout and brown trout.

Figure 62. Elk Tank following being pumped in 2006.

Figure 63. Elk Tank water level in august 2007.

Proposed Action

The Department proposes to stock rainbow trout and brown trout for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked multiple times per season annually from March to November; numbers of rainbow trout stocked may be from 0 – 3,000 annually.

Catchable and sub-catchable brown trout would be stocked from September to November annually; numbers of brown trout stocked may be from 0 - 750 annually.

Water Distribution / Connectivity

Elk Tank and Middle Tank are impoundments on an unnamed tributary that flows into JD Wash, with Elk Tank being the upstream-most tank. JD Dam Lake is located at the confluence of this unnamed tributary and JD Wash. The outflows from these three water bodies occur almost exclusively from snowmelt runoff or other high runoff events. The tanks are subject to

fluctuations in water level from year to year depending on precipitation cycles. It is 1.48 miles from Elk Tank to Middle Tank, and 0.93 miles from Middle Tank to JD Dam Lake. Elk Tank was pumped dry in 2006 and took almost two years to refill to a level acceptable for stocking. From JD Dam Lake, ephemeral JD Dam Wash continues 1.01 miles to Whitetail Tank. Outflow from Whitetail Tank continues 0.07 miles before it descends down a more than 100 foot drop (Figure 64). There is a boulder field at the bottom of the falls. This fall and 18 miles of ephemeral channel separate the trout stocking locations and the upper Verde River. Whitetail Tank spills approximately one out of every six years. From the 100 foot drop, the ephemeral JD Dam Wash channel continues 1.79 miles into Tule Canyon, which is an ephemeral drainage of Sycamore Creek. Tule and Sycamore Creek have ephemeral/intermittent flow for 14.5 miles followed by 4 miles of perennial flow before reaching the upper Verde River.

Figure 64. 100 foot drop located 0.07 miles downstream from Whitetail tank on JD Dam Wash. Note the person in the upper center of the picture for size reference.

Fish Movement
Only wet climactic cycles large enough to cause JD Wash and the series of tanks on it to fill and spill would allow fish to move freely between these tanks. However the nature of the runoff from these tanks is often heavy, with sediment from the earthen tanks and the drainage itself creating a harsh environment for fish movement. Fish from Elk Tank could potentially move downstream into Middle Tank, then to JD Dam Lake, then to Whitetail Tank, as well as upstream JD Dam Wash above JD Dam Lake. Whitetail Tank spills one out of every six years on average. Fish from Whitetail Tank could continue down JD Wash to a 100 foot drop into Tule Canyon.

The JD Dam Wash drainage above the 100 foot fall is considered a closed system because of the nature of the waterfall over which all escaped trout would have to pass. Passage over the 100 foot fall would result in mortality to rainbow or brown trout stocked in the Elk Tank.

Community Description
Recent fish surveys have not been conducted at Elk Tank; however, based on stocking records and angler reports, rainbow trout and non-native bullfrogs are present in the tank.

Consultation Species or Critical Habitat
JD Dam Wash downstream to the 100 foot waterfall is considered a closed system, and there are no endangered, threatened or candidate fish species or critical habitat present within this system. Potential impacts to northern leopard frogs and Mexican spotted owl and its critical habitat are discussed below.

Northern Leopard Frog
Local Analysis: Although Elk Tank and the Sycamore Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Elk Tank is low. There are no records of northern leopard frogs in Elk Tank. There have been 57 surveys at 30 sites within the buffered stocking complex between 1967 and 2000 (Figure 56, AGFD Riparian Herpetofauna Database). Northern leopard frogs were observed at 2 of these sites, Perkins Tank in 1972 and Unnamed Tank (=16 Tank) in 1996 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Perkins Tank was surveyed in 1992 and Unnamed Tank (=16 Tank) was surveyed during 4 visits after the 1996 release of frogs from Deadman Pocket Tank; northern leopard frogs were not observed at either site during these surveys (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and likely do not occupy the area because bullfrogs have been documented at the tank, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Elk Tank is low, because the drainages into which the fish would disperse are below the minimum elevational range for the northern leopard frog in the Verde River Watershed (approximately 5300 feet) (Sredl 1997) and there are no historical records for frogs in these drainages (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl
This stocking location is within critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

<u>Middle Tank</u>
Site Description
Middle Tank is located 18 miles southeast of the City of Williams and approximately 4 miles southwest of White Horse Lake on the Kaibab National Forest. It is 2.19 surface acres when full (Figure 65). Middle Tank is the second and smallest of three impoundments on an unnamed tributary that flows into JD Dam Wash, and is located 1.48 miles downstream from Elk Tank.

Middle Tank is a walk-in only fishery with a small parking pullout and kiosk located off of Forest Road 11. It is located on and managed by the Kaibab National Forest.

Figure 65. Photo of Middle Tank.

Management of Water Body

Middle Tank is primarily managed as a special regulation cold water catch-and-release trout fishery featuring an artificial fly and lure only, single barbless hook regulation (Table 24). Recent management has emphasized the stocking of catchable and sub–catchable rainbow trout as well as sub-catchable and fingerling brown trout. Creel surveys have not been conducted at Middle Tank, and the 2001 statewide angler use survey based on angler license sales does not report angler use days for this tank (Pringle 2004). Middle Tank is currently approved to stock rainbow and brown trout. Middle Tank is a popular catch-and-release rainbow trout fishery for the local fly fishing anglers of Williams, Flagstaff, and surrounding areas.

Middle Tank was drained in 2004 to deepen the tank and repair the spillway; in addition, efforts were made to improve bank stabilization due to heavy cattle and wildlife use. Middle Tank is characterized by large amounts of aquatic vegetation in the summer and is consequently often subject to poor water quality and occasional fish kills.

Table 24. Middle Tank stocking history from 1984 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked

Brown trout	1989	2006	4	1,208
Channel catfish	1984	1984	2	650
Rainbow trout	1990	2008	14	4,711
Total			20	6,569

Proposed Action
The Department proposes to stock rainbow trout and brown trout for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked multiple times per season from March to November annually; numbers of rainbow trout stocked may be from 0 – 3,000 annually.

Catchable and sub-catchable brown trout would be stocked from September to November annually; numbers of brown trout may be from 0 – 750 annually.

Water Distribution / Connectivity
Elk Tank and Middle Tank are impoundments on an unnamed tributary that flows into JD Wash; Elk Tank is the upstream-most tank. JD Dam Lake is located at the confluence of this unnamed tributary and JD Dam Wash. The outflows from these three water bodies occur almost exclusively from snowmelt runoff or other high runoff events. The tanks are subject to fluctuations in water level from year to year depending on precipitation cycles. Elk Tank is located 1.48 miles upstream of Middle Tank, and 0.93 miles from Middle Tank to JD Dam Lake. From JD Dam Lake, ephemeral JD Dam Wash continues 1.01 miles to Whitetail Tank. Outflow from Whitetail Tank continues 0.07 miles before it descends down a more than 100 foot drop (Figure 64). There is a boulder field at the bottom of the falls. These falls and 18 miles of ephemeral channel separate the trout stocking locations and the upper Verde River. Whitetail Tank spills approximately one out of every six years. From the 100 foot drop, the ephemeral JD Dam Wash channel continues 1.79 miles into Tule Canyon, which is an ephemeral drainage of Sycamore Creek. Tule and Sycamore Creek have ephemeral/intermittent flow for 14.5 miles followed by 4 miles of perennial flow before reaching the upper Verde River.

Fish Movement
Only wet climactic cycles large enough to cause JD Wash and the series of tanks on it to fill and spill would allow fish to move freely between these tanks. However, the nature of the runoff from these tanks is often heavy with sediment from the earthen tanks and the drainage itself, creating a harsh environment for fish movement. Fish from Middle Tank could potentially move upstream to Elk Tank or downstream into Middle Tank, then to JD Dam Lake, then to Whitetail

Tank. Whitetail tank spills one out of every six years on average. Fish from Whitetail tank could continue down JD wash to a 100 foot drop into Tule Canyon.

The JD Dam Wash drainage above the 100 foot fall is considered a closed system because of the nature of the waterfall over which all escaped trout would have to pass. Passage over the 100 foot fall would result in mortality to rainbow or brown trout stocked in Middle Tank.

Community Description
Recent fish surveys have not been conducted at Middle Tank; however, based on stocking records and angler reports, rainbow trout and a large, non-native bullfrog population are currently present in the tank.

Consultation Species or Critical Habitat
JD Dam Wash downstream to the 100 foot waterfall is considered a closed system, and there are no endangered, threatened, or candidate fish species or critical habitat present within this system. Potential impacts to northern leopard frogs, Mexican spotted owl and its critical habitat are discussed below.

Northern Leopard Frog
Local Analysis: Although Middle Tank and the Sycamore Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Middle Tank is low. There are no records of northern leopard frogs in Middle Tank. There have been 57 surveys at 30 sites within the buffered stocking complex between 1967 and 2000 (Figure 56, AGFD Riparian Herpetofauna Database). Northern leopard frogs were observed at 2 of these sites, Perkins Tank in 1972 and Unnamed Tank (=16 Tank) in 1996 (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Perkins Tank was surveyed in 1992 and Unnamed Tank (=16 Tank) was surveyed during 4 visits after the 1996 release of frogs from Deadman Pocket Tank; northern leopard frogs were not observed at either site during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and likely do not occupy the area because bullfrogs have been documented at the tank, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Middle Tank is low, because the drainages into which the fish would disperse are below the minimum elevational range for the northern leopard frog in the Verde River Watershed (approximately5300 feet) (Sredl 1997) and there are no historical records for frogs in these drainages (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl

This stocking location is within critical habitat (CH)**.**

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

JD Dam Lake

Site Description

JD Dam Lake is located approximately 18 miles southeast of the City of Williams and approximately 4 miles southwest of White Horse Lake on the Kaibab National Forest; it is about 8 surface acres when full (Figure 66). JD Dam Lake is the downstream most of the three managed waters on the JD Dam Wash drainage. JD Dam Lake is vehicle accessible and includes a parking lot, boat launch, information kiosk, and outhouses, located off of Forest road 105. Boats are restricted to a single electric motor only. JD Dam Lake is the most popular of the three fisheries on the JD Wash drainage, since it is accessible by vehicle and the largest of the three.

Figure 66. Photo of JD Dam Lake.

Management of Water Body

JD Dam Lake is primarily managed as a special regulation cold water catch-and-release trout fishery featuring artificial flies and lures only, single barbless hook regulation (Table 5). In 1998 NAF, the Kaibab National Forest, the City of Williams, and the Department undertook a project to improve the fishery. The project involved pumping the lake dry, removing silt, re-contouring the lake, building islands and peninsulas, reseeding the area including the islands and peninsulas, and rebuilding fences to control cattle.

Recent management has emphasized the stocking of catchable and sub–catchable rainbow trout as well as sub-catchable and fingerling brown trout. Creel surveys have not been conducted at JD Dam Lake; however, the 2001 statewide angler use survey based on angler license sales estimated that the lake supported 2,140 angler use days (Pringle 2004). JD Dam Tank is currently cleared to stock rainbow and brown trout, which are the only species stocked since 1995 (Table 25).

Elk Tank, Middle Tank, and JD Dam Lake are popular catch-and-release fisheries for the local fly-fishing anglers of Williams, Flagstaff, and surrounding areas. All three tanks have catch-and-

release, artificial fly and lure single barbless hook regulations. Table 25. JD Dam Lake stocking history from 1936 to 2009.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook Trout	1965	1986	6	4,620
Bluegill	1936	1936	1	8,500
Brown Trout	1964	1995	23	31,943
Channel Catfish	1957	1960	2	563
Largemouth Bass	1946	1957	4	8,395
Rainbow Trout	1954	2008	75	94,978
Redear Sunfish	1949	1949	1	1,950
Total			112	150,949

Proposed Action

The Department proposes to stock rainbow trout and brown trout for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked multiple times per season from March to November annually; numbers of rainbow trout stocked may be from 0 – 14,000 annually.

Catchable and sub-catchable brown trout would be stocked multiple times per season from September to November annually; numbers of brown trout stocked may be from 0-1,500 annually.

Water Distribution / Connectivity

JD Dam Lake is located at the confluence of this unnamed tributary and JD Dam Wash. JD Dam Lake receives runoff from the unnamed tributary that holds Elk and Middle Tanks, after Elk and Middle Tank upstream have filled and spilled, as well as from JD Dam Wash upstream of JD Dam. The outflow from these tanks occurs almost exclusively from snowmelt runoff or other high runoff events. The tanks are subject to fluctuations in water level from year to year depending on precipitation cycles. Elk Tank is located 1.48 miles upstream of Middle Tank, and 0.93 miles from Middle Tank to JD Dam Lake. From JD Dam Lake, ephemeral JD Dam Wash continues 1.01 miles to Whitetail Tank. Out flow from Whitetail Tank continues 0.07 miles before it descends down a more than 100 foot drop. There is a boulder field at the bottom of the falls. These falls and 18 miles of ephemeral channel separate the trout stocking locations and the upper Verde River. Whitetail Tank spills approximately one out of every six years. From the 100 foot drop, the ephemeral JD Dam Wash channel continues 1.79 miles into Tule Canyon an

ephemeral drainage of Sycamore Creek. Tule and Sycamore Creek have ephemeral/intermittent flow for 14.5 miles followed by 4 miles of perennial flow before reaching the upper Verde River.

Fish Movement

Only wet climactic cycles significant enough to cause JD Wash and the series of tanks on it to fill and spill would allow fish to move freely between these tanks. However the nature of the runoff from these tanks is often heavy with sediment from the earthen tanks and the drainage itself, creating a harsh environment for fish movement. Fish from JD Dam Wash could potentially move upstream to Middle and Elk tanks or downstream into to JD Dam Lake, then to Whitetail Tank. Whitetail Tank spills one out of every six years on average. Fish from Whitetail Tank could continue down JD wash to a 100 foot drop into Tule Canyon.

The JD Dam Wash drainage above the 100 foot fall is considered a closed system because of the nature of the waterfall over which all escaped trout would have to pass. Passage over the 100 foot fall would result in mortality to rainbow or brown trout stocked in the JD Dam Lake.

Community Description

In September 2007, a trammel netting and angling survey was conducted in response to angler reports of a possible illegal stocking of northern pike into the tank. Two 15 foot and one 150 trammel nets were set in random locations across the tank for approximately 6 hours. Two anglers also actively fished for pike during a 3-hour period using artificial lures and flies with single, barbless hooks. Results of that survey indicated a fish community of catchable sized rainbow and brown trout (Table 26). The survey also indicated that adult bullfrogs were observed in extremely large numbers (in the hundreds) at the tank.

Table 26. 2007 JD Dam Lake trammel net and angling survey.

Species	**# Collected**	**Length Range (mm)**	**# caught Angling**	**# caught Trammel**
Rainbow Trout	17	216-302	7	10
Brown Trout	2	206-211	2	0

Elk Tank, Middle Tank, and JD Dam Lake all suffered from low water levels due to drought conditions in 2008. In April of 2008, a gill netting survey was conducted to determine if the trout population in JD Dam Tank survived the winter of 2007-2008 (Table 27). One 150 foot 6 panel experimental trammel net was set across the tank for 17.25 hours. The results of the survey indicated that rainbow trout were still present in the tank.

Table 27. 2008 JD Dam Lake gill netting survey.

Species	Num. Collected	Average Length (mm)	Min-Max Length (mm)
Rainbow trout	12	334.8	320-350
Brown trout	0	-	-
Northern pike	0	-	-
Totals	12	-	-

Consultation Species or Critical Habitat
JD Dam Wash downstream to the 100 foot waterfall is considered closed system, and there are no endangered, threatened, or candidate fish species or critical habitat present within this system. Potential impacts to northern leopard frogs, Mexican spotted owl and its critical habitat are discussed below.

Northern Leopard Frog
Local Analysis: Although JD Dam Lake and the Sycamore Creek buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in JD Dam Lake is low. There are no records of northern leopard frogs in JD Dam Lake (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 57 surveys at 30 sites within the buffered stocking complex between 1967 and 2000 (Figure 56, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were observed at 2 of these sites, Perkins Tank in 1972 and Unnamed Tank = (16 Tank) in 1996 (AGFD Riparian Herpetofauna Database). Perkins Tank was surveyed in 1992 and Unnamed Tank (=16 Tank) was surveyed during 4 visits after the 1996 observation; northern leopard frogs were not observed at either site during these surveys (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and likely do not occupy the area because bullfrogs have been documented at the tank, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at JD Dam is low, because the drainages into which the fish would disperse are below the minimum elevational range for the northern leopard frog in the Verde River Watershed (approximately 5300 feet) (Sredl 1997) and there are no historical records for frogs in these drainages (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Mexican Spotted Owl
This stocking location is within critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Sycamore Creek Complex Analysis

All of the proposed stocking sites located within the Sycamore Creek drainage are upstream of significant barriers over which stocked fish are not expected to survive. No stocked fish in this drainage are expected to survive escapement and move downstream into the lower reaches of Sycamore Creek or the Upper Verde River.

Upper Verde River Impacts Analysis

Site Description

The upper Verde River for the purposes of this analysis is 48.5 miles long and begins at the base of Sullivan Dam at river-mile (RM) 0 near Paulden, and terminates and the Pecks Lake or TAPCO Diversion at river-mile 48.5 near Clarkdale. The upper Verde River is fed by the Big Chino, Granite Creek, and Sycamore Creek Complexes, which were previously described (Figure 67). Land ownership for the first 6-miles is a mixture of Private, Arizona Game and Fish Commission, and State Trust Land. At river-mile 6, the Prescott National Forest is the dominate landowner with various private in holdings.

Management of Water Body

The upper Verde is currently managed as a recreational fishery with an emphasis on native fish species. Access is poor and most fishing occurs at or near the upper Verde River Wildlife Area (UVRWA). In addition to the UVRWA, only 2 additional road access sites exist on the upper Verde River; 1 at Bear Siding, and 1 at Perkinsville. In early 2002, a mail out angler survey was developed by the Arizona Game and Fish Department (Department) and Arizona State University (ASU) to collect data on statewide fishing efforts. The survey sample was developed using fishing license sales from 2001. To increase precision by county, all available fishing

licenses from Department offices and Internet sales, and those entered manually from the license dealers across the State were used. This produced a sample of 46,149 anglers of which 37,729 were office sales and 8,420 from license dealers; from this survey it was estimated a total of 191 angler use days were expended on the upper Verde River to fish for non-trout species (Pringle 2004).

The UVRWA (Figure 68) was purchased in 1996 using Heritage Fund monies. The land and resource values associated with this acquisition provide outstanding opportunities to meet objectives of Arizona's Heritage Fund Program for Threatened, Endangered and Sensitive (TES) species and habitats, as well as provide benefits for other wildlife species and the public. Located approximately 8 miles north of Chino Valley in Yavapai County, it was incised from the Cooper-Morgan Ranch that originally consisted of 7,700 acres of deeded land and grazing allotments on 23,397 acres of Forest Service and 21,799 acres of State Trust lands. The primary historical land use in this area was livestock production. Due to recent acquisitions, the UVRWA now roughly extends from river-mile 1.6 to the Prescott National Forest Boundary at river-mile 6.

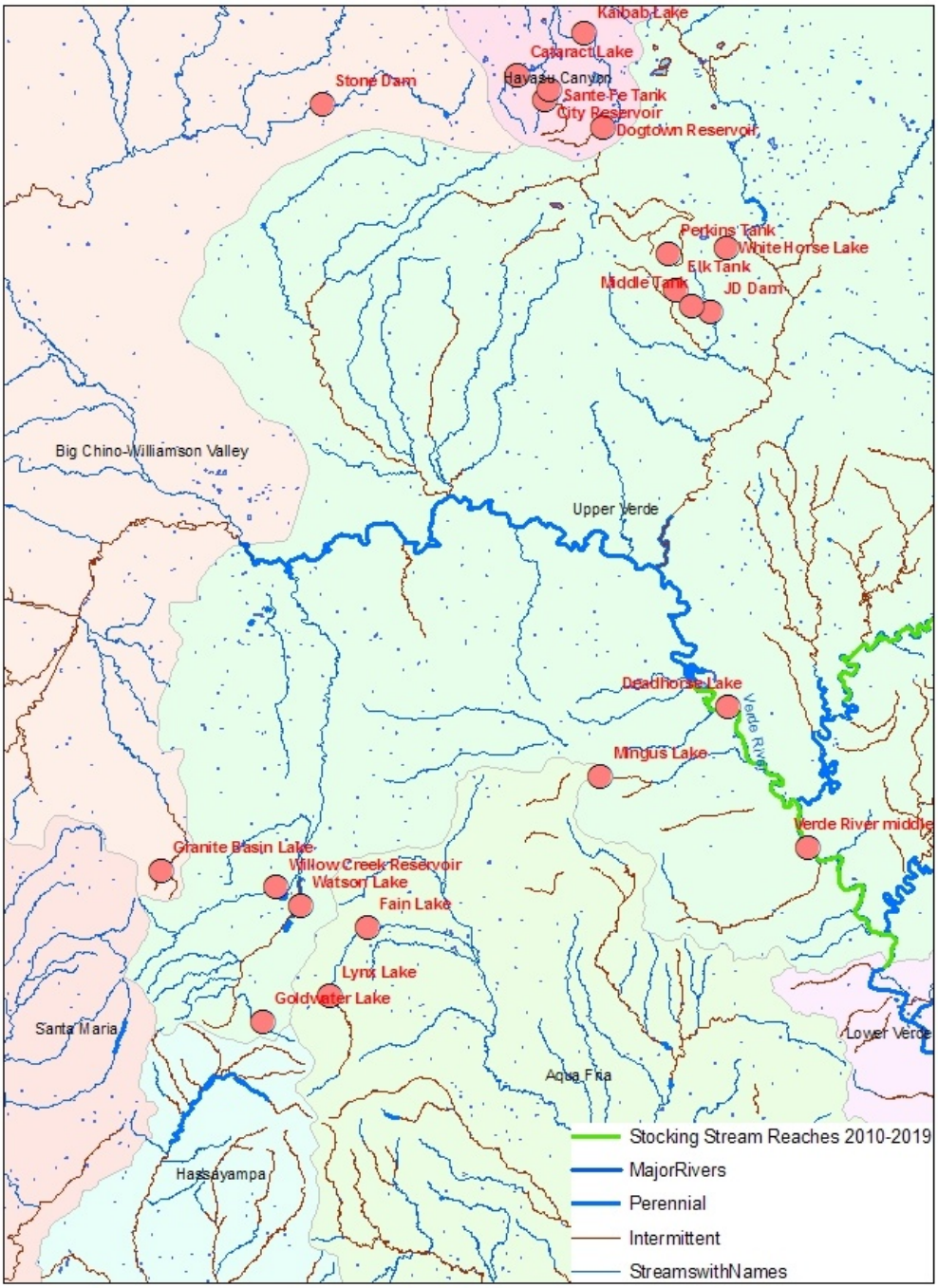

Figure 67. Upper Verde Sub-Watershed and surrounding Sub-Watersheds

The Game and Fish Commission approved measures to benefit native fish species at their October 1997 meeting by establishing unlimited harvest of warm-water species and restrictions on baitfish transport and use. The Verde River was included in a list of several Arizona Rivers to

fall under the new regulations. These two changes to Commission Order 40 were designed to encourage angling and harvest as well as limit the spread of baitfish into sensitive areas.

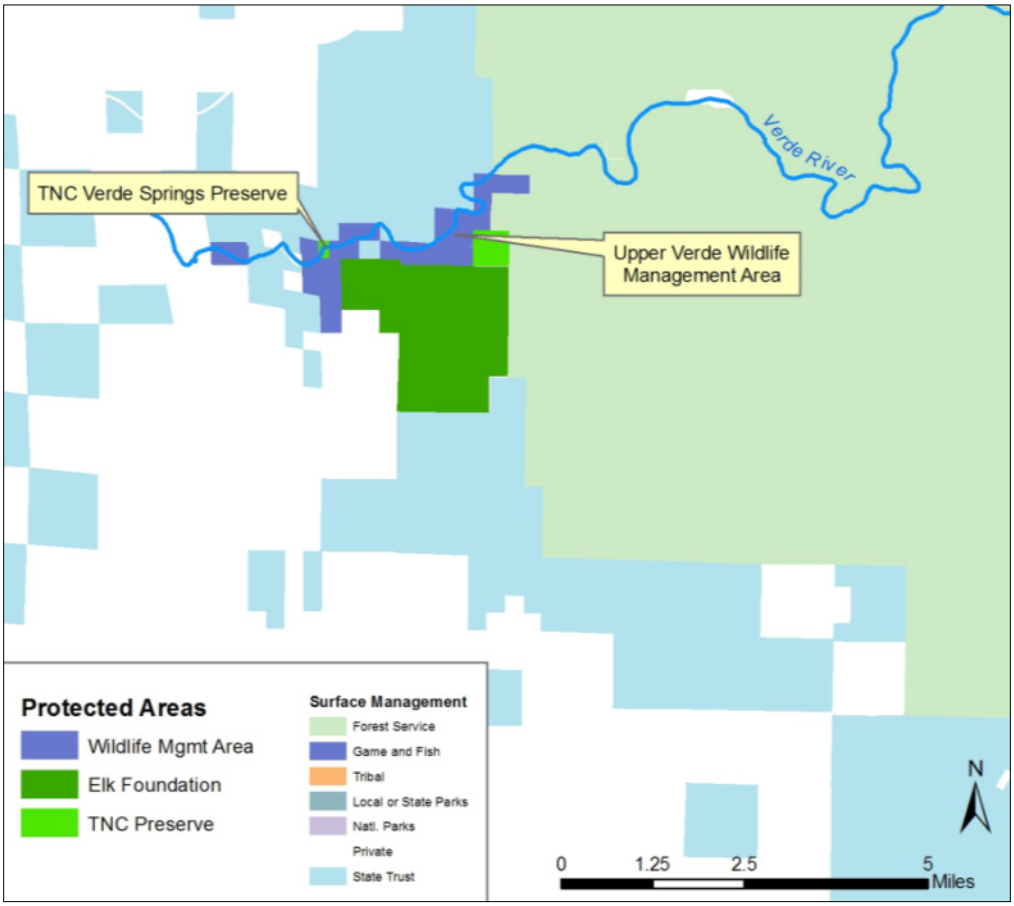

Figure 68. Upper Verde River Wildlife Area.

The Department's historic fish stocking activities on the Verde River immediately upstream of Sycamore Creek are listed in Table 28 and Table 29. The area from Sullivan Lake to Perkinsville is identified as the upper reach; the area between Perkinsville and Sycamore Creek is identified as the middle reach, for a total of 38.5 miles. Stockings of 4 non-native species occurred up to 1991. Only the stockings of smallmouth bass appear to have been successful in the establishment of a reproducing population. Stockings subsequent to 1991 have been exclusively reintroduction efforts for native species.

Table 28. Historical Stocking Report Verde River – Sullivan Lake to Perkinsville.

Common Name	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1943	1944	2	13,213

Colorado squawfish	1988	1992	4	34,114
Rainbow trout	1951	1991	5	5,689
Razorback sucker	1986	1993	11	122,448
Smallmouth bass	1942	1944	3	36,000
		Total	**25**	**211,464**

Table 29. Historical Stocking Report Verde River – Perkinsville to Sycamore Creek.

Common Name	First Year	Last Year	Num. of Stockings	Num. Stocked
Colorado squawfish	1988	1992	3	60,005
Northern pike	1968	1968	1	44
Razorback sucker	1987	1994	6	70,107
Total			**10**	**130,156**

The Strategic Direction for the Department's Sport Fish and Nongame and Endangered Wildlife Programs envisions a balanced approach to maintaining and enhancing sport fishing opportunities, while simultaneously contributing to the conservation and restoration of Arizona's native aquatic wildlife resources (AGFD 2007c). The Sport Fish Program's goals include the charge to "Maintain, manage, and enhance the quality, abundance, availability, and diversity of sport fishing opportunities while contributing to the recovery of Arizona's native fishes." Recognizing this charge, the objectives of both programs have envisioned the completion of Watershed-Based Fisheries Management Approaches that identify reaches or zones for the management of sport fishes and separates reaches or zones for the management of native fishes. This has proven to be necessary where nonnative fishes, combined with habitat parameters, have created conditions that threaten the persistence or continued existence of native aquatic populations. Efforts to create a Watershed-Based Fisheries Management Plan for the Verde River Watershed is planned to begin in 2010 (AGFD 2009c).

The Game and Fish Commission has long recognized the value of the Verde River to conservation of Arizona's biodiversity, and to the conservation of native aquatic fauna. Existing and long-standing Commission Policy Direction (DOM A2.13 and A2.17) set the foundation for the Commission's guidance for conservation of the Verde River's unique biological and habitat values to the State. Further, Commission action taken in 1997 consciously removed bag limits for warm-water fishes and banned the transport of bait fishes to the Verde River Watershed above Horseshoe Dam, which clarified the Commission's objectives for management of the

Verde River above Horseshoe Dam, to be first and foremost for native aquatic communities. While this was not without some amount of controversy, this latter decision recognized that:

- conservation of Arizona's imperiled aquatic resources was essential to the Commission's mission;
- geographically concurrent objectives for managing to benefit nonnative fishes and to conserve native aquatic animals could often be in direct conflict; and
- to best protect and conserve sport fishing opportunity and native fish resources, the watershed would have to be partitioned into segments for native fish conservation and often separate segments for sport fish conservation.

Conservation and enhancement of the upper Verde River's native aquatic community is critically important to the future persistence and existence of those resources, and to the future of sport fishing in Arizona. The upper Verde River has constituted a diverse and important habitat for native fish communities in Arizona, but those communities are in decline in part due to interactions with resident nonnative fishes. Continued decline of that community and further imperilment of native aquatic resources can only lead to greater limitations on providing sport fish management services and sport fishing in the future. In concert with the direction the Commission has already set by Commission Policy, by Commission Order, and through its strategic plan, we propose that the upper 48.5 miles of the Verde River (upper Verde River) mainstem be considered a prime zone for the assertive management of native aquatic wildlife. The ramifications of such a decision may include experimental or operational suppression or removal of nonnative warm-water fishes, and if feasible, a potential barrier construction to maintain and protect core native fish reaches. We would anticipate in making the decision to identify the upper Verde River mainstem as an area for active or passive management for native aquatic wildlife, the Department and its partners would fully recognize the significant benefits and opportunities for sport fish management in other zones or areas of the Verde River Watershed.

Proposed Action

No stocking enhancements are proposed at this time for the upper Verde River. However, based on the potential for hydraulic connectivity between the Big Chino Complex, Granite Creek Complex, and Sycamore Creek Complex, an analysis of potential movement of fish and impacts to the fauna of the upper Verde River is provided. This analysis relies, in part, on the information previously provided in the three complexes just mentioned.

Water Distribution / Connectivity

The upper Verde River drains an area of 2,507 square miles, and begins at the bottom of the Big Chino Wash Complex and the Granite Creek Complex (Figure 1). The upper portion of the Verde River is primarily spring fed but is subject to high spring runoff events that result during years with above normal snowfall in the watersheds upstream from the upper Verde River . Summer thunderstorm activity can increase flows locally, but rarely are these effects seen on a large scale, nor do they contribute to significant run-off events downstream. The uppermost USGS stream gauge on the Verde near Paulden has a contributing drainage area of about 2,000 square miles, which is about 40% of the total basin area. Despite its large size, this portion of the basin appears to contribute little runoff to the peak discharge of the large floods historically recorded at the gauges downstream of the Paulden gauge, such as at the Clarkdale, Childs, or Tangle Creek. Peak flows recorded at the Paulden gauge almost always lag behind those at the Clarkdale gauge downstream by several hours (Haney et al. 2008). Base flow in the upper stretches of the Verde vary between 20-25 cubic feet per second and vary little from summer to winter (Haney et al. 2008). Base flow increases slightly with additional spring influence in various localities downstream to Sycamore Creek (Figure 69 [taken from Wirt et al. 2005]). Springs and small tributaries may contribute sub-surface flow in some locations. Sycamore Creek enters the Verde at river-mile 37.5 and is the first major tributary to contribute perennial surface flow (Haney et al. 2008). There are no known barriers to fish movement within the upper Verde River except upstream movement, which is blocked by Sullivan Dam. Partial barriers exist during times of normal to below normal flow at Stillman Lake, at a Salt River Project low flow gauge on the UVRWA, at Tunnel Falls (RM 30.2), and at various beaver dams, when they exist throughout the system. However, these barriers do not restrict fish movement during higher than base flow events. Haney et al. (2008) gives an excellent description of the fluvial geomorphology and flow regime for the upper Verde River.

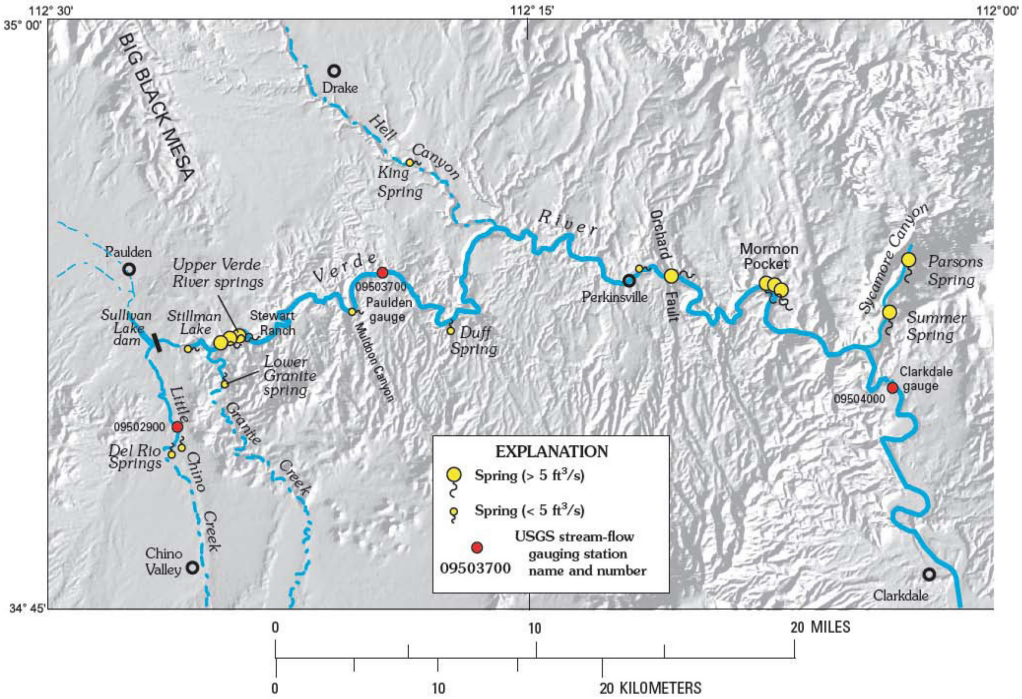

Figure 69. Locations of known springs and gauges along the upper Verde River from Sullivan Lake to Sycamore Creek (Wirt et al. 2005).

The gauge records for Granite Creek below Watson Lake do not begin until September 1999 (Table 30, Table 31 and Table 32) and indicate that the channel is dry or nearly dry for many days of the year. The gauge is located 150 feet north of the Highway 89A bridge on Granite Creek, upstream of the confluence with Willow Creek. Over the period of record, significant flows in Granite Creek occurred in 2003, 2005, and 2008 (Table 32). Interestingly, hurricane Javier which came over Arizona from the Gulf of California in September 2004 did not result in a spike flow down Granite Creek, although the rest of the Big Chino and upper Verde River watershed did flood (Table 33). Similarly, the December 2008 high flow event from Williamson Valley Wash was not reflected in increased flows in Granite Creek. Reservoir storage of high flows makes it difficult to assess when an inflow will spill; however, the City of Prescott's intention to keep both Watson Lake and Willow Creek Reservoir as full as possible increases the potential for incoming flows to exceed the spillway capacities of either lake.

Table 30. USGS gauge data for Granite Creek showing mean daily flows for selected months.

Day of Month	January	February	March	December
1	6.9	8.0	8.9	1.6
2	3.9	6.5	7.6	0.25

3	6.6	7.4	6.0	0.13
4	48	25	5.4	0.12
5	20	11	5.5	0.13
6	12	6.5	5.4	0.16
7	19	5.9	5.8	0.81
8	21	5.5	4.2	0.67
9	21	4.7	3.4	0.37
10	26	4.6	9.4	0.36
11	84	13	8.6	0.31
12	55	122	5.7	0.22
13	19	44	4.4	0.24
14	12	23	3.5	0.22
15	8.0	16	2,9	0.23
16	6.1	15	2.9	0.21
17	5.3	11	3.3	0.21
18	4.4	19	7.9	0.21
19	3.6	37	7.5	0.21
20	2.8	27	6.9	0.20
21	2.4	20	5.7	0.20
22	3.1	23	4.3	0.21
23	1.7	26	5.5	0.23
24	1.6	23	3.9	0.23
25	1.4	17	3.2	0.21
26	1.4	15	2.9	0.22
27	17	14	2.5	0.21
28	56	11	2.5	0.24
29	26	7.1	2.1	70
30	14		2.1	42
31	8.7		1.7	13

Table 31. USGS gauge data for Granite Creek showing mean monthly flows over 5 cfs.

January		**February**		**March**		**April**		**December**	
2005	111.6	2005	138.2	2001	7.15	2005	5.99	2004	36.5
2008	36.6	2008	38.2	2003	6.97				
				2005	25.0				

Table 32. USGS gauge peak flow data for Granite Creek.

Water Year	Date	Flow (cfs)
2000	August 24, 2000	119
2001	August 3, 2001	184
2002	September 7, 2002	120
2003	July 27, 2003	1,100
2004	July 27, 2004	78
2005	January 11, 2005	2,180
2006	August 13, 2006	250
2007	July 25, 2007	119
2008	January 28, 2008	808

Table 33. Comparison of mean daily flows (cfs) at Williamson Valley Wash, Granite Creek, and Verde River at Paulden USGS gauges.

Date	Williamson Valley	Granite Creek	Verde R. at Paulden	Dominant Watershed?
February 1978				Williamson Valley
2/27/78	2.6		22	
2/28/78	1,540		227	
3/1/78	4,180 (max 7,490)		4,000 (max 8,080)	
3/2/78	1,850		6,210	
3/3/78	1,740		3,400	
3/4/78	318		1,130	
3/5/78	1,160		1,030	
3/6/78	648		1,610	
3/7/78	242		722	
February 1980				Mixed
2/13/80	1.5		34	
2/14/80	2,390		558	
2/15/80	3,700		7,450	
2/16/80	712		3,420	
2/17/80	763		1,970	
2/18/80	696		1,500	

Date	Williamson Valley	Granite Creek	Verde R. at Paulden	Dominant Watershed?
2/19/80	1,360		1,850	
2/20/80	2,800 (max 10,100)		7,400 (max 15,700)	
2/21/80	964		4,430	
2/22/80	575		4,260	
2/23/80	196		1,890	
2/24/80	115		881	
September 1983				Williamson Valley
9/22/83	0.50		25	
9/23/83	4,200 (max 14,800)		2,720	
9/24/83	1,800		6,550 (max 15,600)	
9/25/83	235		1,510	
9/26/83	131		387	
July 2003				No effect
7/25/03	0.0	5.4	20	
7/26/03	0.0	0.0	20	
7/27/03	0.0	35 (max 1,100)	20	
7/28/03	0.0	5.2	20	
September 2004				Big Chino
9/18/04	0.0	0.0	21	
9/19/04	401 (est) (max 2,180)	0.0	1,501 (max 11,390)	
9/20/04	67 (est)	0.0	6,280 (max 12,350)	
9/21/04	5.9 (est)	0.0	714 (max 1,270)	
9/22/04	1.3 (est)	0.0	198 (max 430	
January 2005				Big Chino
1/3/05	82	57	88	
1/4/05	969	430	801 (max 1,450)	
1/5/05	315	180	1,080 (max 1,360)	
1/6/05	120	101	561 (max 735)	

Date	Williamson Valley	Granite Creek	Verde R. at Paulden	Dominant Watershed?
1/7/05	68	72	316 (max 393)	
1/8/05	58	68	179 (max 220)	
1/9/05	746	147	308 (max 720)	
1/10/05	1,210	218	1,950 (max 4,250)	
1/11/05	2,780	743 (max 2,180)	5,740 (max 9,400)	
1/12/05	1,330	489	7,440 (max 12,300)	
1/13/05	326	164	2,450 (max 4,560)	
1/14/05	134	101	840 (max 1,270)	
1/15/05	66	70	398 (max 542)	
1/16/05	43	52	244 (max 301)	
1/17/05	42	44	167 (max 201)	
1/18/05	39	36	67	
February 2005				Williamson Valley
2/10/05	37	11	32	
2/11/05	879	89	35	
2/12/05	5,300 (max 8,340)	1,070	4,960 (max 8,210)	
2/13/05	976	351	5,440 (max 6,440)	
2/14/05	417	170	1,750 (max 3,300)	
2/15/05	185	116	643 (max 953)	
2/16/05	176	112	377 (max 454)	
2/17/05	134	80	264 (max 264)	
2/18/05	727	147	294 (max 522)	
2/19/05	1,450	322	1,690 (max 2,800)	
2/20/05	739	231	2,830 (max 3,440)	
2/21/05	321	155	1,620 (max 2,700)	
2/22/05	948	176	816 (max 1,030)	
2/23/05	1,070	171	1,290 (max 1,540)	
2/24/05	891	144	1,170 (max 1,510)	
2/25/05	469	102	561 (max 765)	
January 2008				Williamson Valley

Date	Williamson Valley	Granite Creek	Verde R. at Paulden	Dominant Watershed?
1/26/08	2.3	0.22	24	
1/27/08	826 (max 3,320)	95	27	
1/28/08	878	452 (max 808)	784 (max 1,880)	
1/29/08	244	180	301 (max 487)	
1/30/08	44	71	114 (max 174)	
December 2008				
12/25/08	2.4	2.3	25	Williamson Valley
12/26/08	1,140	7.9	415 (max 1,610)	
12/27/08	66	1.3	263 (max 720)	
12/28/08	15	0.62	71 (max 109)	

It is unknown how high a flow must be in Granite Creek to reach the confluence with the upper Verde River. The 23.3 mile distance is in part along a low-grade, sandy alluvial course (14.5 miles) with 1 sand and gravel operation in the wash near Chino Valley that could trap or impede flows (Clark 2003b). The lower 8.8 miles are in a canyon-like reach much steeper and narrower, before reaching the permanent water in Granite Creek at the confluence with the upper Verde River. Because the gauge is located upstream of Willow Creek, there may be some flows from Willow Creek Reservoir that are not counted in the gauge data. To attempt to address the potential connectivity, the Department will only look at flows over 800 cfs, in the assumption that a flow of that magnitude, combined with flows out of Willow Creek, could reach the confluence with the upper Verde River. The Department understands this may overestimate the potential number of events, since the July 2003 high flow on Granite Creek (1,100 cfs) is not represented in any flow increases at the Paulden gauge (Table 33).

Table 32 only shows the highest flow per water year in Granite Creek from October through September of the following year; there may have been other flows in a year that were high but not as high as the peak. This is apparent in Table 33, where the peak flow was in January 2005, even though there was another high flow in February that same year. The record contains three events that then qualify for connectivity: January 2005, February 2005, and January 2008.

In addition to these years, Clark (2003b) also looked at gauge data from the Paulden and Williamson Valley Wash gauges in a similar way to Table 33. These data are reported in Table

34. Table 35 provides yearly peak flow at the Williamson Valley gauge, and Table 36 provides yearly peak flow at the Paulden gauge. Table 37 shows mean monthly flows at the Paulden gauge over 100 cfs. Table 33 focused on the contributions of Big Chino Wash (ungauged) and Williamson Valley Wash to the flows at Paulden, and where a peak for Granite Creek occurred at those same points, included the daily flow data. Table 31 overlaps slightly; however, it looks at a number of other dates not included in Table 30. Importantly, we modified the table to look at the flow "remainders" in terms of both Big Chino Wash and Granite Creek as potential contributions. Six additional years, December 1965, October 1972, December 1978, February 1980, September 1983, and September 1984 show a possible Big Chino Wash/Granite Creek contribution.

Table 34. Comparison of Paulden and Williamson Valley Wash gauge data to estimate potential contributions from Big Chino Wash and Granite Creek. Modified from Clark 2003a.

Date	**Williamson Valley Wash**	**Verde River @ Paulden**	**Big Chino Wash and/or Granite Creek (estimated)**
12/30/65	3,630	6,130	2,500
10/20/72	1,940	3,040	1,100
2/9/76	3,910	4,430	430
3/1/78	7,490	8,080	590
12/19/78	4,890	5,700	810
2/20/80	10,100	15,700	5,600
9/24/83	14,800	15,600	800
9/1/84	3.1	3,650	3,650

Table 35. USGS gauge yearly peak flow data for Williamson Valley Wash.

Water Year	**Date**	**Flow (cfs)**
1965	April 10, 1965	820
1966	December 30, 1965	3,630
1967	December 7, 1966	1,710
1968	January 28, 1968	2,120
1969	February 26, 1969	400
1970	August 19, 1970	445
1971	August 23, 1971	465
1972	August 12, 1972	254
1973	October 19, 1972	1,940
1974	September 27, 1974	570

Water Year	Date	Flow (cfs)
1975	November 2, 1974	112
1976	February 9, 1976	3,910
1977	September 12, 1977	1,300
1978	March 1, 1978	7,490
1979	December 18, 1978	4,890
1980	February 20, 1980	10,100
1981	August 8, 1981	137
1982	February 11, 1982	572
1983	September 23, 1983	14,800
1984	October 5, 1983	1,280
1985	December 24, 1984	2,780
2001	August 9, 2001	1,010
2002	September 6, 2002	1,710
2003	August 29, 2003	1,650
2004	September 19, 2004	2,180
2005	February 12, 2005	8,340
2006	July 24, 2006	754
2007	August 2, 2007	212
2008	January 27, 2008	3,320

Table 36. USGS gauge yearly peak flow data for Verde River near Paulden.

Water Year	Date	Flow (cfs)
1963	August 25, 1963	710
1964	August 5, 1964	1,270
1965	April 10, 1965	685
1966	December 30, 1965	6,130
1967	December 7, 1966	1,250
1968	January 28, 1968	1,800
1969	July 26, 1969	465
1970	August 19, 1970	705
1971	August 13, 1971	2,270
1972	August 08, 1972	1,620
1973	October 20, 1972	3,040
1974	September 5, 1974	270
1975	July 9, 1975	73

Water Year	Date	Flow (cfs)
1976	February 9, 1976	4,340
1977	September 12, 1977	1,290
1978	March 1, 1978	8,080
1979	December 19, 1978	5,700
1980	February 20, 1980	15,700
1981	August 9, 1981	195
1982	March 16, 1982	541
1983	September 24, 1983	15,600
1984	September 0, 1984	3,650
1985	December 28, 1984	2,390
1986	November 30, 1985	1,460
1987	August 12, 1987	217
1988	April 26, 1988	342
1989	July 08, 1989	263
1990	July 15, 1990	123
1991	March 2, 1991	6,320
1992	February 14, 1992	1,590
1993	February 20, 1993	23,200
1994	September 2, 1994	192
1995	February 15, 1995	3,960
1996	July 15, 1996	1,030
1997	August 30, 1997	208
1998	August 31, 1998	592
1999	September 24, 1999	1,070
2000	August 25, 2000	83
2001	October 28, 2000	633
2002	September 10, 2002	1,610
2003	August 15, 2003	909
2004	September 20, 2004	12,350
2005	January 12, 2005	12,300
2006	July 31, 2006	124
2007	August 14, 2007	770
2008	January 28, 2008	1,880

Table 37. USGS gauge data for Verde River near Paulden showing mean monthly flows over 100 cfs (years shown are actual calendar years, not water years).

January		February		March		September		October		December	
1979	112.9	1973	122.8	1973	304.5	1983	440.3	1972	200.1	1965	295.4
1980	231.8	1976	155.7	1978	668.5	2004	314.8	2004	168.2	1978	214.7
1993	860.9	1980	1,311	1979	224.2					1984	105.4
2005	770.3	1993	1,443	1983	208.0					2004	142.0
		1995	192.9	1991	152.4						
		2005	906.5	1993	123.2						
				1995	188.3						

Clark (2003b) notes that Granite Creek has flooded to a "sufficient magnitude" to allow transport of fishes several times over the last 30 years. He also reports that local residents of Chino Valley, which is more than half-way down to the upper Verde River confluence, recall the creek flowing "bank to bank" in 1980, 1983, and 1993. The February 1980 and September 1983 comparisons in Table 37 likely reflect these events. The Williamson Valley gauge was not in service during the February 1993 flood that produced 23,300 cfs at the Paulden gauge, and was likely the 1993 event at Granite Creek. Fish can be transported downstream during floods. There are factors that influence how successfully this can occur, since water velocities and sediment loads can be quite high which can injure or kill fish caught in the flows. Fine clay sediments transported with runoff often prohibit fish survival in pools following runoff events. High sediment loads can also result in fish mortality as a result of decreased dissolved oxygen concentrations concurrent with increased suspended sediments (Bozek and Young 1994; Robinson et al. 2004a; Rinne and Carter 2008). During the process of the flood, there may be safer eddies or shallow waters where fish can ride out the worst; however, depending on the duration of the high flows, these areas may become isolated and not allow further downstream movement.

Based on available flow information, it appears that all three of the contributing watersheds to the upper Verde River have the potential to hydraulically connect. Lack of flow data on the Big Chino watershed prevents assessing the contribution of its sub-watersheds to the overall flow coming into the upper Verde River. Some run-off may be coming from Partridge Creek where proposed stocking sites are located, while some contributing flows may come from other sub-watersheds, such as Walnut Creek, Little Chino Wash, or upper Big Chino Wash, where no stocking sites are located.

Fish Movement

While fish movement likely does occur from the Big Chino Complex and the Granite Creek Complex into the upper Verde River, it is unclear how often and what species of stocked sport fish are the most prone to movement. Data from the Regional Department surveys, and the long-term data set compiled by John Rinne and partners for the upper Verde, suggest species like

largemouth bass, longfin dace, and speckled dace may move into the upper Verde from either upstream or downstream sources during large scale flooding events. However, those same data sources suggest that these species do not persist over time (Table 38 through Table 43). Other species such as channel catfish, green sunfish, yellow bullhead, red shiner, and mosquitofish appear to maintain populations in the upper Verde. However, the origin of those fish collected in the upper Verde cannot be distinguished from populations found elsewhere lower in the Verde River or some of its contributing watersheds, such as Granite Creek, Big Chino Wash, Williamson Valley Wash, Little Chino Wash, Hell Canyon or Sycamore Creek. Impediments to movement downstream are few in the upper Verde. If significant numbers of stocked fish, especially largemouth bass, were moving into the upper Verde from tributaries, it would be reasonable to assume surveys would reflect reproduction or migration of this species downstream of confluences with Big Chino Wash and Granite Creek; however, data do not suggest significant reproduction or migration because although individual largemouth bass have been collected from Stillman Lake following large floods (but maybe not as a result of them); they have not been collected from downstream habitats in the last 15 years, except for 1 individual found near Sycamore Creek, 37 miles downstream.

The Pecks Lake diversion is a complete barrier to upstream fish movement during all but the largest flood events. Flooding in 2004 showed water going around the structure and significant damage was sustained by the diversion during that event (Figure 70). It is possible, although unlikely, that during large 100 year flooding events species such as largemouth bass are able to move up and around the Pecks diversion. It is more feasible that small numbers of largemouth bass were coming downstream from tributaries and finding suitable habitat around the Sycamore Creek area due to more pool habitat being available. Largemouth bass have not been sampled above the Pecks Lake diversion in the last 9 years (Table 39 through Table 43) suggesting this species is not maintaining populations in the upper Verde River. A robust population of largemouth bass exists from the Pecks Diversion downstream; refer to the Middle Verde River analysis at the end of the document.

Community Description

As described above, the upper Verde fishery has been extensively studied and surveyed in recent history. Because of efforts by the Department, Rocky Mountain Research Station, Prescott National Forest, The Nature Conservancy, Salt River Project, Fish and Wildlife Service, Bureau of Reclamation-Central Arizona Project, and many private landowners along the river, more is known about the upper Verde River riparian and aquatic ecosystems than most river systems in Arizona.

Figure 70. Pecks Diversion September 20, 2004.

The Region III Fisheries Program shares the responsibility with Region II and Region VI for 106 miles of the Verde River, from Sullivan dam to the Childs Power plant. The upper Verde and the middle Verde reaches had not been surveyed following a standard protocol until beginning in 2000. Survey efforts had been effective in local areas or at access points, but lacked the continuity to be able to make Region-wide assessments about the fish community throughout the river. Specifically, problems with sample bias had plagued previous surveys. Prior to 2000, samples had been collected using a backpack type electrofishing unit. While effective in shallow, gravel dominated areas, these units lose effectiveness in sampling larger, deeper (> 4-feet) pools. Backpack units also lack the power and flexibility to sample in high discharge water situations often found during summer-month surveys.

Beginning in 2000, summer sampling of the variety of habitats found in the upper Verde has been conducted using an electrofishing canoe and block seine. Between July 2000 and August 2008, over 2,061 minutes of electrofishing time was expended by Department Regional survey crews to sample 37,839 individuals of 14 species of fish (Table 39). The efforts were in 16 reaches or areas of the upper Verde River. Regional survey crews select sample sites using a combination of random and fixed 200-meter long areas; fixed sites are selected using historic

data and access points. By selecting both random and fixed sites, sample bias is further minimized. The methods used in these canoe efforts have minimized sample bias to an acceptable level by giving survey crews flexibility to sample all types of habitats with the same assumption of success on all sizes of fishes. Further, the Smith-Root electrofishing units used allow great flexibility in power and wavelength selection. This allows crews to select settings for electrofishing that are the most appropriate for river conditions.

In 1993, Forest Service Research Fisheries Biologist John Rinne and a team of biologists established 7 permanent monitoring sites from Sullivan Dam down to Sycamore Creek (Table 40 and Table 41). These sites were to be sampled using backpack electrofishing units and seine nets in the spring and fall annually, and were selected based on road access points. While useful for long-term trend data, these sites contain fairly high sample bias and may not accurately reflect changes in habitat and species composition across the entire upper Verde River.

In the winter of 1992-93, flooding occurred in the Verde drainage. At the Paulden USGS gauging station some 10 miles downstream of Sullivan Dam, flows were recorded in excess of 23,000 cfs. The series of flood events that winter caused significant change to occur in the Verde River system; 80-90% of streamside vegetation was altered or removed. Millions of tons of sand and gravel substrates were moved and deposited in different areas downstream, and beaver dams previously present were removed. Data collected suggested that native species responded positively post-flooding, and non-native fish species responded poorly after such floods (Table 40 and Table 41). Small bodied natives such as spikedace, longfin dace, and speckled dace were all found in large numbers for 1-2 years following the 1993 flood event. However, within that same timeframe, non-native species like the red shiner began rebounding, quickly re-colonizing in many areas. By 1997, the presence of spikedace and the other small-bodied natives were significantly reduced from the upper Verde River across Rinne's 7 sampling sites. During that same period, surveys conducted by Department biologists confirmed non-native species presence in large numbers but also showed large bodied, relatively long-lived natives, including: roundtail chub, desert sucker and Sonora sucker persisting more abundantly than smaller bodied species.

Sampling data as previously referenced, suggests that fish assemblages transition to an increasing dominance of non-native species in an upstream to downstream direction, which may be related to increasing levels of hydrologic alteration (Rinne et al. 1998). This is most relevant below Sycamore Creek. The upper Verde River is home to robust populations of green sunfish, yellow bullhead and smallmouth bass (Table 39). Red shiner and mosquitofish are also very abundant (Table 39). Common carp, fathead minnow, flathead catfish and channel catfish can be found locally in higher numbers, although channel catfish have been markedly less common since the late 1990's (Table 39 and Table 43).

Hell Canyon is a tributary to the upper Verde and also harbors populations of black crappie and green sunfish as described in a spot check of Meath Wash from Barrata seep to Meath Springs (Cummins 2007 (6)) and Hell Canyon west of Highway 89 spot check (Cummins 2006). The privately owned dam at Meath Tank failed during the high water events in February 2005 and was not able to hold water in later years. Local Wildlife Manager Bill Ough claimed black crappie were present in this tank historically and may have been the origin of the crappie sampled in 2007, after the compromising of Saw Dam at Meath Tank (A. Clark pers. comm.). The confluence of Hell Canyon and the upper Verde is at river mile 18.6. Stillman Lake remains one place channel catfish have been found since 2001 consistently, but in low numbers (Table 38). During renovation efforts at Stillman Lake in November 2009, crews recorded dozens of channel catfish in the 6-8 inch size class (A. Clark pers. comm.). It is unclear what the origins of these catfish are; however, Stillman Lake is prime habitat for channel catfish because it is the largest pool habitat on the upper Verde. It also contains boulder, woody, and cavity type habitats which catfish prefer for spawning and recruitment (Minckley 1973). While individual channel catfish may have washed in from tributaries such as Big Chino and Granite Creek, or have come from other undetermined vectors, it is most likely that the origins of these fish is from downstream, and is supported by the fact that other species such as common carp have been observed swimming back and forth from Stillman Lake to areas below the pool during the high water events in 2008; refer to the Granite Creek Complex analysis (A. Clark pers. comm.). Regardless, it appears some component of the Stillman Lake microcosm is not allowing for the channel catfish to recruit to higher numbers as there seems to be some level of reproduction and habitat for them, but a limited response due to some ongoing factor.

It is suggested that existing flathead catfish and bullhead catfish populations are limiting the recruitment of channel catfish in Stillman Lake and in the rest of the upper Verde River, but these fish are not totally eliminating channel catfish. This scenario is more likely than if the presence of catfish in the Upper Verde River were the result of channel catfish coming in from somewhere else. Typically, catfish anglers are harvest-oriented and harvest most of what they catch (Michaletz et al. 2008). It is possible this harvest, in addition to competition and predation by the other catfishes, is limiting recruitment of channel catfish.

Regardless of whether channel catfish are reproducing or not in the upper Verde River, outside of Stillman Lake, they are rare in the upper Verde. Spikedace have not been sampled since 1999, when 1 individual was sampled in the vicinity of Forest Road 638. This species is still considered present in the upper Verde. The same concept regarding presence of a reproducing population of fish at levels at or below detection ability can be said for channel catfish in the upper Verde River. Juvenile channel catfish (individuals less than 200 mm) have been collected from the upper Verde River during surveys in 1988, 1989, 1990, 1992, 1993, 1994 and 1995 (Table 43).

Table 38. Species and number of individuals sampled in Stillman Lake, using a canoe based electrofishing unit, 150' experimental gillnets and 3' diameter hoopnets, 2000 through 2008.

Common Name	2001	2004	2005	2006	2007	2008	Totals
Longfin Dace							
Yellow Bullhead		11	21	23	82	126	240
Sonora Sucker			28	2	6	274	308
Carp	#	152	111	65	50	100	413
Red Shiner	#		135	8	77	164	376
Mosquitofish				5		23	23
Roundtail Chub						82	82
Channel Catfish	3	3	2			2	7
Green Sunfish	#	12	559	80	329	305	1205
Smallmouth Bass		1	1			386	388
Largemouth Bass		1	2				3
Desert Sucker						28	28
Fathead Minnow			10	4	3	66	79
Flathead Catfish	6	22	8	4	5	3	38
Totals	**9**	**202**	**877**	**191**	**552**	**1559**	**3190**

=present in samples but not counted

Table 39. Species and number of individuals sampled in the upper Verde River using a canoe based electrofishing unit, 2000 through 2009 (additional breakdown of sampling data by site, year and species for years 2000-2006 is provided in Table 51).

Common Name	2000	2001	2003	2004	2005	2006	2007	2008	Totals
Longfin Dace					58			901	959
Yellow Bullhead	72	26	3	161	114	29	159	1	565
Sonora Sucker	244	111	11	556	7020	709	1241	57	9949
Sucker (young-of-the-year)					3200				3200
Carp	30	13	4	133	417	27	293		917
Red Shiner	475	2486	159	3645	1606	134	1262	1789	11556
Mosquitofish	68		1	141				3	213
Roundtail Chub	136	11	4	34	432	51	79		747
Green Sunfish	23	21	13	176	83	6	137	36	495
Smallmouth Bass	372	95	99	1766	1039	242	398	1	4012
Desert Sucker	266	62	58	510	2937	446	646	57	4982

Common Name	2000	2001	2003	2004	2005	2006	2007	2008	Totals
Fathead Minnow				1	55			137	193
Flathead Catfish	14	1		14	3	1	5		38
Speckled Dace					13				13
Totals	**1700**	**2826**	**352**	**7137**	**16977**	**1645**	**4220**	**2982**	**37839**

Table 40. Native Fish community summary of 7 sites sampled from 1994 to 2008 on the upper Verde River, Prescott National Forest (Rinne unpublished data); additional data breakouts by year, site and species are provided in Table 44 through Table 50.

Year	Longfin Dace	Speckled Dace	Spikedace	Desert Sucker	Sonora Sucker	Roundtail Chub
1994	1319	171	428	2644	1810	776
1995	12	25	72	328	322	341
1996	282	68	140	471	654	259
1997	21	1	0	231	240	50
1998	13	12	0	126	125	64
1999	2	2	0	167	118	25
2000	1	7	0	137	197	20
2001	2	0	0	376	163	43
2002	1	0	0	148	90	20
2003	1	0	0	128	75	4
2004	0	0	0	94	67	6
2005	1	0	0	44	24	0
2006	0	0	0	1119	742	259
2007	0	0	0	380	294	14
2008	1	3	0	221	366	24

Table 41. Nonnative Fish community summary of 7 sites sampled from 1994 to 2008 on the upper Verde River, Prescott National Forest (Rinne unpublished data) - additional data breakouts by year, site and species are provided in Table 44 through Table 50.

Year	Fathead Minnow	Mosquitofish	Red Shiner	Green Sunfish	Smallmouth Bass	Largemouth Bass	Channel Catfish	Flathead Catfish	Yellow Bullhead	Common Carp

Year	Fathead Minnow	Mosquitofish	Red Shiner	Green Sunfish	Smallmouth Bass	Largemouth Bass	Channel Catfish	Flathead Catfish	Yellow Bullhead	Common Carp
1994	7	0	1473	4	14	0	5	0	31	23
1995	0	0	97	29	10	0	2	1	29	6
1996	0	0	275	6	32	0	0	1	9	13
1997	0	3	2238	8	35	0	1	1	40	19
1998	0	6	1047	21	66	0	0	1	33	9
1999	0	59	545	49	104	0	0	0	15	4
2000	0	227	1594	95	48	1[1]	0	0	22	15
2001	0	131	1608	192	163	0	0	5	36	15
2002	0	97	276	53	211	0	0	0	19	4
2003	0	32	632	139	193	0	1	1	29	4
2004	0	76	928	31	57	0	1	1	16	4
2005	0	0	326	29	15	0	1	1	6	10
2006	0	0	701	14	143	0	1	1	57	0
2007	0	0	469	45	58	0	1	1	38	15
2008	0	0	264	73	115	0	0	1	20	0

1. This single largemouth bass was collected at the furthest downstream site near Sycamore Creek confluence.

Table 42. All largemouth bass records for upper Verde River.

Date	Location	Num.	Source
1966	T18NR1E (near Bear Canyon)	1	SONFISH
12/11/1989	T17NR2W sec 12 (confluence Granite Creek	1	SONFISH, likely record from Hendrickson 1993 survey data
7/18/1990	T17NR2W sec 12 and 14 (below Granite Creek	5	SONFISH, likely record from Hendrickson 1993 survey data
2/5-6/1991	T17NR2W section 15 (at/below Sullivan Lake?)	2 (also 3 channel catfish)	SONFISH, likely record from Creef et al 1992
9/25-10/29/1992	Morgan Ranch to Perkinsville	6 (also 4 channel catfish)	Creef and Clarkson 1993

2000	Near Sycamore Creek	1	Rinne compiled data
2004	Stillman Lake	1	Cited USFWS 2009a
2005	Stillman Lake	2	Cited USFWS 2009a

Table 43. Summary of fishes collected from the upper Verde River, above TAPCO Diversion, from the AGFD Native Fish database (data points depicted in Figure 71). Grayed rows are species proposed for stocking in the upstream watershed.

Common Name	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Longfin Dace		126	244	182	600	222	3	28	2021	53	681					4160
Black Bullhead			20		1	22										43
Yellow Bullhead	14		50	45	69	164	46		42	90	324		5	17		866
Sonora Sucker	42	29	500	236	2329	1452	998	1014	2144	906	1426	23	66	137		11302
Unidentified Suckers			1		1765											1766
Carp		5	50	28	364	201	118	121	30	53	37	22	26	3		1058
Red Shiner		37	579	3942	6614	3377	435	941	197	667	369		10	7		17175
Mosquitofish		7	267	1239	7654	5485	1445	433								16530
Roundtail Chub	94	7	210	223	529	288	117	172	163	199	528	4	13	29		2576
Brown Bullhead								2								2
Channel Catfish				10	50	103	9	20	3	2	7		1	2		207
Green Sunfish	3		191	90	307	90	8		14	102	88	1	21	62		977
Bluegill								3								3
Spikedace		637	1	146	199	60		5	148	13	111				1	1321
Smallmouth Bass			137	98	330	153	57	82	11	34	335	8	40	68		1353

Common Name	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Spotted Bass								6								6
Largemouth Bass					6	9	2				2					19
Rainbow Trout							1									1
Desert Sucker	4	1	281	238	885	519	243	201	1755	1060	1310	16	15	24		6552
Fathead Minnow				11	22	4	1		20	7	3					68
Colorado Squawfish	7		11	834				3			2					857
Flathead Catfish					12	29	4	8								53
Speckled Dace			18	7	10	17	1	135	524	77	695					1484
Razorback Sucker		363	7	64	51	41	3	2	44	104						679
Totals	164	1212	2586	7393	21797	12236	3491	3176	7116	3367	5918	74	197	349	1	69077

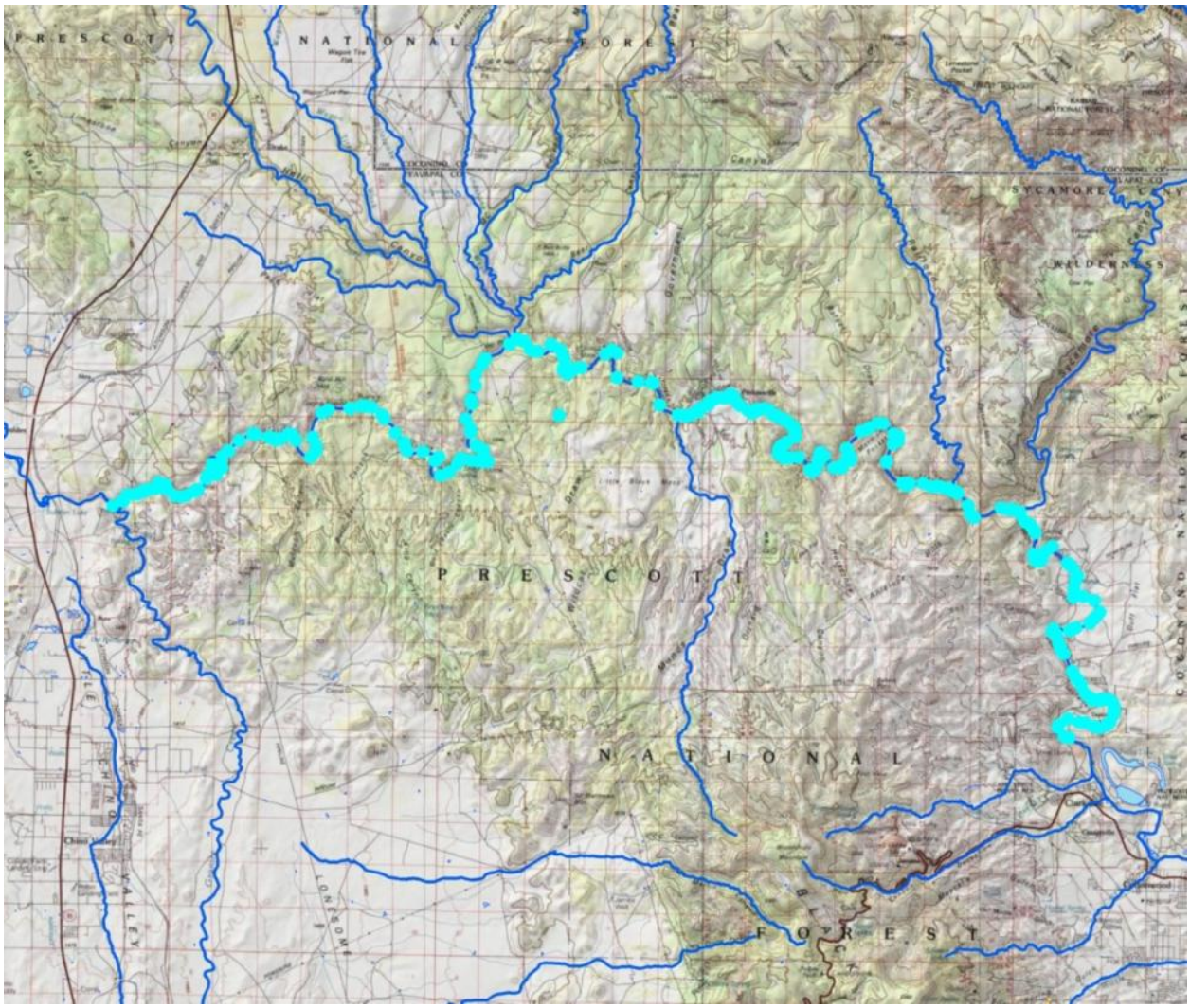

Figure 71. Location of Native Fish Database sample sites as summarized in Table 43.

Consultation Species or Critical Habitat

No stocking enhancements are proposed at this time for the upper Verde River. However, based on the potential for hydraulic connectivity between the Big Chino Complex, Granite Creek Complex, and Sycamore Creek Complex, an analysis of potential movement of fish and impacts to the fauna of the upper Verde River is provided. This analysis relies, in part, on the information previously provided in the three complexes just mentioned. Impacts on razorback sucker and critical habitat, Colorado pikeminnow, roundtail chub, spikedace and critical habitat, northern Mexican and narrow-headed gartersnakes (discussed also in the previous complexes) are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican and narrow-headed gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Razorback Sucker and Critical Habitat

The razorback sucker is not found in the Big Chino Complex, Granite Creek Complex, or the upper Verde River. Historically, razorback suckers were found in the Verde River (Minckley 1973) and were stocked into the upper Verde River 33 times between 1985 and 1993 (Hendrickson 1993; Creef and Clarkson 1993; Hyatt 2004) (Table 28 and Table 29). Recaptures of stocked razorback suckers in the upper Verde were typically soon after stocking, although some fish recaptured in lower Granite Creek and Stillman Lake in 1990 may have been at large 1 to 4 years after they were stocked (Hendrickson 1993). As part of the Stillman Lake native fish restoration effort, razorback suckers will be reintroduced into the lake once non-native fish have been removed (USFWS 2009a). It is expected that razorback suckers will move out of the lake during high flows and establish in the upper Verde River.

Critical habitat for the razorback sucker on the Verde River was designated in 1995 and extends from the western boundary of the Prescott National Forest west of Perkinsville to Horseshoe Dam. The Verde River critical habitat unit was described in the biological support document for the designation as contributing to delisting of the species, therefore important for recovery (Maddux et al. 1993). The upper Verde reach was described as being altered by livestock grazing, mining, and recreational use, with a diverse native fish community present. At the time of the designation, the upper Verde River maintained populations of six native species, and non-natives were not dominant in the system.

At the time of designation, the upper Verde River supported several constituent elements of critical habitat as described below:

Water: the upper Verde River base flow is supported by springs near the confluence with Granite Creek. Higher flows are created through runoff from the Big Chino sub-watershed, Granite Creek, and Sycamore Creek. The Little Chino sub-basin may have been a more significant contributor to flows in the past (Wirt and Hjalmarson 2000); although that contribution may have been more effecting in contributing to base flows via the spring system. At the time of designation, the upper Verde River had sufficient flows and hydrological regimes to support native fish populations.

Physical habitat: the upper Verde River contained a wide variety of habitats suitable for razorback sucker. While backwaters were generally lacking, the clean substrates and pools provided opportunities for spawning and nursery habitats, although conditions downstream in the middle and lower reaches may have been more favorable for nursery habitats in backwaters and sloughs.

Biological environment: at the time of designation, non-native fish species were present in the upper Verde River, but they did not dominate the aquatic fauna, and native fish species were maintaining populations. In the 13 years since, the spikedace has all but disappeared, and populations of the other native species appear to have declined (Rinne 2001; Rinne and Carter 2005; Rinne et al. 1998) as numbers of non-natives, particularly smallmouth bass and flathead catfish, have increased. Smallmouth bass have been in the system since at least 1984, and flathead catfish since 1989.

Additional selection criteria besides the primary constituent elements were developed to assist in selecting critical habitat areas for the razorback sucker:

Presence of spawning population: there was no spawning population in the Verde River at the time of designation. The Verde River may have supported a spawning population of razorback suckers later than did the Gila or Salt Rivers, as the last razorback sucker from the Verde River was documented in 1954, several years after the species was gone from the other central Arizona rivers.

Nursery habitat: nursery habitat is available in all reaches of the Verde River.

Historic or present distribution: the reintroduction of razorback sucker into the Verde River began in the 1980s, and the river was considered occupied at the time of designation of critical habitat.

Maintenance of range-wide distribution: as the last of the central Arizona rivers to support razorback suckers, the Verde River shares some physical characteristics with the Gila River in terms of elevational changes and the mixture of canyon and open alluvial floodplain areas. The Gila River is also free-flowing in that critical habitat reach. The

significant difference is that the Gila River supported a large and dominant non-native fish community at the time of designation, unlike the upper Verde River.

Special management: the potential for groundwater development in the upper Verde River watershed was identified as an issue of concern, for maintaining suitable flows in the river to support the water and physical habitat primary constituent elements. Maintenance of a natural flow regime that would encourage native fish and discourage non-native fish was also identified as an important management need.

Potential Impacts

Potential impacts to razorback suckers in the upper Verde River would result from transportation of the non-native fish or their progeny stocked or propagated in the upper watersheds into downstream occupied habitat. Historically, Sullivan Lake and the upper Verde River were stocked with non-native fish (Table 28 and Table 29), although the only species to have established appears to be smallmouth bass. The response from razorback suckers to potential interactions with stocked sport fish species, if they were to find their way into the upper Verde River or into critical and occupied habitat further downstream, would be predation by the stocked fish or their progeny; specifically on larval or juvenile razorbacks if they are able to successfully spawn, or potential competition for food or space where habitats overlap. Largemouth bass and channel catfish were documented eating desert and Sonora suckers (Bonar et al. 2004) in the Verde River. Marsh and Brooks (1989) documented extensive predation on newly stocked, small razorback suckers by channel catfish in the Gila River. There is a considerable overlap in preferred habitats between these three species, with pools being preferred over runs and riffles (Bonar et al. 2004). Stillman Lake is the first likely location where non-native stocked fish or their progeny could interact with razorback suckers. As demonstrated by surveys of the fish community in the lake (Table 38 and Table 42), Stillman Lake habitat is suitable for largemouth bass, sunfish, and channel catfish as well as razorback suckers.

At the present time, razorback suckers are either not present in the upper Verde River or are at such low numbers that the surveys conducted to date have not detected them. There has been no stocking of razorback suckers into the upper Verde River since 1993, and no recaptures since 1994 (AGFD unpublished database). However, razorback suckers will be reintroduced into Stillman Lake as part of the native fish recovery portion of the project. The Stillman Lake/Granite Creek area successfully supported razorback suckers between 1986 and 1990 (Hendrickson 1993; USFWS 2009), and the type of deep pool/backwater-like habitat at Stillman Lake would be expected to provide suitable habitat for adults and juveniles, once non-native fish are removed. It is unclear if there is suitable substrate (clean gravel) for razorback suckers to spawn in Stillman Lake; however, there may be such areas downstream or in lower Granite

Creek that can be used once fish disperse out of the lake. Largemouth bass and channel catfish pose a threat of predation on larval and juvenile razorback suckers. The number of potential predation attempts by these non-native species is limited due to the low numbers of largemouth bass and channel catfish expected to enter the upper Verde over the next 10 years. The impact of any particular predation action is the loss of individual razorback suckers. Efforts will be made to monitor and evaluate the numbers and interactions between native and non-native fish in Stillman Lake under the management plan for the native fish introductions (USFWS 2009).

The connectivity of the Big Chino Wash Complex and the Granite Creek Complex to the upper Verde River has been documented using USGS gauge data. It is believed that the Williamson Valley Wash drainage may contribute more frequent surface runoff events that allow for connection of that system than the Big Chino Wash itself or Granite Creek. Within the Big Chino Wash, other tributaries, such as Walnut Creek where no stocking is proposed, are likely a more significant supply of seasonal runoff than is Partridge Creek, where some stocking sites are located. However, that does not rule out the potential for transport of non-native sport fish or their progeny from any site to the upper Verde River during very high flow events. The presence of channel catfish in Stillman Lake and downstream does appear to be the result of a self-sustaining population of this species in the upper Verde River because sizes collected indicate reproduction (A. Clark pers. comm.), although likely at a very low level. Channel catfish do maintain self-sustaining populations in the Middle and Lower Verde River, and some may move upriver if they can get past the TAPCO Diversion Dam. Channel catfish have only been sporadically found in regular surveys between 1994 and 2008 (Table 38 through Table 43) between Stillman Lake and Sycamore Creek. Channel catfish have been found in Stillman Lake itself in several surveys between 2001 and 2009, and were detected in renovation efforts in November 2009. Largemouth bass have been recorded in Stillman Lake; 2 were reported in 1991 from between Sullivan Lake and Perkinsville (Creef et al. 1992); 4 from the same area in 1992 (Creef and Clarkson 1993); 1 in 2004; 2 in 2005, and 1 near Sycamore Canyon in 2000. No largemouth bass were recorded in renovation efforts during November 2009. No bluegills have been reported, although they have been stocked into the river itself (Table 28) as well as 4 Big Chino Watershed stocking sites, and are already present in the fifth stocking site (Stone Dam). Black crappie have not been stocked into the Big Chino stocking sites but are present in Stone Dam and are proposed for Garrett, Shucking, and Presley Tanks, but not for Stone Dam or Granite Basin Lake.

The origin of the channel catfish and largemouth bass in the upper Verde River is unknown. These individuals may have been brought into the system from stocking sites in the Big Chino Wash sub-watershed or Granite Creek. There are also other waters located on private lands not stocked by the Department that may maintain sport fish populations established historically or illegally. Persons could also have deliberately transported these species to the river in an attempt

to establish a fishery for them. The origin point of such transported fish is unknown but could be from any nearby population, including the proposed stocking sites in the upper watersheds or other ponds.

The 2 largemouth bass recorded in May 2005 in Stillman Lake were found after the major flood events of September 2004 and January 2005. The 1 largemouth from July 2004 was recorded prior to these high flow events. The 2 found in 1991 were from surveys in February, before or just at the start of a high flow (maximum 6,320 cfs March 2 1991 at the Paulden Gauge). The 4 in September 1992 may have come in with the 1991 flows or the runoff events in March of 1992. Any of these largemouth bass may also have been illegally moved into the reach. Access to the upper Verde River is not easy at Stillman Lake, but is available via horseback or by foot. Road access is readily available at the fish survey site at Burnt Corral, at Forest Road 638, and at Perkinsville. The only other record of largemouth bass, from near Sycamore Creek in September, 2000, could have moved up from the populations below TAPCO Diversion either on its own or been illegally moved by someone. The confluence of Sycamore Creek with the Verde River was formerly private land known as the Packard Ranch, which is targeted for conservation acquisition or transfer to Forest Service ownership.

The channel catfish records are more numerous and are spread across the upper Verde in both time and location. There is no distinct pattern of records relative to high flows; however, that does not mean these individuals were not transported by those flows and were not found immediately after. The longest data set, from 1994 to 2008 (Table 41) for the upper Verde is based on 1 survey in the fall of each year at the same 7 sites. Surveyors found 12 channel catfish, all but 1 of them at or above Perkinsville. If these fish were moving up from below the TAPCO Diversion, one would expect most of them to be found below Perkinsville. Looking specifically at Perkinsville, 5 were taken there, 4 in 1994 and 1 in 2002. In 1989, 9 were taken in surveys from Perkinsville to TAPCO, most of which were from the lower end of the reach near Sycamore Creek (Hendrickson 1993). Other records for channel catfish in the upper Verde are from Bonar et al. (2004), for probably less than 10 individuals; 10 in 1991 (Creef et al. 1992), and 20 in 1992 (Creef and Clarkson 1993). Of those 30 fish, 7 were in the uppermost reach above Perkinsville and 23 were from below Perkinsville. Channel catfish appear to reproduce in the upper Verde River as reflected in sizes collected since 1985 (AGFD Native Fish Database; AGFD Region III fisheries data).

Potential impacts to designated critical habitat must be considered based on the result of those impacts to the ability of the critical habitat unit to contribute to the recovery of the species. The upper Verde River contains only a portion of the entire designated reach, approximately 22 of the total 123 miles, but is the section that showed the most promise relative to the dominance of native fish species over non-native fish species at the time of designation. As shown from survey

data (Table 39 through Table 43), this is no longer the case. The change is not consistent across the entire upper Verde or between species. The larger-bodied desert and Sonora suckers still fare better than any other native species, but their numbers are significantly reduced throughout. Small-bodied longfin and speckled dace are largely gone from the system, and spikedace have not been found since 1999.

The portion of the razorback sucker critical habitat in the upper Verde River has experienced the most significant alteration in the native fish community since designation, as documented over time. The rise to dominance of non-native fish species in this area cannot be attributed to stocked largemouth bass, since despite sporadic captures, they have not established a presence in the reach. While individuals are present, they do incrementally contribute to the non-native fish populations in the critical habitat. Channel catfish in the Perkinsville to TAPCO Reach are a minority of the catch of nonnative fish as apparent in the previous data summary tables, which is dominated by potential predators such as green sunfish, smallmouth bass, and yellow bullhead (no channel catfish have been documented from 2000-2008 Table 39). The catfish found above Perkinsville can certainly move downriver during even moderate flow events to contribute to the numbers in the critical habitat reach. The overall number of channel catfish detected in the critical habitat reach has not increased since the time of designation, thus the changes to the native fish community in this reach cannot be ascribed to channel catfish. The effects of the other non-natives present, particularly smallmouth bass and yellow bullheads, are greater than the incremental effect of the presence of channel catfish, largemouth bass or any other sport fish proposed for stocking in the watershed.

Colorado Pikeminnow

Colorado pikeminnow were stocked into the upper Verde River 22 times between 1985 and 1992 (Hendrickson 1993; Hyatt 2004) and only 1 individual has been recaptured in the reach (Hyatt 2004). The species was extirpated from this area prior to the stocking efforts, and survival of the stocked fish has been low or non-existent. The Colorado pikeminnow is not believed to be present in the upper Verde River.

Potential Impacts

No impacts to the Colorado pikeminnow are expected to result from the proposed action because they are no longer present in the upper Verde.

Roundtail Chub

Roundtail chub are known from the upper Verde River beginning below Sullivan Dam and extending down the Verde River past Granite Creek and throughout its entirety to the confluence with the Salt River. The specific abundance or density of roundtail chub has not been documented with certainty, but they are known to occur throughout the entire reach of river.

Potential Impacts
See discussion for Razorback Sucker; potential impacts to roundtail chub could result from the escapement of stocked fish species downstream to occupied habitat. If these events should occur, and the stocked species were able to access the occupied habitat even for only brief periods of time before dying of natural causes or moving (i.e. being transported) further downstream, there would be the potential for predation on roundtail chub, competition for food, or competition for space in the aquatic habitats. Adult roundtail chub appear to handle non native fish better than most native fish species (Minckley 1973). However, 26 years later, the 12-month finding for roundtail chub (USFWS 2009c) found that nonnative species that compete or prey on roundtail chub are a serious and persistent threat to the continued existence of the roundtail chub.

With periodic flooding, roundtail chub appear to maintain viable population numbers in the presence of non native predators. The most important possible impact of stocked species that may be in areas of the upper Verde is on young of year during dry or low water periods. Low water limits riffle habitats and as such removes preferred habitat of young chub. The result is increased predation by non native predators. The stocked species have not been found to persist in the upper Verde River; channel catfish excepted, because they currently appear to maintain a reproducing population. Additionally, the upper Verde River is occupied by several other competing and predatory non-native species that occur independent of stocking actions, such as smallmouth bass, flathead catfish, green sunfish, red shiner, yellow bullhead, crayfish etc.

Spikedace and Critical Habitat
See discussion for Razorback Sucker; spikedace are historically known from the Verde River from below Sullivan Dam downstream to the lower reaches of West Clear Creek. Critical habitat is also present in the upper Verde River from Sullivan Dam downstream to near Pecks Lake. There is no suitable habitat for spikedace in or near Garret Tank. The intervening ephemeral and intermittent channels between Garret Tank and the upper Verde River are also not suitable habitat for this species. Spikedace were last documented from the upper Verde River with 1 individual sampled in 1999, despite large efforts in multiple surveys resulting in nearly 38,000 individual fish being surveyed (AGFD data). Targeted surveys have also not found spikedace in the upper Verde River (Richardson 2006).

Potential Impacts
Potential impacts to spikedace and its critical habitat would result from transportation of the stocked fish downstream to occupied or critical habitat. The response would be potential predation by the stocked fish or their progeny on the spikedace, or potential competition for food or space. The proposed stocking activity would not be anticipated to have negative impacts to spikedace or its critical habitat due to the low likelihood of movement of stocked fish to their habitat. The significance of transport of the stocked species from the stocked location to the

occupied habitat is further diminished by the fact that the stocked species have not been found to persist in the upper Verde River, except for channel catfish, which are already present and reproducing in numbers sufficient to maintain a small population. In addition, the fact that the upper Verde River is occupied by large numbers of several other competing and predatory non-native species that occur independent of stocking actions, such smallmouth bass, flathead catfish, green sunfish, red shiner, crayfish, and others further diminishes the impact stocked species will have.

Northern Mexican Gartersnake

Watershed analysis: There are no recent records of northern Mexican gartersnakes from the Upper Verde River or its tributaries, and the species is likely extirpated from the Upper Verde River north of Clarkdale (USFWS 2008a). The most recent record is from 1987 above TAPCO on the Upper Verde (HDMS). Holycross et al. (2006) did not find any northern Mexican gartersnakes during surveys in a stretch of the Upper Verde River east of Hells Canyon, and they reported that crayfish and non-native fish were abundant. There are 2 historical records from Sycamore Creek from 1954 (0.6 river mi and 1.5 river mi upstream of the confluence of the Verde River (HDMS, Rosen and Schwalbe 1988). During surveys in this stretch in 2004, Holycross et al. (2006) found no gartersnakes and they suggested that northern Mexican gartersnakes were probably extirpated from this locality. There are no other records of the species from the Upper Verde. Additionally, the abundance of bullfrogs, crayfish, and non-native sport fish, including spiny-rayed fishes such as catfish and green sunfish, makes the habitat in the Upper Verde less suitable for northern Mexican gartersnakes. Given the unsuitable habitat and that only one northern Mexican gartersnake has been recently observed on the Upper Verde River, it is unlikely that northern Mexican gartersnakes would be exposed if stocked sport fish from Big Chino, Granite Creek, or Sycamore Creek complexes disperse into the Upper Verde.

Downstream analysis: The Middle Verde, downstream of Pecks Lake, is occupied by northern Mexican gartersnakes. There are multiple records of the species from near Cottonwood on the Verde River, approx. 2.8 river mi downstream of Pecks Lake, including one from 2003 and one from 2004 (Holycross et al. 2006, HDMS). There appears to be a low density population in this vicinity (Holycross et al. 2006). There is also a population (likely low density) of northern Mexican gartersnakes from near Camp Verde, approx. 25 river mi downstream of Pecks Lake, with an observation as recent as 2003 (HDMS). Additionally, there are 3 historical (1954-1986) records of northern Mexican gartersnakes on the Verde River between West Clear Creek and the East Verde River (HDMS, Rosen and Schwalbe 1988). If stocked sport fish from Big Chino, Granite Creek, or Sycamore Creek complexes disperse into the Middle Verde River, there is a likelihood of exposure to northern Mexican gartersnakes.

Narrow-Headed Gartersnake

Watershed analysis: Narrow-headed gartersnakes currently occupy the Upper Verde River. Two records exist from Bear Siding, 18.6 and 19.3 river mi downstream of Sullivan Dam (from 1996 and 2000, respectively; HDMS). There is a photo voucher of an individual from Mormon Pocket in 2001, approx. 29 river mi downstream of Sullivan Dam. There also are two observations of narrow-headed gartersnakes farther downstream: one from approx. 0.6 river mi downstream of Sycamore Creek (HDMS), and one from the vicinity of Clarkdale in 1988 (photo voucher, T. Jones pers. comm.). The presence of crayfish and non-native fish, including spiny-rayed fishes, within the Verde River make the habitat less suitable for narrow-headed gartersnakes, but the species appears to persist in the Upper Verde, at least in low numbers (Holycross et al. 2006). If stocked sportfish disperse into the Upper Verde from Big Chino, Granite Creek, or Sycamore Creek complexes, there is likelihood of exposure to narrow-headed gartersnakes.

Downstream analysis: Narrow-headed gartersnakes occupy the Middle and Lower Verde River, though likely in low numbers. A narrow-headed gartersnake was observed on the Verde River at The Falls in 1987, approx. 64 river km downstream of Pecks Lake (HDMS). Another was observed at Ikes Backbone, just south of Fossil Creek, in 2005 (Holycross et al. 2006, HDMS). Because the Upper Verde is occupied by narrow-headed gartersnakes, it is possible for these snakes to disperse into the Middle and Lower Verde Rivers. Oak Creek, a tributary of the Verde River, supports a large population of the species. The population begins approx. 40 river mi upstream of the confluence of Oak Creek and the Verde River. There is potential for fish from the Verde River to move into Oak Creek since no fish barriers exist on Oak Creek south of Sedona. Narrow-headed gartersnakes also are able to disperse into the Verde from Oak Creek. If stocked sportfish disperse from Big Chino, Granite Creek, or Sycamore Creek complexes into the Middle Verde River, there is likelihood of exposure to narrow-headed gartersnakes.

Table 44. Survey history for Burnt Ranch Site (Campbell Place).

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
1994	1072	0	257	339	278	15	0	0	39	0	2	0	0	0	2	1
1995	0	0	33	15	60	3	0	0	7	0	3	0	0	0	2	0
1996	91	0	33	79	92	23	0	0	88	1	5	0	0	0	1	1
1997	0	0	0	66	68	24	0	3	1	4	8	0	0	0	13	3
1998	0	0	0	21	43	12	0	5	27	9	11	0	0	0	0	1
1999	0	0	0	13	19	3	0	58	1	39	6	0	0	0	1	0
2000	0	0	0	23	124	6	0	226	89	31	18	0	0	0	4	3
2001	0	0	0	50	51	19	0	127	2	131	37	0	0	0	5	7
2002	0	0	0	43	30	11	0	96	0	17	32	0	0	0	7	0
2003	0	0	0	23	6	0	0	30	31	30	24	0	0	0	4	0
2004	0	0	0	2	3	0	0	54	64	25	22	0	0	0	4	0
2005	1	0	0	1	2	0	1	0	158	14	9	0	0	0	0	0
2006	0	0	0	242	165	44	0	0	66	2	33	0	0	0	27	0
2007	0	0	0	197	82	0	0	0	71	13	17	0	1	0	13	0
2008	0	0	0	17	96	0	0	0	6	6	38	0	0	0	0	0

Table 45. Survey information for FR 638 site.

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
1984	30	0	131	16	7[1]	4	0	0	3	12	3	0	0	0	1	0
1986-1987	187	0	314	103	110	5	0	2	30	12	6	0	1	0	14	7
1986[2]	130		62	501	84			19								
1994	227	0	2	230	154	18	0	0	61	0	0	0	0	0	3	0
1995	11	0	2	48	57	4	0	0	8	8	1	0	0	0	3	1
1996	179	1	53	127	307	81	0	0	112	1	0	0	0	0	0	5
1997	19	0	0	76	57	8	0	0	82	0	1	0	0	0	10	1
1998	12	0	0	28	27	19	0	1	101	1	5	0	0	0	0	1
1999	0	0	0	20	4	3	0	1	33	0	5	0	0	0	3	2
2000	0	0	0	74	27	0	0	1	437	3	10	0	0	0	7	0
2001	0	0	0	219	74	11	0	4	144	0	36	0	0	0	8	0
2002	1	0	0	57	10	0	0	1	30	0	15	0	0	0	0	0
2003	0	0	0	68	15	0	0	0	80	0	16	0	0	0	0	2
2004	0	0	0	29	23	2	0	11	132	1	12	0	0	0	1	3
2005	0	0	0	25	11	0	0	0	15	6	1	0	0	0	0	10
2006	0	0	0	205	171	2	0	0	49	0	10	0	0	0	4	0
2007	0	0	0	62	84	0	0	0	92	0	8	0	0	0	6	0

2008	0	0	0	50	124	23	0	0	50	4	25	0	0	0	6	0

1 Plus an additional 61 suckers not identified to species
2 Surveys for larval fish only in April 1986

Table 46. Survey information for Duff Spring Site.

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
1994	0	0	1	192	329	28	0	0	32	0	4	0	0	0	1	3
1995	0	0	0	65	73	50	0	0	55	5	6	0	2	1	17	1
1996	6	0	0	32	51	17	0	0	1	0	12	0	0	0	1	5
1997	2	0	0	0	11	5	0	0	830	0	6	0	1	0	0	12
1998	0	0	0	10	17	23	0	0	79	2	19	0	0	1	9	2
1999	0	0	0	15	17	5	0	0	23	0	18	0	0	0	4	0
2000	0	0	0	2	3	7	0	0	100	8	9	0	0	0	3	1
2001	0	0	0	16	12	0	0	0	133	2	59	0	0	0	4	0
2002	0	0	0	5	7	0	0	0	9	3	54	0	0	0	3	0
2003	0	0	0	2	2	0	0	2	94	1	26	0	0	0	8	0
2004	0	0	0	2	7	0	0	9	143	2	3	0	0	0	7	0
2005	0	0	0	3	3	0	0	0	59	0	1	0	0	0	0	0
2006	0	0	0	96	88	1	0	0	202	0	1	0	0	0	12	0
2007	0	0	0	24	76	1	0	0	16	0	16	0	0	0	3	0
2008	0	0	0	6	49	0	0	0	32	1	11	0	0	0	0	0

Table 47. Survey information for Bear Siding (= U.S. Mine) site.

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
1986-1987	11	2	4	42	68	57	0	0	124	3	0	0	4	0	8	0
1986[1]	60		5	385	223	3			71							
1994	0	3	1	382	357	249	0	0	227	0	3	0	1	0	1	4
1995	0	0	0	45	47	22	0	0	10	10	0	0	0	0	5	0
1996	0	1	0	50	25	6	0	0	27	2	10	0	0	0	3	1
1997	0	0	0	18	4	0	0	0	9	3	11	0	0	1	0	0
1998	0	0	0	15	9	1	0	0	6	6	4	0	0	0	4	4
1999	0	0	0	5	2	0	0	0	203	7	15	0	0	0	0	0
2000	0	0	0	1	3	3	0	0	238	52	2	0	0	0	1	1
2001	0	0	0	8	12	7	0	0	283	56	17	0	0	2	8	6
2002	0	0	0	5	3	0	0	0	87	27	54	0	0	1	4	3
2003	0	0	0	1	2	0	0	0	118	72	67	0	1	0	2	2
2004[2]	Ns	ns	ns	ns	ns	ns	n	ns	ns	ns	ns	ns	ns	Ns	ns	ns
2005	0	0	0	3	1	0	0	0	70	7	1	0	0	1	0	0
2006	0	0	0	49	21	7	0	0	63	0	6	0	0	0	2	0
2007	0	0	0	30	7	0	0	0	217	17	6	0	0	1	9	0

2008	0	0	0	8	6	0	0	0	118	30	4	0	0	0	3	0

1 Survey for larval fish April 1986
2 Not sampled due to turbidity

Table 48. Survey information for Perkinsville Site.

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
1984	3	22	62	51	18[1]	63	0	0	0	0	0	0	0	0	1	0
1986-1987	28	246	50	503	199	181	0	0	224	2	3	0	0	0	45	29
1986[2]	12	1	2	453	276				20							
1989[3]	0	0	0	217	516	67		0	0	1	15	0	9	3	2	42
1993	0	51	18	51	16	3	0	0	7	0	0	0	0	0	1	0
1994	19	61	37	885	442	244	7	0	1109	4	2	0	4	0	12	11
1995	1	23	1	90	10	115	0	0	4	3	0	0	0	0	1	1
1996	5	63	0	112	76	57	0	0	36	0	1	0	0	1	4	0
1997	0	1	0	15	28	0	0	0	1222	1	1	0	0	0	1	0
1998	0	12	0	35	10	5	0	0	701	1	4	0	0	0	5	0
1999	2	2	0	69	37	0	0	0	261	1	11	0	0	0	5	1
2000	1	7	0	30	11	0	0	0	421	1	2	0	0	0	1	0

2001	2	0	0	61	12	0	0	0	948	2	2	0	0	3	3	2
2002	0	0	0	22	7	0	0	0	74	2	23	0	1	0	2	0
2003	0	0	0	13	0	0	0	0	116	30	15	0	0	0	7	0
2004	0	0	0	45	2	0	0	1	425	2	6	0	0	0	3	0
2005	0	0	0	6	2	0	0	0	18	0	0	0	0	0	0	0
2006	0	26	0	296	114	85	0	0	113	1	7	0	0	0	4	0
2007	0	0	0	46	1	0	0	0	2	0	0	0	0	0	3	0
2008	1	3	0	89	6	0	0	0	8	17	14	0	0	1	2	0

1 Plus 628 suckers not identified to species
2 Survey for larval fish only April 1986
3 Perkinsville to TAPCO: all flathead catfish were below Sycamore Creek. First record in upper Verde

Table 49. Survey information for Black Bridge Site.

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
1994	0	88	38	237	27	57	0	0	2	0	0	0	0	0	2	0
1995	0	2	19	36	38	43	0	0	8	1	0	0	0	0	0	1

1996	0	3	3	33	62	50	0	0	2	2	4	0	0	0	0	0
1997	0	0	0	44	34	13	0	0	77	0	2	0	0	0	0	0
1998	0	0	0	13	11	4	0	0	132	2	18	0	0	0	8	0
1999	0	0	0	34	38	13	0	0	7	2	13	0	0	0	1	1
2000	0	0	0	1	4	4	0	0	260	0	3	0	0	0	1	0
2001	0	0	0	13	1	1	0	0	99	0	2	0	0	0	6	0
2002	0	0	0	3	21	9	0	0	71	3	10	0	0	0	2	1
2003	1	0	0	17	37	4	0	0	104	5	21	0	0	0	5	0
2004	0	0	0	16	32	4	0	1	150	1	12	0	0	0	1	0
2005	0	0	0	6	4	0	0	0	4	1	0	0	1	0	2	0
2006	0	0	0	201	152	119	0	0	52	7	43	0	0	0	4	0
2007	0	0	0	18	22	12	0	0	0	0	1	0	0	0	1	0
2008	0	0	0	14	4	1	0	0	1	12	16	0	0	0	2	0

Table 50. Survey information for Sycamore Site.

Year	**Longfin dace**	**Speckled dace**	**Spikedace**	**Desert sucker**	**Sonora sucker**	**Roundtail chub**	**Fathead minnow**	**Mosquito fish**	**Red shiner**	**Green sunfish**	**Smallmouth bass**	**Largemouth bass**	**Channel catfish**	**Flathead catfish**	**Yellow bullhead**	**Common carp**
1984	76	4	25	1	32[1]	2	0	0	4	2	6	0	0	0	0	1
1986-1987	1	0	52	27	34	4	0	0	6	5	13	0	0	0	27	7

1986[2]			30	113	23											
1994	1	19	92	379	223	165	0	0	3	0	3	0	0	0	10	4
1995	0	0	17	29	37	104	0	0	5	2	0	0	0	0	1	2
1996	1	0	51	38	41	25	0	0	9	0	0	0	0	0	0	1
1997	0	0	0	12	38	0	0	0	17	0	6	0	0	0	16	3
1998	1	0	0	4	8	0	0	0	1	0	5	0	0	0	7	1
1999	0	0	0	11	1	1	0	0	17	0	36	0	0	0	1	0
2000	0	0	0	6	25	0	0	0	49	0	4	1	0	0	5	10
2001	0	0	0	9	1	5	0	0	0	1	10	0	0	0	2	0
2002	0	0	0	13	12	0	0	0	5	1	23	0	0	0	1	0
2003	0	0	0	4	13	0	0	0	89	1	24	0	0	0	3	0
2004	0	0	0	0	0	0	0	0	14	0	2	0	0	0	0	1
2005	0	0	0	0	1	0	0	0	2	1	3	0	0	0	4	0
2006	0	0	0	30	31	1	0	0	156	4	43	0	0	0	4	0
2007	0	0	0	3	22	1	0	0	71	15	10	0	0	0	3	15
2008	0	0	0	37	81	0	0	0	49	3	7	0	0	0	7	0

1 Plus 990 suckers not identified to species

2 Survey for larval fish only in April 1986

Table 51. AGFD Surveys in the upper Verde River 2000-2006[1].

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
Granite Creek to Verde Ranch																
2002	9	0	0	683	270	119	0	80	338	47	350	0	0	0	32	44
2004	0	0	0	192	248	24	0	72	1887	61	1066	0	0	2	37	106
2005	49	0	0	713	4000	56	57	0	942	56	239	0	0	0	9	54
2006	0	0	0	443	752	51	0	0	118	7	392	0	0	1	31	27
Burnt Ranch/Campbell Place																
2003	0	0	0	72	17	4	0	1	159	16	237	0	0	0	3	4
2004	0	0	0	90	74	1	1	56	151	27	429	0	0	0	16	1
2004[2]	0	0	0	80	49	0	0	0	61	67	294	0	0	0	13	2
Verde Ranch to Bear Siding																

Year	Longfin dace	Speckled dace	Spikedace	Desert sucker	Sonora sucker	Roundtail chub	Fathead minnow	Mosquito fish	Red shiner	Green sunfish	Smallmouth bass	Largemouth bass	Channel catfish	Flathead catfish	Yellow bullhead	Common carp
2004	0	0	0	84	128	0	0	13	2020	61	313	0	3	16	130	45
2004	0	0	0	92	142	21	0	0	321	9	385	0	2	14	87	18
Verde Ranch to Perkinsville																
2005	8	0	0	1191	1610	54	0	0	616	24	192	0	0	0	76	89
Perkinsville to Sycamore Creek																
2001	0	0	0	475	113	114	0	0	2496	86	560	0	0	1	113	33
2004	0	0	0	145	180	44	0	2	773	54[3]	626	0	1	10	75	13
2005	1	13	0	1058	1637	323	0	0	59	4	471	0	0	3	22	291
Granite Creek to Verde Ranch																
2003	26	0	0	20	32	0	25	6	0	8	0	0	0	0	0	0

1 Data from Morgan 2000a, 2000b; Fong 2004 (3), 2004 (4), 2004 (6); Chmiel 2005a, 2005b; Clark 2003e, 2004b, 2004c, 2005, 2006c; AGFD 2001

2 After the September 2004 high flow event

3 Plus 1 redear sunfish

MIDDLE VERDE RIVER SUB-WATERSHED

Physical Geographic Description

Drainage Area

The Middle Verde Watershed contains eight proposed stocking locations. These locations form three distinct stocking complexes (Middle Verde, Wet Beaver Creek and West Clear Creek). This area of the assessment begins at the Peck's Lake Diversion Dam (TAPCO) and extends down the Verde River to Beasley Flats (downstream of Camp Verde) and includes the perennial tributaries of West Clear Creek, Oak Creek and Wet Beaver Creek (Figure 72). Riparian vegetation can be found along Oak and Wet Beaver Creeks made up of mixed broadleaf (ADWR 2007). Several diversion dams exist in this reach of the river. The Peck's Lake diversion (Figure 73) is located upstream of Clarkdale and also may be known as the TAPCO diversion. Designated wilderness areas along the middle Verde River include West Clear and Wet Beaver Creeks. Unique waters, as designated by the Arizona Department of Environmental Quality, includes Oak Creek.

Range of elevations

Elevations in the watershed range from about 7600 feet near Mingus Mountain down to 3000 feet at Beasley Flats.

Tributaries

The significant tributaries in this sub watershed are Oak Creek, Wet Beaver Creek and West Clear Creek.

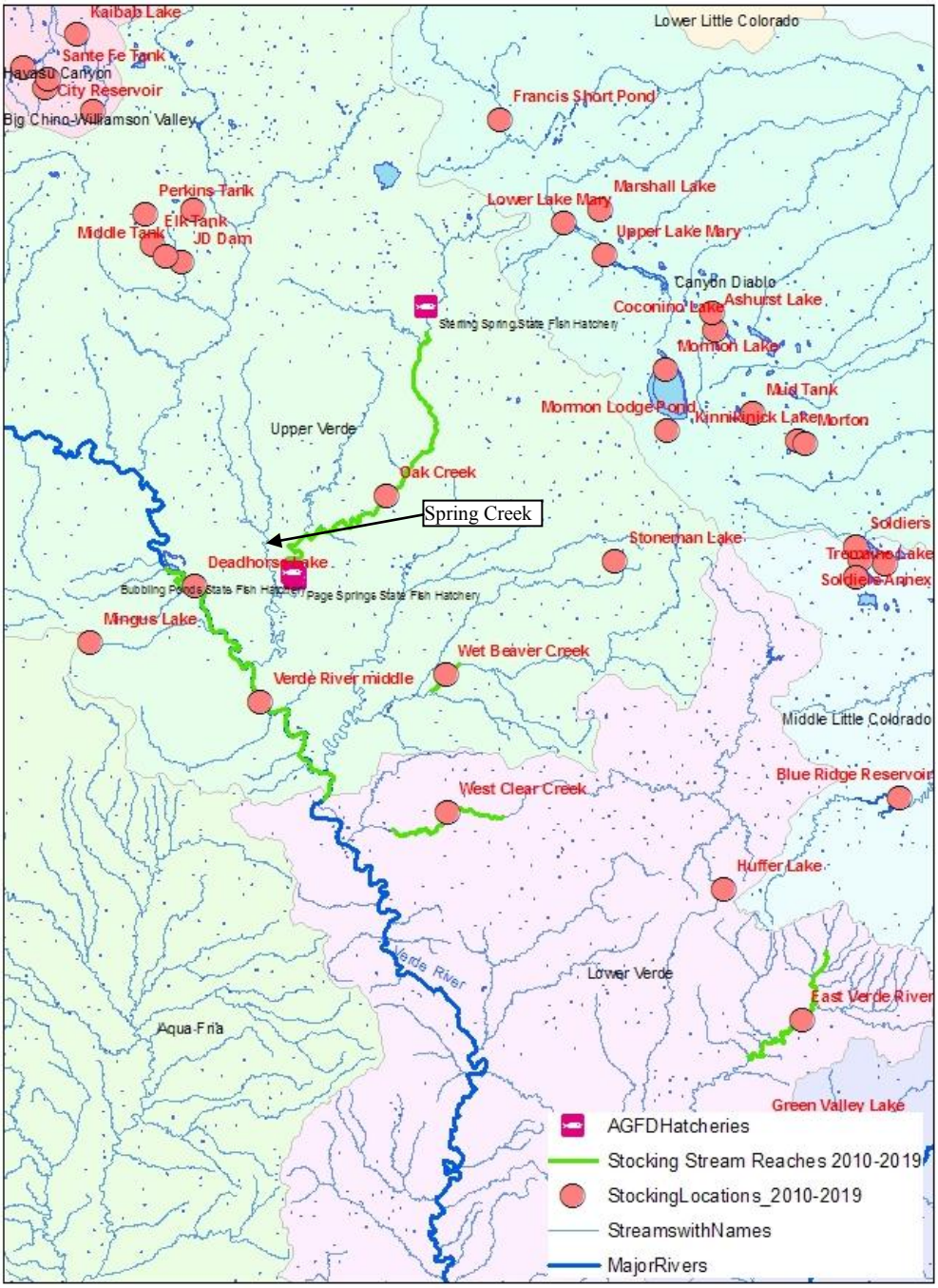

Figure 72. Middle Verde stocking locations and hatchery overview

Figure 73. Pecks Lake diversion on the Verde River near Clarkdale as barrier to upstream movement of fish

MIDDLE VERDE COMPLEX

Oak Creek

Site Description

Oak Creek extends from the Mogollon Rim to its confluence with the Verde River near Cornville. Stocking occurs in Oak Creek over an approximate 29 mile area from near Page Springs Hatchery in Cornville upstream to approximately 10 miles north of Sedona in Oak Creek Canyon. The stocking area starts upstream from the Verde River and extends upstream to the top of the canyon near the switchbacks of Highway 89A.

Land ownership within a 1.6 km (1.0 mi) buffer along Oak Creek is comprised of Coconino National Forest (73%), private (22%), Arizona State Land Department (4%), Coconino County (1%), AGFD (<1%), and Prescott National Forest (<1%) lands. Private lands are found primarily in the Sedona, Cornville, and Oak Creek Canyon areas.

There are multiple camping and picnic grounds managed by the Coconino National Forest that are vehicle accessible via paved roads or foot accessible.

Three department hatcheries are located along Oak Creek Sterling Springs Hatchery, Page Springs Hatchery, and Bubbling Ponds Hatchery (Figure 74). Sterling Springs Hatchery is located near the upper end of Oak Creek Canyon. Page Springs Hatchery and Bubbling Ponds Hatchery are located across Oak Creek from each other downstream of Sedona near Cornville. A private fee fishing fish farm known as the "Rainbow Trout Farm" is located on Oak Creek upstream of Sedona and is also spring fed.

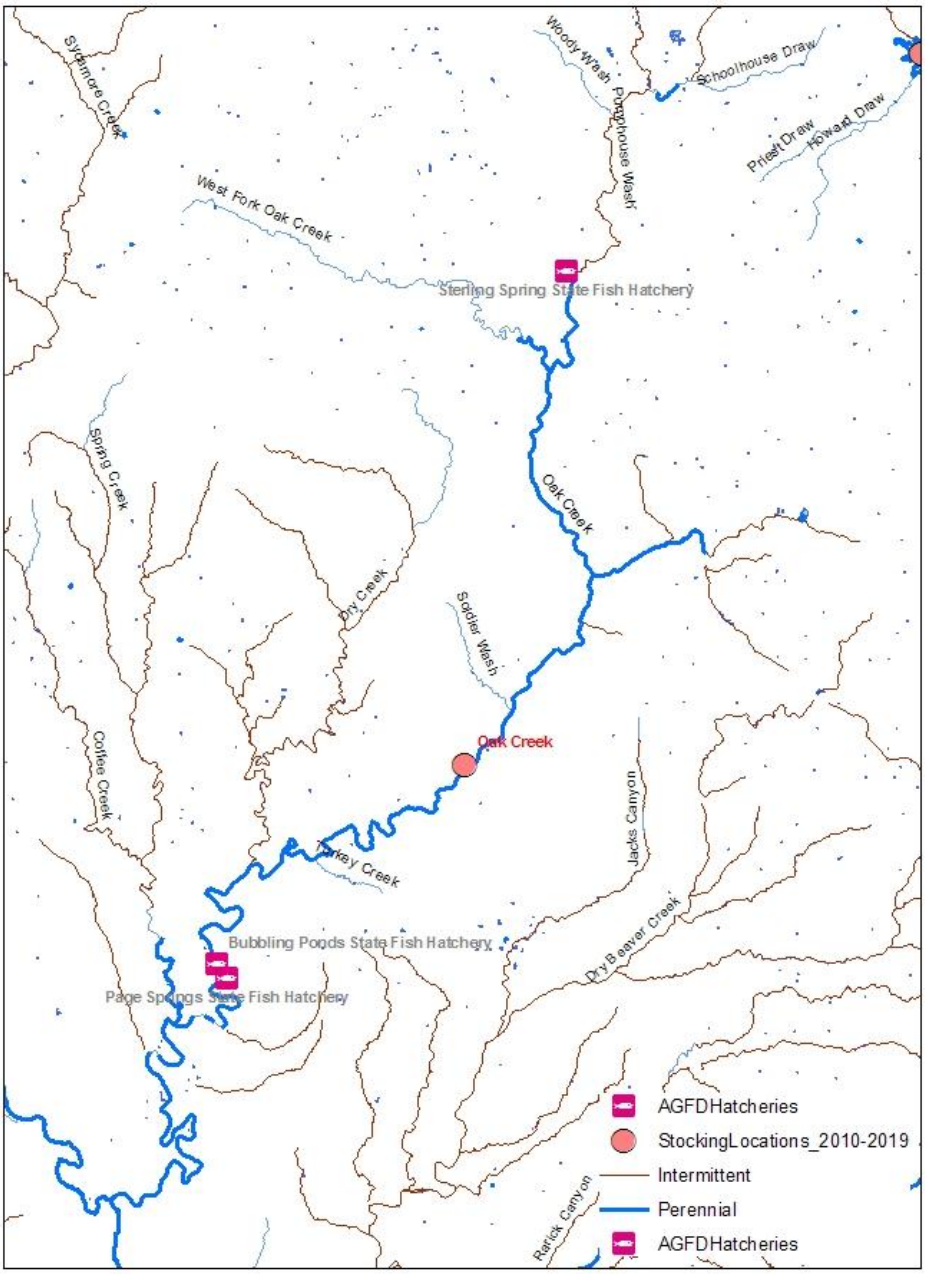

Figure 74. Oak Creek and Department Hatcheries

Management of Water Body

Angling for trout in Oak Creek began shortly after the area was settled in the late 1800's. According to information in Arizona Wildlife – The Territorial Years 1863-1912 (Brown 2009) Dr. E. A. Mearns fished for Gila trout in Oak Creek in 1886 and caught fish up to approximately 3 lbs. Other early anglers of Oak Creek reported that "Native trout as long as 16 inches were abundant as far downstream as the falls." According to the book the falls were "Upstream of Sedona". There are preserved specimens of Gila trout from Oak Creek collected in 1888-1889.

Arizona Wildlife – The Territorial Years 1863-1912 also reports of a newspaper account of trout, either brook trout or rainbow trout, first being stocked into Oak Creek in the spring of 1892 and a 1908 newspaper report of rainbow trout being stocked into Oak Creek.

Today, the primary fishery for Oak Creek is a high intensity, put and take rainbow trout fishery. Secondary fishery is a catch and release coldwater fishery for self sustaining rainbow and brown trout in the 2 mile long catch and release section of the creek. The catch and release section of Oak Creek extends from the Call of the Canyon Crossing and day use area downstream about 2 miles to the Junipine Resort Crossing. The only angler use data on Oak Creek comes from the 2001 Statewide Angler Survey. According to the results of the mail survey 30,423 coldwater angler use days and 7,442 warmwater angler use days were estimated for Oak Creek in 2001 (Pringle, 2004). This creek had the third highest estimated use for coldwater anglers in the region below Lees Ferry and Ashurst Lake.

Approximately 25 locations are stocked at various times during the year on Oak Creek (

Table 52). Beginning on the downstream end and progressing upstream the stocking sites are:

- Cornville Area
- Mormon Crossing below Oak Creek Elementary School.
- Adjacent to the Page Springs Hatchery nature area.
- At the bridge on Page Springs Rd.
- Sedona Area
- Red Rock Crossing/Crescent Moon Camp Ground (day use).
- End of the road at Chavez Crossing.
- Adjacent to the Tlaquepaque Resort.
- Upstream of Sedona
- At Grasshopper Point (day use).
- By the "Ropes that Rescue" sign on Highway 89A.
- Parking area Across from Indian Gardens.
- Big pool before Dairy Queen.
- At the end of the old road across from Encinoso Picnic Area (day use).
- Bridge at Shangri La.
- Pull out before Manzanita Camp Ground.
- Manzanita Camp Ground.
- Under the bridge at Slide Rock State Park.
- Banjo Bill Camp Ground.
- Junipine Resort, upstream.
- Large pools both up and downstream across from Don Hoel's.
- Call of the Canyon camp ground.
- Low water crossing upstream from Call of the Canyon camp ground .
- Pools upstream from house on bluff.

- Cave Springs Camp Ground. Several places throughout campground, starting upstream from entrance crossing.
- Meadow Stocking.
- Pine Flats Camp Ground. (Depending on water levels, very intermittent).
- Suicide Hole, North of blue "Adopt a HWY" sign large pool down from northernmost guardrail

Table 52 .Stocking history in Oak Creek (1933 to present).

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Rainbow trout	1933	2008	2,064	6,298,320
Brown trout	1933	1994	134	380,382
Brook trout	1936	1937	5	38,275
Channel catfish	1981	1987	12	46,795
Bluegill	1937	1969	2	4,050
Redear sunfish	1968	1969	2	60
Smallmouth bass	1941	1990	2	1,500
Largemouth bass	1937	1975	5	14,507
Apache trout	1936	1984	4	20,116
Cutthroat trout	1949	1949	2	4,200
Razorback sucker	1991	1991	1	1920
Arctic grayling	1969	1969	1	10,000
Total			2,234	6,820,125

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times annually from March-November; numbers of rainbow trout stocked may be from 0 – 60,000 annually.

Water Distribution / Connectivity

The Oak Creek watershed includes areas both above and below the Mogollon Rim in Central Arizona. Tributaries to Oak Creek in Oak Creek Canyon, upstream of Sedona, include West Fork Oak Creek, Pumphouse Wash, and Munds Canyon (Figure 74). West Fork Oak Creek is the only permanent stream of these tributaries. Springs are common along Oak Creek. Spring Creek is a tributary of Oak Creek downstream of the town of Sedona. Oak Creek has permanent flow from its beginning near Sterling Springs downstream to its confluence with the Verde River near Cornville.

Fish Movement

Fish can move freely throughout the system. A low flow natural barrier to upstream migration may be present at Grasshopper Point (Figure 76) where a set of small waterfalls are located. This set of falls may be the same one mentioned by trout fishermen in the 1880's as the downstream limit of trout fishing and marks the current upstream limit of warm water nonnatives and roundtail chub captures during surveys since 1991. Grasshopper point is located about 2 miles upstream of the City of Sedona.

Community Description

Table 54 provides a summary of past survey data from 1991 through 2007. Recently, Rinker (2007a) reported rainbow trout, brown trout, smallmouth bass, green sunfish, bullhead catfish, flathead catfish, rock bass, speckled dace, Sonoran sucker, and desert sucker from Oak Creek. The majority of the fish collected were brown trout at 41.63% of the total catch and speckled dace at 37.77% of the total catch. Rainbow trout, desert sucker and Sonora sucker were also relatively abundant during the 2007 July-August survey.

The Native Fish Database contains fish survey data from the following years: 1987, 1989, 1990, 1992-1996 and 2000. During those surveys, 1008 fish were collected and identified and consisted of the following species: longfin dace, yellow bullhead, rock bass, Sonoran sucker, carp, red shiner, mosquitofish, channel catfish, green sunfish, warmouth, bluegill, smallmouth bass, rainbow trout, desert sucker, flathead catfish, speckled dace and brown trout (Table 53 and Figure 75). Notably, no roundtail chub were collected. The collection of Apache trout cannot be explained with certainty but may be the result of mis-identification.

In 2007, the fish assemblage in Oak Creek upstream of the Grasshopper Point recreation site included: rainbow trout (stocked and wild spawned), speckled dace, brown trout (wild spawned because they are no longer stocked), Sonora sucker and desert sucker. The fish assemblage downstream of the Grasshopper Point recreation site in 2007 included: rock bass, green sunfish, smallmouth bass, channel catfish, bullhead catfish, carp, rainbow trout (stocked), Sonora sucker, speckled dace and desert sucker.

Roundtail chub were last collected in Oak Creek in 2001, during surveys near Sedona. One large adult was caught near the Tlaquepaqui Resort and an angler was found with 2 near a set of houses just upstream of Sedona (Voeltz 2002, L. Luedeker, pers. comm).
In addition to fish, Oak Creek supports a large population of narrow-head gartersnakes (Brennan and Rosen 2009). Northern Mexican gartersnakes also persist along Oak Creek near the Page Springs and Bubbling Ponds state fish hatcheries (V. Boyarski pers. comm.).

Table 53. Fish collected from Oak Creek, 1987-2000 from AGFD NFDB. Collection localities depicted in Figure 75.

Species collected	**Num.**
longfin dace	4
yellow bullhead	8
rock bass	119
Sonoran sucker	58
unidentified sucker juv	31
carp	4
red shiner	43
mosquitofish	16
channel catfish	3
green sunfish	257
warmouth	25
bluegill	4
unid sunfish	1
smallmouth bass	184
Apache trout?	3
rainbow trout	45
desert sucker	101
flathead catfish	4
speckled dace	57
brown trout	41
Total	**1008**

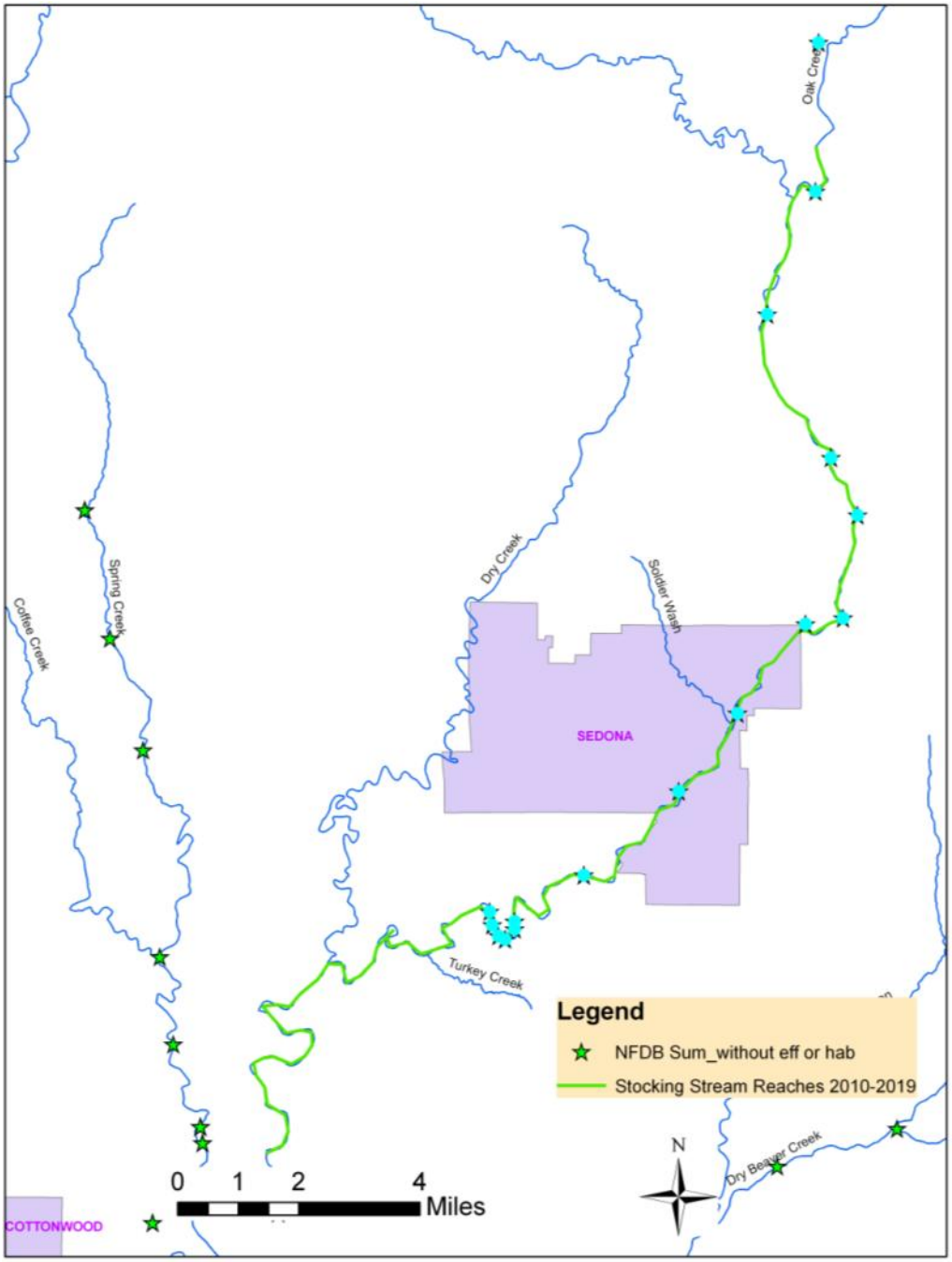

Figure 75. Fish collection locations for data in Table 53.

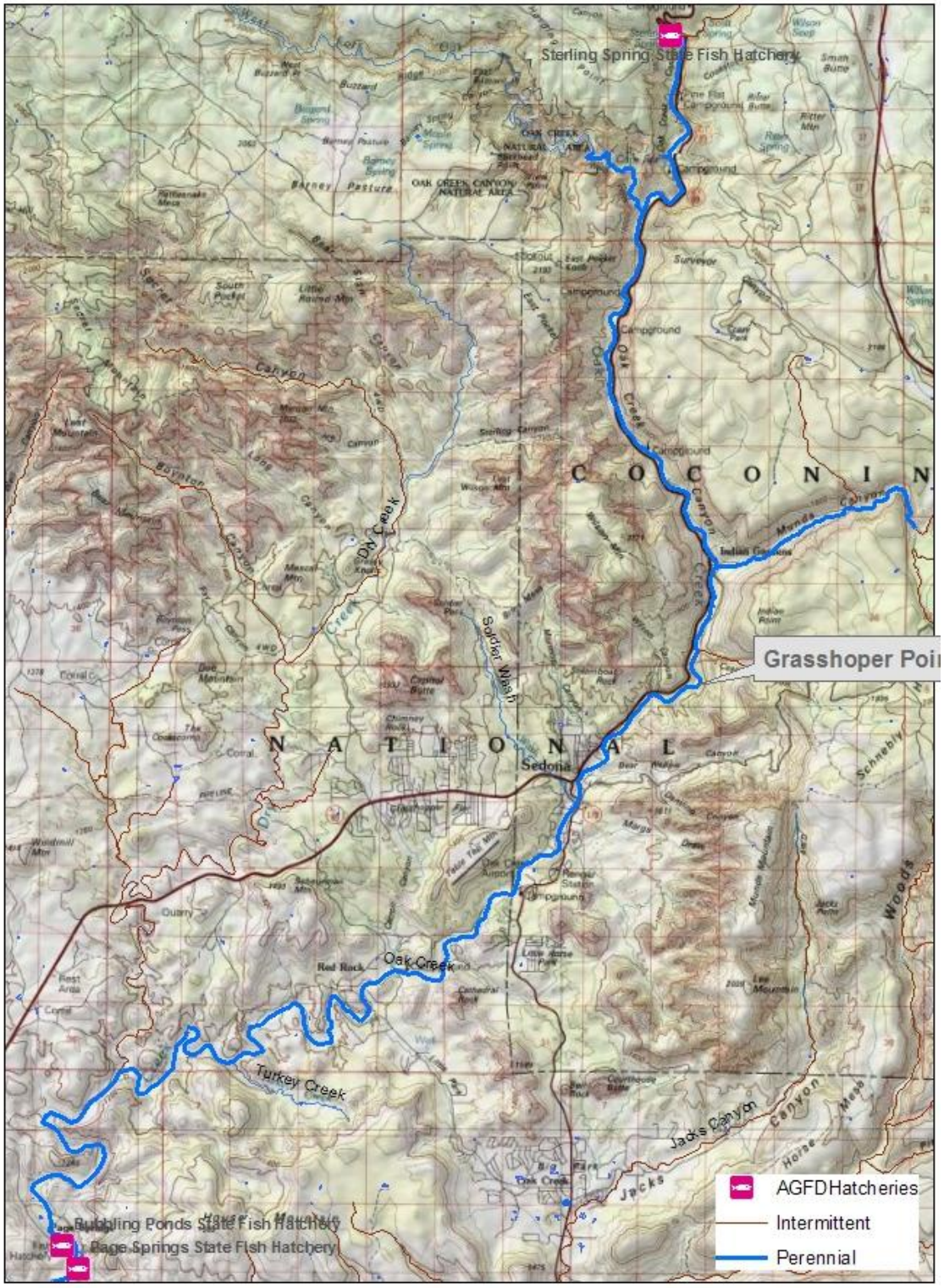
Sterling Spring State Fish Hatchery
Grasshoper Poi
C O C O N I N
N A T I O N A L
Sedona
Oak Creek
Red Rock
Turkey Creek
Jacks Canyon
Bubbling Ponds State Fish Hatchery
Page Springs State Fish Hatchery
AGFD Hatcheries
Intermittent
Perennial

Figure 76. Oak Creek with Grasshopper Falls location

Table 54. Summary of fish collection data from Oak Creek, 1991-2007 (AGFD unpublished data).

LOCATION/YEAR	Smallmouth bass	Channel catfish	Brown trout	Green sunfish	Desert sucker	Sonora sucker	Speckled dace	Red Shiner	carp	Rock bass	Flathead catfish	Rainbow trout	Bullhead catfish
Below Grasshopper point 1991				1	10	3							
Above Grasshopper point 1991			2			3	25						
Oak Creek 1991			2		5		6						
Pine Flats 1991							81						
Oak Creek 1991												2	
West Fork Tailhead 1991			5										
Oak Creek 1992			1		24	8	2					9	
Grasshopper point 1992					45	13	4					9	
Red Rock State Park 1994	18	1		37			1	1	1				2
Oak Creek South of Hatchery 1994					5								1
Oak Creek Campground 1994	9			5									5
Troutdale 1994			35		2		63					16	
Red Rock State Park 1996	18			24	1	3						28	
Chavez Crossing 1996	1				12	11						19	
Grasshopper Point 1996			1		19		5					11	
Garland below bridge 1996			23		3		7					10	
Encinoso 1996			2		3		16					3	
Sterling Springs 1996												13	
Troutdale 1996			19				5					1	
Downstream of trout farm rd x-ing 1996					9		22					5	
Talaquepaque 1996	2				15	4							26
West fork Trailhead 1998			3		8		63					2	
Oak Creek 1999			4	1								4	
Above West Fork Confluence 2000			20				36						
Oak Creek Hotel 2000			12									1	
Above catch and release section 2003			19				27					5	
Catch and release section 2003			34				3					4	
Below Catch and release 2003			14		6	4	2					15	

LOCATION/YEAR	Smallmouth bass	Channel catfish	Brown trout	Green sunfish	Desert sucker	Sonora sucker	Speckled dace	Red Shiner	carp	Rock bass	Flathead catfish	Rainbow trout	Bullhead catfish
Totals from 2007sampling stations above Grasshopper Point			485	12	60	31	438					82	
Totals from 2007sampling stations below Grasshopper Point	11			12	8	13	2			13	1		3
TOTALS	59	1	681	80	235	93	805	1	1	13	1	239	37

Consultation Species or Critical Habitat
Potential impacts to bald eagle, Gila chub and critical habitat, northern leopard frogs, Mexican spotted owl and critical habitat, page springsnail, roundtail chub, and Western yellow-billed cuckoo are discussed below. Potential downstream impacts to Colorado pikeminnow, northern Mexican and narrow-headed gartersnakes, razorback sucker and critical habitat, Southwestern willow flycatcher and critical habitat, spikedace with critical habitat and Western yellow-billed cuckoo are analyzed within the Middle Verde River complex analysis later in the document.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur; however, due to large drops along the stream courses and the differing elevation limits of both northern and Chiricahua leopard frogs in various areas of the watershed, the Middle Verde River complex was divided into 3 smaller buffered complexes for analysis that included the vicinity of: 1) Stoneman Lake, 2) Oak Creek and 3) the Verde River proper.

Bald Eagle
Oak Creek Breeding Area is approximately 5.6 miles from Oak Creek and is within the Bald Eagle DPS. The eagles were first observed in 2002 and were last observed 14 April, 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Oak Creek Breeding Area productivity data shows that the nest was successful in 2007 with one nestling found dead below the nest, was successful in 2008, and failed in 2009 when a nestling was found injured on the ground and taken to rehabilitation but was deemed not releasable (Jacobson et al. 2007, McCarty and Jacobson 2008, 2009). Oak Creek does not currently have monofilament bins present.

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Gila Chub and Critical Habitat
Gila chub are known from one tributary of Oak Creek, Spring Creek. Spring Creek joins Oak Creek downstream from the reach proposed for stocking of rainbow trout. The reach of Spring Creek currently occupied by Gila chub is a little over a mile upstream of the confluence with Oak Creek. Critical habitat is also designated in Spring Creek at three disjunct locations on public land, the nearest of which is about ½ mile upstream of the confluence.

Potential Impacts
Potential impacts to Gila chub could occur from stocking of rainbow trout in Oak Creek if Gila chub adults or juveniles move out of Spring Creek into Oak Creek during times when stocked trout may be present in this reach of Oak Creek, or if stocked rainbow trout migrate up Spring Creek to occupied or critical habitat. These streams warm in the summer time and rainbow trout do not persist through the summer. The potential response could be competition for food or space if either is limited for Gila chub or predation on juvenile Gila chub by rainbow trout. Surveys of Oak Creek near Spring Creek confluence in June 1987 and Sep 1995 did not document either rainbow trout or Gila chub. Surveys in Spring Creek in Aug. 1994, Sep. 1995 and May 1996, Sep. 1998 and Jul. 2003 did not detect rainbow trout in Spring Creek. An irrigation diversion in Spring Creek currently may be acting as a fish barrier under normal flows precluding the movement of fishes into Spring Creek from Oak Creek (Figure 77). This barrier, in conjunction with normal summer water temperatures, also may prevent rainbow trout access to critical habitat.

Exposure to stocked trout is unlikely to occur for two reasons. First, the existing warm-water nonnative fish assemblage in Oak Creek at the confluence with Spring Creek, which is dense and comprised of more predacious centrarchid and ictalurid species, would limit the opportunity for exposure because they would likely prey on the chub before the trout would. Second, the irrigation diversion prevents rainbow trout from accessing occupied Gila chub habitat during most, if not all seasons and years. Existing fisheries survey data indicate that Gila chub do not persist outside known occupied areas and stocked rainbow trout have not been found within occupied areas or critical habitat (AGFD data, Bagley 2002).

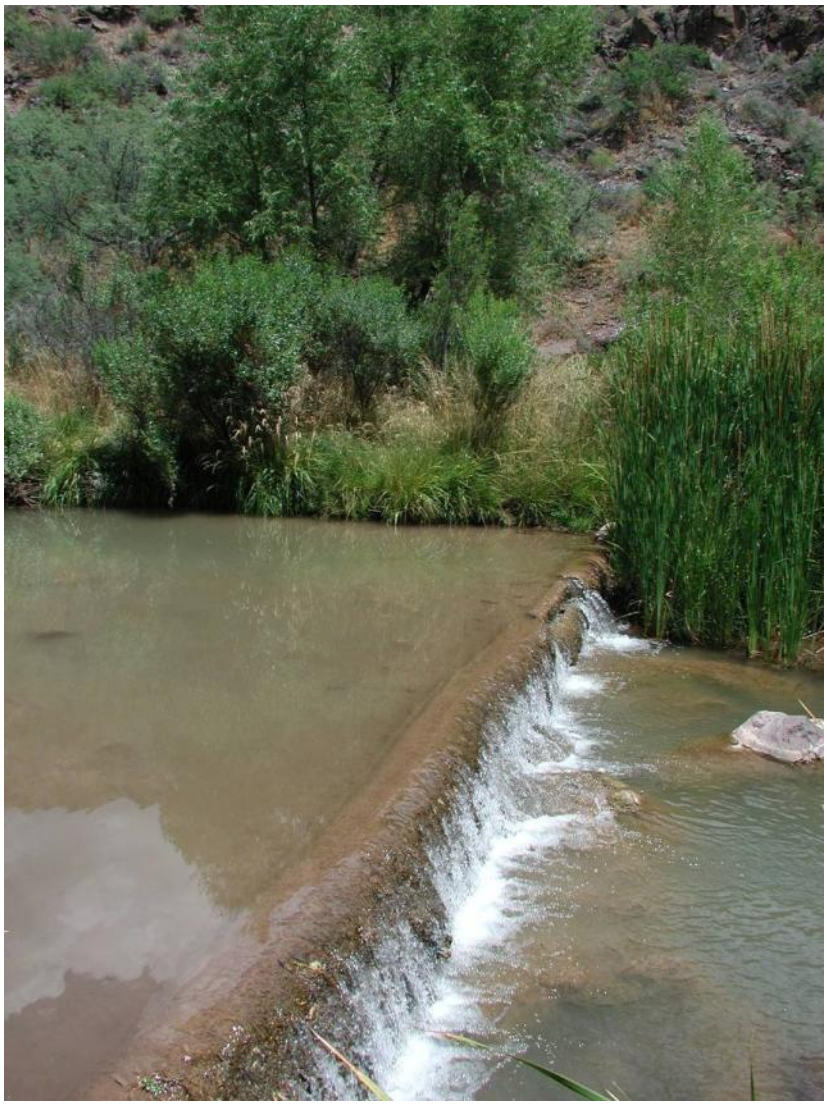

Figure 77. Diversion dam on Spring Creek, upstream from Oak Creek confluence.

Northern Leopard Frog

Local Analysis: Although Oak Creek is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in the Oak Creek buffered stocking reach is low. There are 3 historical records for northern leopard frogs in the buffered stocking reach: 2 records from the Oak Creek at West Fork confluence (1960, 1969) and 1 record from Foxboro Lake (=FS153) (1971) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database; M. Sredl pers. comm.). There have been 89 surveys or site visits at 17 localities in the Oak Creek buffered stocking reach between 1924 and 2008 (Figure 78, AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS). Northern leopard frogs were not observed at any site, including the West Fork confluence (2000 [n=2], 2002 [n=2]) and Foxboro Lake. Given that Oak Creek has been adequately surveyed and subsequent surveys have not

detected northern leopard frogs, it is likely they no longer occupy Oak Creek or the area within its buffered stocking reach (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in the Oak Creek reach is low, because northern leopard frogs no longer occupy Oak Creek, the prevalence of non-natives, and the drainages where fish could disperse fall below the elevational limit of northern leopard frogs in the region (approximately 5,300 ft) (Sredl 1997; AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

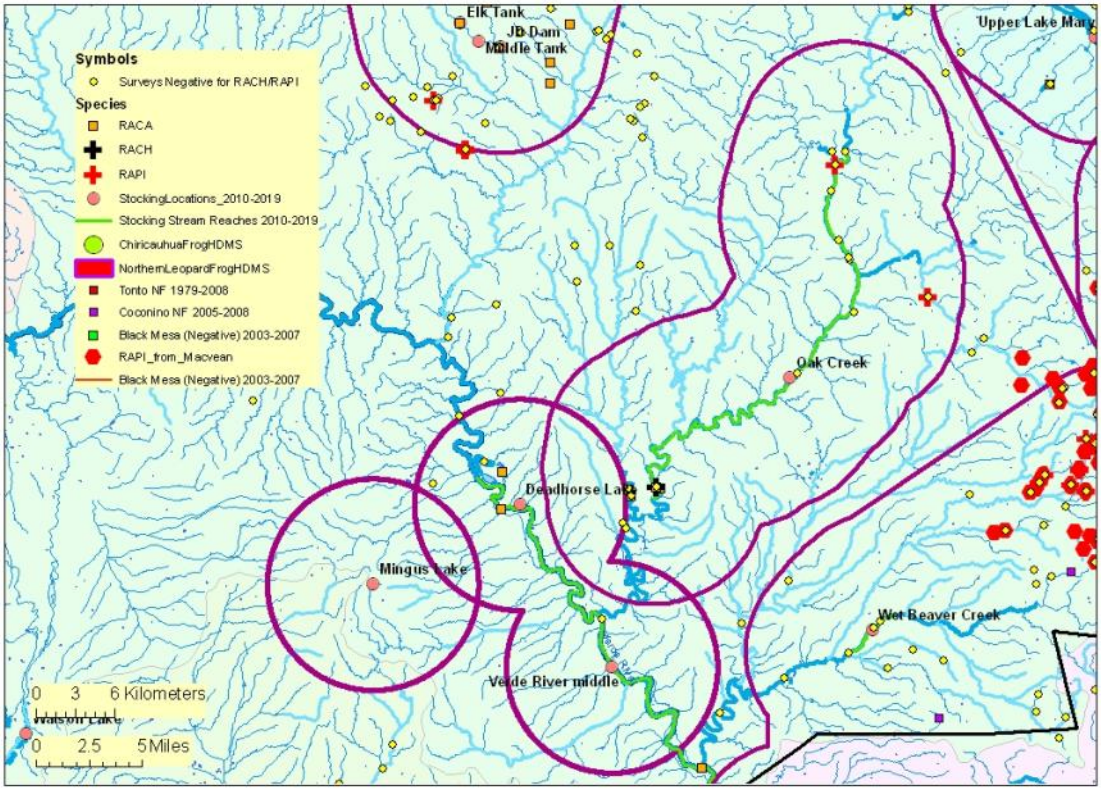

Figure 78. Map of Oak Creek and Lower Verde Sub-Complexes of Middle Verde buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the

legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Mexican Spotted Owl and Critical Habitat

The stocking stream reach is within Mexican spotted owl (MSO) critical habitat (CH), with only 0.14 miles of creek in the buffer. There appears to be angler access in Oak Creek Canyon based on topographic and world imagery maps.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around MSO PACs in the general vicinity of the site. No physical effects to MSO habitat in the PAC are anticipated, since anglers are not expected to be present in the PAC. There may be some disturbance to MSOs from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale

changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Page Springsnail

Page springsnails are known from the vicinity of the Page Springs and Bubbling Springs Pond. Their primary habitat is in Page Springs and other springs nearby, although they have been documented in ditches and other areas nearby. A small population historically occurred at Peck's Lake (Shea Spring) along the Verde River, but that population is believed to have been extirpated in the late 1970s. A previously unknown population of Page springsnails was discovered on private property in the Spring Creek area (Sheepshead Canyon) in July 2007. A final draft Candidate Conservation Agreement with Assurances (CCAA) was prepared by the Department that thoroughly describes the history and occurrences for Page Springsnails in the area. That agreement was submitted to the USFWS in March 2009 for signature.

Potential Impacts

The proposed activity is stocking rainbow trout at various points along Oak Creek, including in the vicinity of the springs. No stocking activity occurs into occupied Page springsnail habitat, and stocked fish cannot access that habitat. Page springsnails have not been documented as occurring in or along Oak Creek. Hatchery grounds and springheads where the springsnail occurs are closed to fishing and anglers. The CCAA identifies the springsnail as occupying spring habitat, not stream habitat where they would encounter sport fish. The CCAA does not identify sport fish as a potential threat to the species, since the springsnail occupies habitat not suitable for sport fish. Access to springsnail occupied habitat by the angling public is limited. Springsnail habitat is mostly too shallow and limited in area to support sport fish, and all these sites are isolated (no direct connection) from Oak Creek. Likewise, the Bubbling Springs Pond is an isolated site that has a fish barrier in place that prevents sport fish from Oak Creek from moving up channel into the site. All springsnail sites on AGFD hatcheries are fenced and closed to fishing from the public.

Exposure between the stocked rainbow trout and the springsnail is not expected to occur because of inability for them to come in contact with each other. Indirect impacts from angler activity would not occur in occupied springsnail habitat because the angling public is not allowed access to those habitats.

Roundtail Chub

Roundtail chub are known from Oak Creek as far upstream as the City of Sedona. The last collection of roundtail chub on Oak Creek occurred during surveys in 2001 downstream of Grasshopper Point near the city of Sedona. Roundtail chub have not been collected in department

surveys upstream of Grasshopper Point. Roundtail chub have been documented in the Verde River upstream and downstream of the confluence of Oak Creek.

Potential impacts
Potential impacts to roundtail chub could result from the predation on roundtail chub by stocked rainbow trout, competition for food or competition for space. Rainbow trout are primarily insectivorous, but may consume small fish. The significance of the effects of the stocked species is diminished by the fact that roundtail chub do not appear to be very abundant in Oak Creek, and by the fact that the area proposed for stocking where roundtail chub have been captured is occupied by several other competing and predatory warm-water nonnative species that occur independent of the proposed stocking actions including smallmouth bass, flathead catfish, green sunfish, red shiner, and rock bass.

Exposure of roundtail chub to stocked species is likely to occur based on the proximity and timing of the stocking action and the known distribution of roundtail chub.

Western Yellow-Billed Cuckoo
Western yellow-billed cuckoos have been documented along Oak Creek downstream of the town of Sedona. Suitable breeding and/or foraging habitat exists within Oak Creek.

Documented occurrences from 2004-2006 were within the proposed stocking reach. Breeding birds have been documented near Page Springs Hatchery and Red Rock confluence.
Corman and Magill (2000) reported them as being present only near Cornville and Page Springs Hatchery prior to 1998. They are not known to occur upstream of Sedona in the canyon bound section of stream, although they may be present there periodically, as well. Suitable nesting habitat may exist in riparian gallery forests along Oak Creek throughout the lower reach. Western yellow-billed cuckoos arrive on breeding grounds beginning in June; the earliest egg reported in Arizona is June 15. Nesting activity continues through August and frequently into September (Corman and Magill 2000). Corman and Magill also documented nests in four different tree species: salt cedar, Arizona alder, Fremont cottonwood and Gooding willow. Nest heights varied between 2.5 – 12.2 m with a mean of 5.2 m. Nest height data indicate that cuckoos use tall, old climax vegetation.

Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts
There may be some limited amount of habitat degradation and some amount of disturbance to nesting cuckoos from anglers using or creating new trails to access the stocking site.

<u>Wet Beaver Creek</u>

Site Description
The reach of Wet Beaver Creek proposed for stocking is an approximately 4.5 mile stretch of stream about 15 miles upstream from its confluence with the Verde River (Figure 72). The area is 12 miles northeast of Camp Verde on the Coconino National Forest. The Forest Service manages a campground near the old Beaver Creek Ranger Station and hiking trails and recreation opportunities in the area. Access to the creek is by hiking along the banks.

Management of Water Body
Angler use data on Wet Beaver Creek from the 2001 Statewide Angler Survey showed 3,192 coldwater angler use days and 2,800 warmwater angler use days for Wet Beaver Creek (Pringle, 2004). The creek is managed primarily as an intensive use, put and take rainbow trout fishery. Secondary fishery is a warm water fishery. Limits were removed on smallmouth bass, channel catfish and flathead catfish in the late 1990's to encourage the removal of undesirable warm-water nonnative fish by anglers to benefit native fish. Warm water sport fish have not been stocked in Wet Beaver Creek since 1941 (Table 55).

Table 55. Stocking history in Wet Beaver Creek.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Rainbow trout	1939	2008	589	507,846
Brook trout	1961	1961	1	5,400
Brown trout	1933	1985	17	28,900
Largemouth bass	1941	1941	1	1,000
Smallmouth bass	1941	1941	2	4,000
Total			610	547,146

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times annually during the spring (March-May) and fall (October-November); numbers of rainbow trout stocked may be from 0 – 6,000 annually.

Water Distribution / Connectivity
The Wet Beaver watershed includes areas below the Mogollon Rim in Central Arizona. Flows begin in the area down slope of Stoneman Lake and Apache Maid Mountain. Tributaries to Wet Beaver Creek include Walker Creek and Red Tank Draw. Wet Beaver Creek flows downstream to the area near McGuireville where it joins Dry Beaver Creek to form Beaver Creek which flows to the Verde River thru Camp Verde. Beaver Creek is usually dry during the summer because of water diversions in the Camp Verde area. Walker Creek has a diversion upstream of

Rancho Roco Roja that is located upstream of the confluence of Walker Creek and Wet Beaver Creek that appears to serve as a fish barrier to upstream migration. There is no barrier between Red Tank Draw and Wet Beaver Creek.

Fish Movement
Fish can move freely throughout the system. The small diversion on Walker Creek appears to be an effective fish barrier to upstream movement since no nonnative fish have been caught during surveys in Walker Creek above the diversion.

Community Description
Nonnative fishes of the family Centrachidae, primarily smallmouth bass and green sunfish, have long dominated the fish community of Wet Beaver Creek (Table 56). Results from the 1985 Beaver Creek Fish Management Report (Reger 1985) show that Wet Beaver Creek was dominated by nonnative smallmouth bass. "We sampled 200 fish at the 3 sites on Wet Beaver Creek. Smallmouth bass comprised 53% of this sample, Gila mountain-sucker 36% (desert sucker), Gila sucker 5% (Sonora sucker), rainbow trout 4%, roundtail chub 1%, and speckled dace, longfin dace, brown trout, and green sunfish each less than 1%" (Reger 1985). The 1985 survey was conducted along the lower reaches of the creek during July at elevations and water temperatures reaching the lethal limit for trout. "We surveyed fish and habitat during 1-3 July 1985 at three sites on Wet Beaver Creek: Lawrence Crossing (mi. 17, elev. 3,630 ft.), Boy's School (mil 20.5, elev. 3920 ft.), and approximately 3 miles above Bell trail (mi. 27, elev. 4,540 ft.). Water temperatures ranged from 70-78 ° F and pH from 6.0-7.0." Only 7 rainbow trout were collected during the 1985 survey and all were determined to be hatchery fish. A survey conducted in October 1986 (which was appended to the end of Reger 1985) reported that the upper reaches of the creek also contained a nonnative dominated fish assemblage. "The only self-sustaining trout population in Beaver Creek is of brown trout, and appears to be limited to a 3-5 mi. stretch. We saw only speckled dace above the falls; smallmouth bass, speckled dace, chubs (*Gila robusta grahami*), and Gila mountain-suckers occur though out the remainder of the creek" (Reger 1985). The falls mentioned are in the canyon somewhere upstream of the proposed stocking reach.

Results of a 1987 survey of Wet Beaver Creek (1 mile below the USGS gauge station and about 1/3 mile above the stocked reach) by AGFD Non-game biologist Bill Leibfried, shows a strong nonnative fish assemblage. Of the 50 fish collected in this station of Beaver Creek, 94% of the total catch was nonnative and 86% of the total catch was smallmouth bass. Only 6% of the total catch was native fish, all of which were Sonora suckers.

Table 56. Arizona Game and Fish Department Wet Beaver Creek Sampling 1985 -1998. Below, "in" or" above" indicates where the sampling site was relative to the stocked reach.

Species	Lawrence (below)	Ranger (in)	Boy's School (in)	3Mi. Above trail (above)	Upper Wet Beaver Creek (above)	unnamed location
Smallmouth Bass	154	32	55	25	16	11
Desert Sucker	95	35	9			11
Roundtail Chub	8			2		
Brown Trout	5			1		
Sonora Sucker	35	2	30	21		
Green Sunfish	1					
Rainbow Trout	2	1	7			
Bullhead	21					
Longfin Dace				1		
Speckled Dace				1		

A summary of the population status in the 2002 Roundtail Chub Status Survey Of The Little Colorado River Basin by Voeltz, suggest a steady decline of roundtail chub within Beaver and Wet Beaver Creek. "Barrett and Maughan (1995) found the roundtail chub population in Beaver Creek comprised entirely of large adults, with no juveniles found, during surveys conducted from 1988-1990. Presence of smallmouth bass may have displaced roundtail chubs from preferred habitats, resulting in a sub viable roundtail population below canyon-bound reaches. Surveys noted a simultaneous increase in abundance of all size classes of smallmouth. Montgomery et al (1994) did not find chubs during spring and fall 1993 surveys near Montezuma Castle National Monument (located on Beaver Creek about 3.5 miles downstream the Dry Beaver Creek Wet Beaver Creek confluence), indicating their rarity in the system. One roundtail was found during surveys during 1995 at Davis Hole on Montezuma Castle National Monument (L. Montgomery, pers. comm.). Surveys conducted by AGFD personnel during July 1998, found roundtail common in canyon-bound reaches above the gauge station in the upper reaches of the stream. In the stream reach above a barrier waterfall, brown trout, desert sucker and roundtail chub were common, with smallmouth bass first being sampled below the fall, and increasing in abundance with distance traveled downstream. Cumulatively, this suggests that the occasional roundtail sampled in lower Wet Beaver Creek may be moving down from the population remaining in the upper portions of the drainage." Voeltz gives both Beaver and Wet Beaver Creek's a status of "Unstable – Threatened"

Voeltz goes on to describe how roundtail chub have been essentially extirpated from Dry Beaver Creek due to drought conditions and invasions by nonnative fishes. "Intermittent water and

invasions by nonnative predatory fish have likely caused extirpation of the chub population in Dry Beaver Creek. A complete and thorough survey is needed before chub populations should be declared extirpated. Except for a pool in the vicinity of Beaverhead Spring, Dry Beaver Creek was believed entirely dry during drought conditions of summer 2000 (C. Benedict, pers. comm.). Green sunfish were reportedly abundant in the pool." Voeltz gives Dry Beaver Creek a status of "Extirpated" for roundtail chub.

A 2006 AGFD hoop netting and electro fishing survey reflects the continuing trend of high numbers of nonnative centrachids compared to low numbers of native fishes including roundtail chub. Of the 222 total fish collected 86.49% of the total catch comprised of nonnative fishes and 82.88% of the total catch was smallmouth bass. 13.51% of the total catch was native fishes and only 1.8% (4 fish) of the total catch was comprised of roundtail chub (M. Rinker pers. comm.).

Surveys were conducted in 2007 on Walker Creek (Rinker and Benedict 2007c) and Red Tank Draw (Rinker 2007c) (Table 57, Table 58, Table 59 and Table 60).

Only native fish were captured during the Walker Creek surveys. The Red Tank Draw surveys were dominated by nonnatives including smallmouth bass and green sunfish. Rainbow trout have not been collected in Red Tank Draw or Walker Creek.

Table 57. Walker Creek 2007 Electrofishing Station 1. Upstream From Private Property Fence.

Species	Number	% of total	Mean Length (mm)	Min-Max length (mm)
Longfin Dace	97	76.38	54.1	31-70
Gila Chub	3	2.36	113.33	105-117
Desert Sucker	22	17.32	92.53	36-126
Speckled Dace	5	3.94	86.2	62-106
TOTALS	127	100	-	-

The GPS coordinates for this station are 12S 0435346 UTM3833441.

Table 58. Walker Creek 2007 Electrofishing Station 2. Upstream From Private Property/Below Diversion Dam.

Species	Number	% of total	Mean Length (mm)	Min-Max length (mm)
Longfin Dace	65	73.03	58.79	30-78
Desert Sucker	8	8.99	119.13	103-137
Gila Chub	16	17.98	150.31	101-247
Totals	89	100	-	-

Table 59. Walker Creek 2007 Electrofishing Station 3. Diversion Dam.

Species	Number	% of total	Mean Length (mm)	Min-Max length (mm)
Longfin Dace	13	54.17	67.15	54-101
Desert Sucker	2	8.33	115.5	97-134
Gila Chub	9	37.5	119.67	56-187
TOTAL	24	100	-	-

Table 60. Red Tank Draw 2007 Fish Survey

Species	Number	% of total	Mean Length (mm)	Min-Max length (mm)
Sonora Sucker	10	6.99%	315	258-411
Smallmouth Bass	35	24.48%	142.91	91-249
Green Sunfish	98	68.53%	121.58	48-228
TOTAL	143	-	-	-

Consultation Species or Critical Habitat
Potential impacts to bald eagle, Gila chub and critical habitat, roundtail chub and Western yellow-billed cuckoo are discussed below. Potential downstream impacts to Chiricahua and northern leopard frogs, Colorado pikeminnow, northern Mexican and narrow-headed gartersnakes, razorback sucker and critical habitat, spikedace with critical habitat and Western yellow-billed cuckoo are analyzed within the Middle Verde River complex analysis later in the document.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Bald Eagle
Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year.

Potential Impacts

The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Gila Chub and Critical Habitat

Gila chub are known from two tributaries to Wet Beaver Creek; Red Tank Draw and Walker Creek (Weedman et al 1996). Walker Creek joins Beaver Creek about two miles downstream from the stocking locations. Red Tank Draw joins Beaver Creek about three miles downstream from the proposed stocking locations. Critical habitat is designated in Red Tank Draw from the confluence with Wet Beaver Creek upstream to Mullican Canyon and in Walker Creek from Forest Road 618 upstream to Spring Creek confluence. This is a different Spring Creek than the other Spring Creek previously discussed in the Oak Creek Drainage for Gila chub.

Red Tank Draw is also occupied by green sunfish and smallmouth bass. Green sunfish have been documented as having severe impacts to chub species to the point of eliminating their persistence (Dudley and Matter 1996).

Potential Impacts

Potential impacts to Gila chub could occur from stocking of rainbow trout in Wet Beaver Creek. The impacts could result if Gila chub adults or juveniles move out of Red Tank Draw or Walker Creek into Wet Beaver Creek during times when stocked trout may be present in this reach of Wet Beaver Creek, or if stocked rainbow trout migrate up these streams to occupied or critical habitat. All of the streams in this area become warm in the summer time and rainbow trout do not persist anywhere through the summer. The rainbow trout could compete for food or space with Gila chub if they move into Red Tank Draw or Walker Creek during the cooler seasons. However, this has not been shown to occur. Predation on juvenile Gila chub which could move out of Red Tank Draw into Wet Beaver Creek by rainbow trout is also possible, although not likely because of the abundance of other predatory fishes that would likely consume the juveniles before trout could come in contact with them. Alternatively, adult Gila chub may move out of Red Tank Draw or Walker Creek into the stocked reach or just downstream of the stocked reach where rainbow trout may be present during or shortly after the stocking seasons. This could result in competition for food or space until the trout die off from warm temperatures. However, Gila chub have not been documented in or downstream from the area of rainbow trout stocking. Predation on eggs is not expected to occur because trout don't appear to move into occupied chub habitat and Gila chub eggs are adhesive and would not drift down into areas shown to support rainbow trout during the stocking season. Additionally, naturally reproducing populations of warmwater nonnative species such as green sunfish and smallmouth bass are common in Wet Beaver Creek and Red Tank Draw. These species are known to compete and predate on native fish species. Surveys of Red Tank Draw in 1995 (twice) (Weedman et al 1996), 2005 (Knowles 2005) and 2007 (Rinker 2007c) did not document rainbow trout in Gila chub

occupied or critical habitat, nor have surveys of Wet Beaver Creek documented the presence of Gila chub. Green sunfish and smallmouth bass were found in large numbers in Red Tank Draw in 2007.

Surveys in Walker Creek in 1994 and 1995 (Weedman et al 1996), 1996 (AGFD data) and 2007 (Rinker and Benedict 2007c) also did not detect any nonnative species in occupied or critical habitat in Walker Creek, only native fish species were present. An irrigation diversion in lower portion of Walker Creek just below critical habitat removes most of the water during low flow periods (C. Benedict, pers. comm.).

Exposure to stocked rainbow trout is unlikely to occur in Red Tank Draw because of the existing warm-water nonnative fish assemblage in Red Tank Draw and at its confluence with Wet Beaver Creek. Rainbow trout are not expected to access critical or occupied habitat in the tributaries and would not persist if they entered Red Tank Draw because of warm water temperatures. Fisheries survey data (citations noted above) indicate that Gila chub don't persist outside known occupied areas and stocked rainbow trout are not found within Red Tank Draw or Walker Creek.

Roundtail Chub

Roundtail chub are known from the Verde River beginning below Sullivan Dam and extending down the Verde River past Granite Creek and throughout its entirety to the confluence with the Salt River. Available collection records from the Verde River document roundtail chub occurrence in that vicinity historically up through 1994. Data in that area are lacking since 1994. In Beaver Creek, just downstream from the stocking locality, roundtail chub were documented through 1999. In Wet Beaver Creek near the Ranger Station and in the stocked reach, roundtail chub were collected in 1961 and 1962. Roundtail chub were not reported in HDMS in 1971, 1989 or 2001 when other native fishes were reported. No more recent survey data are available. Roundtail chub are not believed to persist in Wet Beaver Creek due to the abundance of warm-water nonnative fishes, primarily green sunfish and smallmouth bass, occupying the reach from the stocking area downstream to the Verde River confluence. Green sunfish have been documented as having severe impacts to chub species to the point of eliminating their persistence (Dudley and Matter 1996).

Potential impacts

Potential impacts of stocked rainbow trout on roundtail chub could result from the predation on roundtail chub, competition for food or competition for space if stocked rainbow trout move downstream into the Verde River or upstream into areas known to be occupied by roundtail chub. Rainbow trout are primarily insectivorous, but may consume small fish. The significance of the effects of the stocked species is diminished by the fact that they have not been found to persist in Wet Beaver Creek or the Verde River and by the fact that the area proposed for stocking is occupied by several other competing and predatory nonnative species that occur

independent of stocking actions (smallmouth bass, flathead catfish, green sunfish, red shiner, crayfish, bullfrogs, etc.). Roundtail chub have not been captured recently in the reach proposed for rainbow trout stocking, but numerous smallmouth bass and green sunfish have been documented in the reach in the past.

Western Yellow-Billed Cuckoo

Suitable breeding and/or foraging habitat exists within the stocking reach and along the creek. Documented occurrences within the proposed stocking reach and along the creek from 2004-2006 with additional occurrence near the confluence of Wet Beaver and the Verde River. Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site.

Deadhorse Ranch State Park Lagoons

Site Description

Three lagoons are located at Deadhorse Ranch State Park. The park is managed by Arizona State Parks and is located in the town of Cottonwood. The lagoons are approximately one-quarter mile from the Verde River and are above the 100 year floodplain (the 1993 flooding event did not inundate the lake).

Management of water body

Since the mid 1980's, Arizona State Parks (ASP) had planned to expand their fishing and lake recreation opportunities at Deadhorse Ranch State Park (Park). Plans were set in motion in 2002 to build and expand lagoons within the Park to over 20 surface acres. This expansion was completed in 2003. There are now three lagoons within the Park. The lakes are filled using an irrigation ditch from a diversion (Hickey Ditch) on the Verde River that flows through canals and a series of pipes to reach the upper lagoon. There are containment structures that prevent egress of stocked fish out of the lagoons back through the canal to the Verde River. Any outflow occurs over sandy permeable substrates that prevents flowing water and stocked fish, fry, or eggs from reaching the Verde River. Thus, the lakes are closed and isolated waters except with each other.

The upper lagoon is now 3.7 acres. The middle lagoon is 6.4 acres and the lower lagoon is 9.9 acres in size. Each lagoon can be independently filled by ditch or gravity filled from upper to lower ponds. Once filled, the lagoons would be kept at relatively constant levels. A percolation pad is used for outlet water from the lower lagoon. This pad is just east and south of the lower lagoons's outlet. Water drained onto this pad is allowed to naturally percolate into the sandy

substrate. No water from the lagoons is released directly into the Verde River or its tributaries. During large flood events, all water in the ditch supplying the park is shut preventing overflow of the ponds and diverting all water back into the Verde River before it reaches the lakes.

Table 61. Stocking history at Deadhorse State Park

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Black crappie	1980	1980	1	2,000
Bluegill	2006	2006	1	4,727
Channel catfish	1977	2008	21	14,790
Largemouth bass	1987	1988	3	714
Rainbow trout	1985	2008	234	550,935
Redear sunfish	1978	1989	2	6,080
Tadpole	1977	1978	2	2,660
Total			245	539,742

The Verde River Greenway state natural area is also managed by ASP with offices located at Deadhorse Ranch State Park (Park). The most significant natural resource in the Greenway, in addition to the year-round flowing river, is the dense forest of riparian trees and shrubs along its riverbank. This Fremont Cottonwood & Gooding Willow Riparian Gallery Forest is one of five remaining stands in Arizona and one of 20 such stands in the world. This is extensive Cottonwood/willow gallery riparian woodland. The park is an extension of this riparian woodland.

It is estimated that the original lagoon (upper) received over 19,500 angler use days in 2001 (Pringle 2004). An angler use day is defined as any portion of a day that an angler is in the act of fishing. Anglers have historically used the Park heavily in the winter months, typically from November to March. During these months, the Department has stocked roughly 30,000 catchable sized rainbow trout since 1994. In addition, Arizona State Parks and the Prescott National Forest for specific fishing events have stocked warmwater species such as bluegill and channel catfish.

The Regional Fisheries Program with the assistance other Regional Personnel conducted a 13 month roving creel survey from June 1st 2008 – June 30th, 2009. This survey was designed to determine the utilization of stocked fish and angler demographics for the Park. Outlined below are the key findings from this investigation.

- 1,702 people were interviewed with a total of 59,000 angler hours or 36,835 angler use days. An angler use day is defined as any portion of a day that an angler is in the act of fishing.
- An estimated 89,745 fish were caught and 33,134 harvested. Overall, 0.96 fish/hr were caught with a harvest of 0.36 fish /hr. 40,626 fish were stocked into the middle and lower lagoons at the Park during the sampling period, 38,616 trout and 2,010 catfish. Of the trout stocked, 71% were harvested. Fifty-three percent of anglers were successful in catching at least one fish.
- Rainbow trout were the most highly targeted species at 54%. If anglers listed more than one species, they were categorized as targeting anything. This accounted for 22% of the anglers. Catfish was the next highest at 17%.
- Average angler satisfaction with their fishing experience was 4.3 on a scale of 1-5.
- Ninety-six percent of anglers were residents of Arizona. 90% of anglers came from Yavapai County (57%) or Maricopa County (33%).
- The Statewide survey of 2001 Arizona Anglers (Pringle 2004) estimated the annual angler use days to be 19,500 and an annual economic value (direct and indirect) of $2,710,500. We estimate the total number of angler use days to be 36,835 over the 13 month period. If we take into account the difference in the number of months, we still see a 174% increase in angler use days and an increase of $2,015,500 annual economic value.

The fishery at the Park is managed to be an intensive use rainbow trout fishery with high harvest rates (Bovee and Clark 2003) with a secondary warmwater component. Winter trout stocking provides opportunities for local residents, winter tourists and residents, and often special functions (e.g., Boy Scout campouts and AGFD or State Parks outreach events, such as Verde River Days).

These waters are managed similar to an urban park setting with accommodations for intensive use. Extensive facilities including fish cleaning stations, restrooms, parking areas, trails, camping and group sites are available to visitors. A two lane boat ramp is available at the lower lagoon. Boating is restricted to non-motorized rafts, kayaks or canoes only and only on the lower lagoon. No boats are allowed on the middle or upper lagoon. A fishing pier is also available at the lower lagoon. Trails are available around the entire perimeter of both the middle and lower lagoons.

Proposed Action

The Department proposes to stock rainbow trout, largemouth bass, black crappie, channel catfish, bluegill sunfish, and threadfin shad for the period covered by this consultation.

Fingerling, sub-catchable, and catchable rainbow trout would be stocked multiple times from January to March and from November to December annually; total numbers of trout stocked into all three lagoons combined would be from 0 to 300,000 trout annually.

Threadfin shad (any size) would be stocked anytime as needed to augment or recover the fishery following catastrophic events; numbers of shad stocked may be from 0 – 10,000 fish annually.

Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), bluegill sunfish (sub-catchables, catchables), black crappie (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

The Hickey Ditch (ditch) diversion sits just upstream of the larger Cottonwood City Diversion at roughly river mile 49.5 (Figure 79). The Hickey Ditch was destroyed in the flooding February 1993 but was rebuilt by 1998. Flooding in September of 2004 also damaged the ditch and as in 1993, the Park used groundwater to supplement the lagoons until the ditch was repaired. When the ditch is inoperable, the Park does not receive Verde River water. When it is functional, water comes through the Ditch into the upper lagoon via an open canal and then drops several feet over a concrete spillway. No upstream movement of fishes is possible from the upper lagoon back into the ditch. Water then can be released via a screened outlet from the upper lagoon into the middle lagoon. A similar structure allows water to pass from the middle lagoon to the lower lagoon. Water leaving the lower lagoon simply drains into the sandy alluvium and has no surface connection with the Verde River.

Figure 79. Diversions above Deadhorse Ranch State Park.

Figure 80. Intake structure with screened top, middle lagoon at Deadhorse State park.

Fish Movement

No upstream movement of fishes is possible between lagoons, only downstream. Movement of larval and small lifestages of fish is possible in a downstream direction from upper lagoon to lower lagoon within the Park. Adult fishes cannot pass from lagoon to lagoon except by human transport. As referred to above, water discharge leaving the lower lagoon simply drains into the sandy alluvium and has no surface connection with the Verde River.

Community Description

The lagoons currently harbor populations of channel catfish, largemouth bass, black crappie, bluegill sunfish, yellow bullhead and green sunfish as well as rainbow trout on a seasonal basis. Threadfin shad were reportedly present in Deadhorse State Park pond prior to its re-configuration in 2002-2003, although no survey data were available to corroborate this report (A. Clark, pers. comm.). Threadfin shad were not documented during subsequent surveys in 2006-2008. According to Department hatchery records, threadfin shad were previously stocked into Peck's Lake just upstream from the park in 1958 and 1959.

Cattail infestation is an ongoing problem that requires the park to physically cut and remove plants several times per year. Rooted aquatic vegetation is also problematic especially at the lower lagoon. Spiny naiad, curly leave pondweed, and *Chara* are common and necessitate the annual use of aquatic herbicides to ensure open areas for anglers.

Table 62. Number, relative abundance, relative biomass and catch per unit effort by electrofishing at Dead Horse State Park Middle Lagoon July 2006. Effort in minutes.

N= 244			Total Weight= 2631 g		Total effort units = 15	
Common Name	# Sampled	# Measured	% Total	CPUE	Total Wt. (g)	% Total
Black Crappie	1	1	0.41%	0.07	56	2.13%
Largemouth Bass	4	4	1.64%	0.27	696	26.45%
Bluegill	239	239	97.95%	15.93	1879	71.42%

Table 63. Number, relative abundance, relative biomass and catch per unit effort by electrofishing at Dead Horse State Park Lower Lagoon July 2006. Effort in minutes.

N= 328	Total Weight= 11338 g			Total effort units = 17		
Common Name	# Sampled	# Measured	% Total	CPUE	Total Wt. (g)	% Total

Black Crappie	6	6	1.83%	0.35	244	2.15%
Largemouth Bass	14	14	4.27%	0.82	471	4.15%
Bluegill	302	302	92.07%	17.76	5738	50.61%
Channel Catfish	6	6	1.83%	0.35	4885	43.09%

Table 64. Number, relative abundance, relative biomass and catch per unit effort by electrofishing at Dead Horse State Park Middle Lagoon April 2008. Effort in minutes.

N= 133	Total Weight= 7750		Total effort units = 15			
Common Name	# Sampled	# Measured	% Total	CPUE	Total Wt. (g)	% Total
Black Crappie	2	2	1.50%	0.13	243	3.14%
Largemouth Bass	8	8	6.02%	0.53	2938	37.91%
Bluegill	117	117	87.97%	7.80	2575	33.23%
Green Sunfish	4	4	3.01%	0.27	199	2.57%
Channel Catfish	1	1	0.75%	0.07	1606	20.72%
Rainbow Trout	1	1	0.75%	0.07	189	2.44%

Table 65. Number, relative abundance, relative biomass and catch per unit effort by electrofishing at Dead Horse State Park Lower Lagoon April 2008. Effort in minutes.

N= 106		Total Weight= 8073			Total effort units = 15	
Common Name	# Sampled	# Measured	% Total	CPUE	Total Wt. (g)	%Total
Black Crappie	5	5	4.72%	0.33	210	2.60%
Largemouth Bass	8	8	7.55%	0.53	2890	35.80%
Bluegill	70	70	66.04%	4.67	773	9.58%
Channel Catfish	1	1	0.94%	0.07	621	7.69%
Rainbow Trout	21	21	19.81%	1.40	3447	42.70%
Yellow Bullhead	1	1	0.94%	0.07	132	1.64%

Consultation Species or Critical Habitat

Deadhorse Ranch State Park is a closed system. No downstream or upstream movement of stocked fishes is anticipated to occur. Potential impacts to bald eagle and Western yellow-billed cuckoo are discussed below. Chiricahua and northern leopard frogs, Southwestern willow flycatcher and critical habitat, and Western yellow-billed cuckoo (again) are discussed in the Middle Verde complex analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Bald Eagle

Oak Creek Breeding Area is approximately 7.0 miles from Dead Horse Lake and is within the Bald Eagle DPS. The eagles were first observed in 2002 and were last observed 14 April, 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Oak Creek Breeding Area productivity data shows that the nest was successful in 2007 with one nestling found dead below the nest, was successful in 2008, and failed in 2009 when a nestling was found injured on the ground and taken to rehabilitation but was deemed not releasable (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009).

TAPCO Breeding Area is approximately 4.7 miles from Dead Horse Lake and is within the Bald Eagle DPS. The eagles were first observed in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. TAPCO Breeding Area productivity data shows that the nest failed in 2009 (McCarty and Jacobson 2009). Dead Horse Lake does have monofilament bins present.

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Continued stocking of rainbow trout into the middle Verde River may have adverse effects to the bald eagle prey base diversity that is important for the successful fledging of eaglets from this BA. The additive effect of rainbow trout predation on larval suckers to that from existing warm water fish populations is unknown. Alternatively, the benefit of an additional forage species through stocking of rainbow trout is also unknown.

Western Yellow-billed Cuckoo

No occurrences have been documented at or adjacent to the lake; however, suitable breeding and/or foraging habitat exists at or adjacent to the lake. Several occurrences for migratory and breeding birds have been documented along the middle Verde River. Potential impacts are

identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts
There may be some limited amount of habitat degradation and some amount of disturbance from anglers using or creating new trails to access the stocking site.

Mingus Lake
Site Description
Mingus Lake is a 3 acre impoundment sitting atop Mingus Mountain at an elevation of 7,573feet above sea level (Figure 81 and Figure 82). Constructed in the 1920's on the Prescott National Forest to benefit cattle it now mainly serves as a recreational fishery and nature destination for neighboring religious camps. Access by dirt road exists only during summer months. The road is generally closed for the winter due to bad road conditions. The lake is located on Prescott National Forest with private land located nearby. There are no improvements at the lake, but there are campgrounds and picnic/recreation areas nearby.

Figure 81. View of Mingus Lake from dam circa 2002.

Management of Water Body
The lake has historically been managed as a warmwater fishery, infrequently stocked with largemouth bass, smallmouth bass, black crappie, bluegill, channel catfish, and fathead minnow. In August 1996, the lake was re-constructed removing approximately 6,500 cubic yards of sediment material from the basin of the lake. The dam was also repaired and a plastic liner was

installed to prevent bottom seepage. A separate consultation was completed after renovation in 1996 to add rainbow trout to the list of approved species. Although records indicate the warmwater species above were approved for stocking into Mingus, no stockings other than rainbow trout have occurred since the re-construction by the Department. An illegal introduction of yellow bullhead occurred sometime around 2002 and that species has increased in numbers. No formal creel surveys have been done at Mingus Lake. A mail out survey done in 2001 by the Department suggested 4,346 angler use days were expended at Mingus Lake during that year. Stocking history for Mingus Lake is listed in Table 66.

Figure 82. Mingus Lake from dam in June 2009.

Table 66. Stocking History for Mingus Lake.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Rainbow trout	1997	2009	131	68,896
Total			131	68,896

Future management objectives involve providing stock size rainbow trout, bluegill sunfish, and black crappie for anglers to enjoy most months of the year. If consecutive low water years facilitated, the Department would pursue removal of yellow bullhead from the lake by dewatering or chemical means. Once yellow bullheads are removed, a warmwater fishery

component would be pursued using bluegill and black crappie. By establishing a bluegill/crappie fishery, illegal introductions of problematic species such as yellow bullhead may be averted. Rainbow trout stockings would continue seasonally and would not be affected by these activities.

Proposed Action

The Department proposes to stock rainbow trout, bluegill sunfish, and black crappie for the period covered by this consultation.

Catchable rainbow trout would be stocked from April to October annually; numbers of trout stocked may be from 0 to 10,500 fish annually.

Bluegill sunfish (fry/fingerling, sub-catchables, catchables), black crappie (fry/fingerlings, sub-catchables, catchables) may be stocked as needed at any time during the year to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Runoff from the lake follows ephemeral drainages 12 mi through Gaddes and Black Canyons to the confluence with the Verde River. Mingus Lake spills very infrequently due to the small contributing watershed and its position at the very top of that watershed. According to Chris Hill (D. Weedman pers. comm.), manager of the United Methodist Camp just down the road from Mingus Lake, the lake would occasionally fill to over flowing and she has seen water running over the engineered spillway. She reported that overflow events are only in response to heavy winter snowpack that melts and fills the lake slowly. She and her husband Brandon have never seen the lake overflow as a result of summer monsoon storms. Chris stated that the lake levels drop in early summer to the point that the run-off can be captured and stored. The watershed above Mingus Lake is estimated to be roughly 180 acres based on estimates as measured from the USGS topo map.

Fish Movement

It would be possible for fish in Mingus Lake to move downstream out of the lake into drainages leading to the Verde River. This would be very rare as the lake does not maintain high water levels despite the liner installed in 1996. For a spill to occur and fishes to move downstream, the lake would need to be near full and a very large localized storm would have to be centered over the relatively small watershed that feeds the lake. This is possible but far more likely is a localized storm filling the lake and little to now water spilling due to the small drainage contribution area. Extensive steep canyons exist downstream of the lake. These canyons are bedrock dominated or thick with terrestrial vegetation (Figure 83) and provide little habitat for fishes. Since only rainbow trout and yellow bullhead are known from Mingus Lake, and both

these species are either resident or are seasonally stocked into the Verde River, it is impossible to know if these species have moved out of the lake and into the Verde River.

Community Description

The lake maintains self-sustaining populations of yellow bullhead as confirmed by swarms of fry being observed and dip netted. Angler reports of adult yellow bullhead being caught are not uncommon. Rainbow trout are present seasonally as a result of past stocking, and some over-wintering by trout may occur. The lake has not been sampled by net or electrofishing. No angler reports are known of other species being caught or seen in Mingus Lake.

Consultation Species or Critical Habitat

Potential downstream impacts to Chiricahua and northern leopard frogs, Colorado pikeminnow, Gila chub and critical habitat, northern Mexican and narrow-headed gartersnakes, razorback sucker and critical habitat, roundtail chub, spikedace with critical habitat, Southwestern willow flycatcher and critical habitat and Western yellow-billed cuckoo are analyzed within the Middle Verde River complex analysis later in the document.

Figure 83. Channel immediately downstream from Mingus Lake Dam.

Huffer Lake

Site Description

Huffer Lake is a small impoundment (approximately 1.4 acres when full) located on the Coconino National Forest about 15 miles north of Strawberry along Highway 87 at mile marker 282 near the Mogollon Rim. The Lake is fed by annual snowmelt and can achieve maximum depths of 20 to 25 feet when full. Illegally stocked green sunfish inhabited the lake until the summer of 2006 when it completely dried up (G. Fabian pers. comm.). The lake has peak late summer water temperatures of 72°F and pH values in the 8's. Access is walk-in only with small pull off areas on the north and south side of Highway 87. The lake has no other recreational facilities available.

There are several access points to the lake to aid in stocking and angler usage. There is a small turn off on the North side of Highway 87 and a pair of two track roads that travel on either side (East and West) of the lake. The two-track road on the east side of the lake splits and travels right down to the lake for easy stocking access.

Management of Water Body

Prior to 2008 Huffer Lake had not been stocked since 2002. An illegally introduced green sunfish population was present in the lake before it went dry in 2006. The local Wildlife Manager requested that the department start stocking rainbow trout in the lake again when it refilled to provide a recreational fishery and to help reduce the likelihood that someone would illegally reintroduce green sunfish. Primary fishery management is an intensive use, put and take rainbow trout fishery with high harvest rates. Recent management has focused on the stocking of catchable rainbow trout in the spring and summer when water quality is sufficient to support fish. Table 67 provides a summary of historical stocking at Huffer Lake.

Table 67. Stocking history at Huffer Lake

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Rainbow trout	1978	2009	9	4,215
Total			9	4,215

Proposed Action

The Department proposes to stock rainbow for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times annually from April-October; numbers of rainbow trout stocked may be from 0 – 4,000 annually.

Water Distribution / Connectivity

Huffer Lake is the headwaters of Rock Canyon which lies in a drainage that when spilling flows into Clover Creek (A major tributary of West Clear Creek). Clover Creek and Willow Creek join to form West Clear Creek and contain self-sustaining populations of rainbow trout. Huffer Lake would spill mostly in response to winter snow and precipitation events in the spring before the stocking would begin in April. This lake may also spill in response to extreme monsoon rainfall events between July and September. The frequency of spill events cannot be determined with certainty because no discharge or water level measuring devices are present. However, due to the small size of the watershed (about 0.3 mi^2) (Figure 84) Huffer Lake is not expected to spill very frequently, nor for very long during either season.

Figure 84. Approximate watershed area for Huffer Lake.

In the event of flooding outflow from the tank would travel approximately 0.21 miles to Huffer Spring. From Huffer Spring, Pivot Rock Canyon continues approximately 3.96 miles into Toms Creek. Toms Creek Flows for approximately 7.05 miles to Clover Creek, which flows approximately 2.57 miles to the confluence of Clover Creek and Willow Creek to form West Clear Creek. West Clear Creek eventually flows approximately 36.70 miles into the Verde River just south of the town of Camp Verde.

Fish Movement
Fish can move downstream of Huffer Lake via the culvert under Highway 87 eventually to West Clear Creek.

Community Assemblage
No fish surveys have been conducted on Huffer Lake. Rainbow trout are currently stocked in the Lake. Green sunfish have not been reported by anglers since the lake went dry in 2006 and trout stocking resumed in 2008.

West Clear Creek downstream of Huffer Lake has headwater chub, speckled dace, desert sucker, Sonora sucker, self sustaining rainbow trout and self sustaining brown trout populations.

Consultation Species or Critical Habitat
Potential impacts to Chiricahua and northern leopard frogs, headwater chub and Mexican spotted owl are discussed below. Potential downstream impacts to Colorado pikeminnow, Gila chub, northern Mexican and narrow-headed gartersnakes, razorback sucker and critical habitat, roundtail chub, spikedace with critical habitat, Southwestern willow flycatcher and critical habitat and Western yellow-billed cuckoo are analyzed within the Middle Verde River complex analysis later in the document.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua Leopard Frog
Local Analysis: Although Huffer Lake is within the historical range of the Chiricahua leopard frog the likelihood that frogs could be exposed to stocked fish in the buffered stocking complex that includes Huffer Lake is low. There are no historical records for Chiricahua leopard frogs at Huffer Lake; however, there are historical records for frogs from 16 sites within this complex, 14 of which are currently occupied (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.

and HDMS). There have been 731 surveys at 193 sites across the entire Middle Verde complex between 1914 and 2008, the majority of which are in the buffered complex that includes the Huffer Lake (Figure 85, AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS). The Middle Verde complex has been adequately surveyed and it is likely that Chiricahua leopard frogs occupy many stock tanks near the headwaters of Sycamore Canyon. Dispersing fish can swim into West Clear Creek and then move into Verde River but it is very unlikely for stocked fish to swim downstream in the Verde River and upstream in to an intermittent stream in Sycamore Canyon and get into the headwaters where there are occupied frog sites (M. Rinker pers. comm.). Additionally, it is unlikely that frogs would disperse to lower Sycamore Canyon where fish that may have dispersed from the Verde River because it is below the elevational limit of the species (approximately 4,500 feet) (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked at Huffer Lake is low. Stocked fish cannot disperse outside the buffered area and it is not likely for frogs from nearby sites to disperse into lower Sycamore Canyon or the Verde River because the location exceeds the elevational limits of the species and the distance is beyond the distance we expect them to disperse.

Northern Leopard Frog

Local Analysis: Although Huffer Lake is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in Huffer Lake is low. There are no records for northern leopard frogs from Huffer Lake; however, there are historical records for northern leopard frogs from 30 sites within this complex; 26 of which are currently occupied by frogs. There have been 731 surveys at 193 sites across all three buffered stocking complexes in the Middle Verde between 1914 and 2008, the majority of which are in the portion of the buffered stocking complex that includes Huffer Lake (Figure 85, AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS). Susi MacVean (S. MacVean-unpublished data) has surveyed 71 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 25 sites occupied by northern leopard frogs. Additional data (2005-2008) from The Coconino National Forest confirms 25 of 247 surveys were positive for northern leopard frogs (Coconino National Forest unpublished data). Although survey data confirms that northern leopard frogs occupy numerous sites within the buffered stocking complex, there are only historical records for northern leopard frogs near the Huffer Lake stocking site and it is likely they no longer occupy those sites (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS). The Middle Verde complex has been adequately surveyed and northern leopard frogs may occupy the complex that includes Huffer Lake. Fish stocked directly into Huffer Lake cannot disperse to occupied frog sites, nor is it likely for frogs to move into Huffer Lake because the location exceeds the distance a northern leopard frog would likely disperse.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish in Huffer Lake is low. There are no records for northern leopard frogs outside the buffered complex and it is not likely that fish can disperse out of Huffer Lake (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

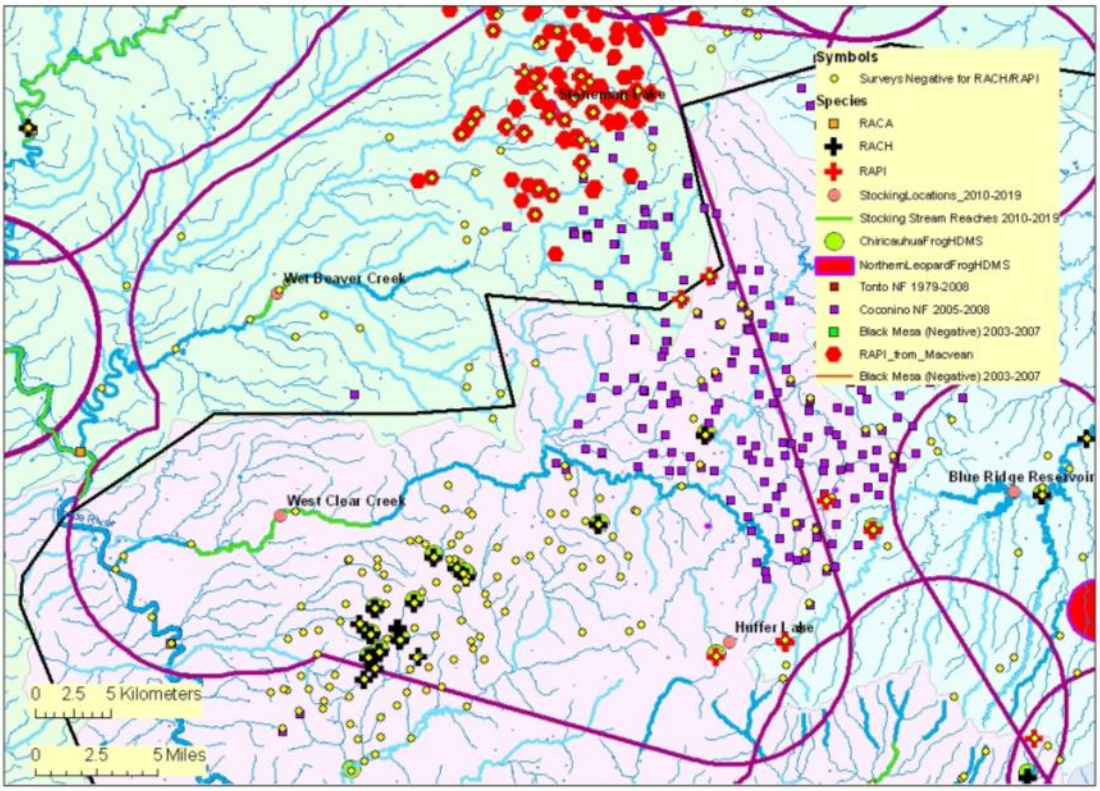

Figure 85. Wet Beaver and West Clear creeks Sub-Complex of Middle Verde buffered stocking complex.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys). NOTE: Stoneman Lake was removed as a proposed stocking location after the analysis and maps were produced.

Headwater Chub

Headwater chub are believed to be the species of chub occupying the upper and middle portions of West Clear Creek (Schwemm 2006), downstream from Huffer Lake. The upstream portions of

West Clear Creek occupied by headwater chub are also occupied by self-sustaining and naturally reproducing populations of rainbow trout and brown trout.

Potential Impacts
Potential impacts to headwater chub could result from the predation on chub by stocked rainbow trout, competition for food or competition for space. Rainbow trout are primarily insectivorous, but may consume small fish, larvae or eggs. For these impacts to occur rainbow trout must escape Huffer Lake; migrate through the ephemeral portions of Toms Creek to Clover Creek and down to the occupied area of the perennial portion of West Clear Creek, a distance of more than 14 miles, where rainbow trout and brown trout are already present and reproducing.

If Huffer Lake stocked fish were transported downstream during a flood, they would not be expected to survive the conditions of transport. There are factors that influence how successfully transport can occur, since water velocities and sediment loads can be quite high which may result in injury or mortality of fish caught in the flows. Fine clay sediments transported with runoff often prohibit fish survival in pools following runoff events. High sediment loads can also result in fish mortality as a result of decreased dissolved oxygen concentrations concurrent with increased suspended sediments (Bozek and Young 1994; Robinson et al. 2004a; Rinne and Carter 2008). During a flood event, there may be safer eddies or shallow waters where fish can ride out the worst; however, depending on the duration of the high flows, these areas may become isolated and not allow further downstream movement.

Mexican Spotted Owl Critical Habitat
This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

<u>West Clear Creek</u>
Site Description

The proposed stocking site is 8.5 miles southeast of the town of Camp Verde and 8.5 river miles upstream of the mainstem Verde River. It is managed as an intensive use trout fishery with a high harvest rate. Approximately 0.5 miles of the creek is stocked at and slightly above Bullpen Campground. The lower reaches below the stocking site and near the Verde River confluence contain water diversions, gravel mines and does not contain suitable habitat for any fish to persist (Voeltz 2002).

West Clear Creek originates on the Mogollon Rim in the Coconino National Forest. The creek flows from east to west into the Verde River approximately three miles south of the town of Camp Verde. Approximately 15-18 miles of the creek is in the West Clear Creek Wilderness Area on the Coconino National Forest. The creek flows through a deep slot canyon with sheer rock cliff's and has many deep long pools.

There are two USFS campgrounds along West Clear Creek, Clear Creek Campground near Hwy 260 and Bullpen Campground about 6 miles upstream. Both provide access to West Clear Creek for recreational activity.

Management of Water Body
The only angler use data for West Clear Creek comes from the 2001 Statewide Angler Survey. According to the results of the mail survey 2,309 coldwater angler use days and 525 warmwater angler use days were estimated for West Clear Creek in 2001 (Pringle, 2004). The creek is managed primarily as an intensive use, put and take rainbow trout fishery with high harvest rates. Secondary fishery is a warm water fishery. Limits were removed on smallmouth bass, channel catfish and flathead catfish in the late 1990's to encourage the removal of undesirable warm-water nonnative fish by anglers to benefit native fish. Rainbow trout are only stocked near the Bullpen Campground.

Table 68. Stocking history in West Clear Creek

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Razorback sucker	1988	1988	1	10,000
Rainbow trout	1981	2008	40	29,474
Total			924	4,584,114

Proposed Action
The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times annually during the spring (March-May) and fall (October-November); numbers of rainbow trout stocked may be from 0 – 6,000 annually.

Water Distribution / Connectivity
The head waters of West Clear Creek begin above the Mogollon Rim near the town of Clints Well. Pivot Rock Creek and Tom's Creek join with Clover Creek (which originates at Clover Springs) and flow into West Clear Creek Canyon west of Clints Well. Clover Creek joins Willow Creek, which originates north of Clints Well, in the canyon to form West Clear Creek. West Clear Creek flows through a steep rocky canyon with large deep pools until it opens into the Verde Valley near the town of Camp Verde at its confluence with the Verde River. All of the canyon reaches of West Clear Creek are perennial but flows are intermittent downstream of Clear Creek Campground where the creek crosses Highway 260, particularly during the summer months. A large waterfall (approximately 50 feet high) is located on the creek approximately 7 miles upstream of the Bullpen stocking site.

Fish Movement
Fish can move freely downstream from the stocking sites to the Verde River when flows are significant enough to make a connection with the Verde River. Fish can also move freely upstream from the stocking sites until they reach the waterfall approximately 7 miles upstream of the Bullpen stocking site.

Community Description
Historically, roundtail chub were believed to be the species of chub occupying West Clear Creek. More recently they have been reconsidered to be headwater chub. Throughout this section, roundtail chub as a name may appear based on historic use of the nomenclature, but the fish are still considered to be headwater chub today.

West Clear Creek continually boasts stable populations of both roundtail chub and nonnative salmonid species. Voeltz (2002) reported "the earliest identified collection of roundtail chubs from West Clear Creek was made in 1937 by Tarzwell, approximately 1 mile above its confluence with the Verde River. Additional collections of roundtail chubs from West Clear Creek were made in 1967, 1970, 1974, 1975, 1977, 1978, 1982, 1983 and 1992. Surveys were roundtail chubs were sampled from West Clear Creek were conducted in 1988, 1992, 1995, 1998, 2000". Voeltz goes on to summarize the results of the surveys conducted for the 2002 project. "Roundtail chubs were common during surveys conducted in summer of 2001 in upper West Clear Creek, upstream of Tramway Trail (C. Benedict, pers. comm.)." Voeltz gives West Clear Creek a status of "Stable – Threatened".

Voeltz summarized past sampling efforts to justify the roundtail chub status in West Clear Creek. Information provided in Minckley and Demarias (2000) indicated the West Clear Creek

population is *Gila robusta*. Brouder et al (2000) found roundtail chubs common during 1998-1999 at Bullpen campground (approximately 16 km upstream of the confluence) on lower West Clear Creek. During this period roundtail chubs were the most abundant species sampled. "The majority of fish collected at the Bullpen Campground site on West Clear Creek from 1998 through 1999 was native species. In 1998 and 1999, roundtail chub comprised 28.6% and 49.7%, respectively." A USFS employee reported catching chubs by hook and line in lower Willow Creek (headwater tributary) in 2001 (C. Benedict pers. comm.) Brouder et al. (2000) found multiple cohorts present during sampling in 1998 and 1999, with no age-0 chubs found during sampling in 1999. In the lower drainage the suitability to support aquatic species may be reduced due to residential development, grazing, and sand and gravel activities on private lands within one mile of the confluence with the Verde River (Girmendonk and Young 1997). Threats include nonnative fishes, crayfish, and water depletion at the extreme lower end of the creek.

Table 69. West Clear Creek Fish Composition 1994-1998 by Site Location. Downstream to Upstream

Species	**Site 2**	**Site 3**	**Campground**	**Site 4**	**Site 5**	**Falls**	**Cash**	**Tramway**
Speckled Dace	22	39	12	74	45		85	425
Sonora Sucker	1	118	13	32	39	1		
Desert Sucker	2	68	62	93	122	43	31	47
Roundtail Chub	30	21	214	104	28	36	25	33
Rainbow Trout				21		16	6	24
Longfin Dace		38		7				
Golden Shiner		15						
Bullhead		11	20	17	14			
Red Shiner		34						
Green Sunfish		4	1	2		3		
Brown Trout							3	4
Smallmouth Bass							8	
Fathead								1

Species	Site 2	Site 3	Campground	Site 4	Site 5	Falls	Cash	Tramway
Minnow								
Bluegill					2			

The results from the 2002 West Clear Creek Tramway Trail sampling data (West Clear Creek 2002b) indicate stable numbers of native fish. Native fish comprised 95.3% of the total catch (mostly speckled dace) with roundtail chub making up only 2.04% (3 individuals). Nonnative salmonids only comprised 2.04% of the total catch. The low numbers of the larger bodied fishes might be attributed to the inefficiency of the backpack electrofishing unit to effectively sample the deep and complex pools found within the reach.

The results from the 2002 West Clear Creek Bullpen Sampling data (West Clear Creek 2002a) indicate stable numbers of desert sucker (with roundtail chub and speckled dace present). Native fish comprised 66.66% of the total catch with desert sucker at 44.44%, roundtail chub at 8.33% (3 individuals), Sonora sucker at 2.78%, and speckled dace at 11.11%. Nonnative fishes comprised the remaining 33.33% with the majority being red shiner at 22% of the total catch. Three bullhead catfish and one green sunfish were collected.

The results from the 2004 West Clear Creek Trip Report (Rinker 2004) indicate stable numbers of both native fish and headwater chubs around Tramway Trail (upstream of the waterfall near the Clover Creek Willow Creek confluence). Native fish comprised 89.14% of the total catch with chubs making up 6.39% (20 individuals) of the total catch. Nonnative salmonids only comprised 0.64% of the total catch. Rinker describes how the low numbers of the larger bodied fishes might be attributed to the inefficiency of the backpack electrofishing unit to effectively sample the deep and complex pools found within the reach. Many chubs were observed in the deeper pools that were not sampled due to their depth.

The results of the 2005 West Clear Creek Trip Report (AGFD 2005) summarize sampling efforts in the lower portion of West Clear Creek near Bullpen Campground. 100% of the fish collected during this survey were nonnative of these 75% were smallmouth bass. Both bullhead catfish and green sunfish comprised the remaining 25%.

The results of the 2008 West Clear Trip Report (Rinker et al 2008) summarize sampling efforts in the lower portion of West Clear Creek from Bullpen Campground upstream approximately 5 miles. Only 27.52% of the fish collected were native desert suckers. The remaining 72.48% were nonnative fish with 42.20% smallmouth bass and 29.36% bullhead catfish. One green sunfish was also collected.

Consultation Species or Critical Habitat

Potential impacts to bald eagle, Chiricahua and northern leopard frogs, headwater chub, Mexican spotted owl, roundtail chub and Western yellow-billed cuckoo are discussed below. Potential downstream impacts to Colorado pikeminnow, Gila chub, northern Mexican and narrow-headed gartersnakes, razorback sucker and critical habitat, spikedace with critical habitat, Southwestern willow flycatcher and critical habitat and Western yellow-billed cuckoo are analyzed within the Middle Verde River complex analysis later in the document.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Bald Eagle

Ladders Breeding Area is approximately 7.6 miles from West Clear Creek and is within the Bald Eagle DPS. Eagles were first observed in 1962 and were last observed 19 May, 2008. Nest watchers were able to observed the prey types and in some cases species that were delivered to the nest by the eagles. In 2008 fish accounted for 40%, mammals 20%, birds 12%, amphibians and reptiles 4%, and unknown 24%. Of the prey items further identified to species, there was one catfish and one sucker. Ladders Breeding Area productivity data shows that the nest was successful in 2007 with one nestling that died in the nest, failed in 2008 when a non-resident, subadult bald eagle entered the nest and took the nestling, and was occupied with the breeding pair exhibiting signs of pre-nesting activity but failed to lay eggs in 2009 (Jacobson et al. 2007, McCarty and Jacobson 2008, 2009). West Clear Creek does not currently have monofilament bins present.

Potential Impacts

Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

Chiricahua Leopard Frog

Local Analysis: West Clear Creek is within the historical range of the Chiricahua leopard frog and the likelihood that frogs could be exposed to stocked fish in this buffered stocking complex is low. There are no historical records for Chiricahua leopard frogs at West Clear Creek; however, there are historical records for frogs from 16 sites within this complex, 14 of which are currently occupied. There have been 731 surveys at 193 sites across the three buffered complexes in the Middle Verde complex between 1914 and 2008, the majority of which are in the buffered stocking complex that includes West Clear Creek (Figure 78, AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS). The Middle Verde complex has been adequately surveyed and it is likely that Chiricahua leopard frogs occupy many stock tanks near the headwaters of Sycamore Canyon. Even during high flows or extreme storm events, it is very unlikely that stocked fish from West Clear Creek would swim downstream in the Verde River and upstream through several large diversion structures (including Pecks Lake diversion, Figure 73) to an intermittent stream in Sycamore Canyon and get into the headwaters where there are occupied frog sites (M. Rinker pers. comm.). Additionally, it is unlikely that frogs would disperse to lower Sycamore Canyon where fish that may have dispersed from the Verde River because it is below the elevational limit of the species (approximately 4,500 feet,) (Sredl 1997).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish in West Clear Creek is low. There are no records for Chiricahua leopard frogs outside the buffered complex where fish from West Clear Creek could disperse and the presence of nonnative fish and crayfish in the Verde River preclude their establishment or persistence there (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

Northern Leopard Frog

Local Analysis: Although West Clear Creek is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in West Clear Creek is low. There are no records for northern leopard frogs from West Clear Creek. There have been 731 surveys at 193 sites across the entire Middle Verde complex between 1914 and 2008, the majority of which were in the buffered stocking complex that includes West Clear Creek. There are historical records for northern leopard frogs from 30 sites within this complex; 26 of which are currently occupied by frogs (Figure 78, AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.). The Middle Verde complex has been adequately surveyed and it is likely that northern leopard frogs occupy the complex that includes West Clear Creek (AGFD Riparian

Herpetofauna Database; M. Sredl pers. comm.; HDMS). Susi MacVean (S. MacVean-unpublished data) has surveyed 71 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, had confirmed 25 sites occupied by northern leopard frogs. Additional data (2005-2008) from the Coconino National Forest confirm 25 of 247 surveys were positive for northern leopard frogs. Although northern leopard frogs occupy numerous sites within the buffered complex, fish stocked directly into West Clear Creek cannot disperse to occupied frog sites due to lack of water connectivity, nor is it likely for frogs to move into the stocked reach of West Clear Creek because it is over 13 miles away and exceeds the distance a northern leopard frog would likely disperse (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish in West Clear Creek is low. There are no records for northern leopard frogs outside the buffered complex where fish from West Clear Creek could disperse and the presence of nonnative fish and crayfish in the Verde River preclude their establishment or persistence there (AGFD Riparian Herpetofauna Database; M. Sredl pers. comm.; HDMS).

Headwater Chub

Headwater chub are believed to be the species of chub occupying the area of West Clear Creek above the waterfall (Schwemm 2006). Chubs in lower portions of West Clear are listed as roundtail chub but may be genetically influenced by headwater chub migrating over the waterfall down West Clear Creek along with roundtail chub migrating upstream out of the Verde River. The reach proposed for stocking of rainbow trout may be occupied by one or both species of chub. It is also occupied by smallmouth bass, yellow bullhead, mosquito fish, red shiner and green sunfish.

Potential Impacts

Potential impacts to chub could result from the predation on small (juvenile) headwater chub, larvae or eggs by stocked rainbow trout, competition for food or competition for space if headwater chub move downstream over the falls into the reach proposed for trout stocking. Rainbow trout are primarily insectivorous, but may consume small fish. Headwater chub do not appear to be very abundant in West Clear Creek in the reach proposed for stocking. This stocking reach is also occupied by several other competing and predatory warmwater nonnative species such as green sunfish, smallmouth bass, bullhead catfish and crayfish that occur independent of stocking actions.

Chance for exposure of headwater chub to rainbow trout stocked in the lower reach of West Clear Creek is limited because known distribution of headwater chub is mostly upstream of the stocked reach and the trout are only stocked seasonally and do not persist through the summer.

The exposure could result if chub move downstream into the stocked reach and into the population of other nonnative fishes.

In addition few trout were found in the sampling data. The results from the 2002 West Clear Creek Tramway Trail sampling data (West Clear Creek 2002b) indicate stable numbers of native fish. Native fish comprised 95.3% of the total catch (mostly speckled dace) with roundtail chub making up only 2.04% (3 individuals). Nonnative salmonids only comprised 2.04% of the total catch. The low numbers of the larger bodied fishes might be attributed to the inefficiency of the backpack electrofishing unit to effectively sample the deep and complex pools found within the reach.

The results from the 2004 West Clear Creek Trip Report (Rinker 2004) indicate stable numbers of both native fish and headwater chubs around Tramway Trail (upstream of the waterfall near the Clover Creek Willow Creek confluence). Native fish comprised 89.14% of the total catch with chubs making up 6.39% (20 individuals) of the total catch. Nonnative salmonids only comprised 0.64% of the total catch. Rinker describes how the low numbers of the larger bodied fishes might be attributed to the inefficiency of the backpack electrofishing unit to effectively sample the deep and complex pools found within the reach. Many chubs were observed in the deeper pools that were not sampled due to their depth.

Roundtail Chub

Headwater chub are believed to be the species of chub occupying upper and middle portions of West Clear Creek (Schwemm 2006) upstream of the waterfall. Chubs in lower portions of West Clear are listed as roundtail chub but may be genetically influenced by headwater chub migrating down West Clear Creek along with roundtail chub migrating upstream out of the Verde River. The reach proposed for stocking of rainbow trout may be occupied by one or both species of chub. It is also occupied by smallmouth bass, yellow bullhead, mosquitofish, red shiner and green sunfish.

Potential Impacts

Potential impacts to roundtail chub could result from the predation on (juvenile) roundtail chub, larvae or eggs by stocked rainbow trout, competition for food or competition for space. Rainbow trout are primarily insectivorous, but may consume small fish. Based on recent survey data, roundtail chub has declined in the reach and do not appear to be very abundant in West Clear Creek in the reach proposed for stocking. This stocking reach is occupied by several other competing and predatory warmwater nonnative species such as green sunfish, smallmouth bass, bullhead catfish and crayfish that occur independent of stocking actions.

Exposure of roundtail chub to stocked species is likely to occur based on the proximity and timing of the stocking action and the known distribution of roundtail chub.

Western Yellow-billed Cuckoo

Suitable breeding and/or foraging habitat exists along the stocking reach and the creek. Western yellow billed cuckoo have been documented at the downstream end of the reach of West Clear Creek proposed for stocking with rainbow trout. In 2004, a documented occurrence in the stocking reach in the area of the campground was recorded with additional occurrences at the confluence with the Verde River 2004 and 2006. Breeding birds were recorded at the West Clear Creek campground. Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential impacts

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site.

Middle Verde River

Site Description

For purposes of this consultation, the middle Verde River is defined as that portion of the Verde River beginning at the Diversion known locally by several different names including Pecks Lake, TAPCO or Brewers Tunnel (river-mile 48.5) and terminating at Childs (river-mile 106.5).

The stocking reach includes approximately 32 miles of river from below Pecks Lake Diversion downstream to near the confluence of West Clear Creek. Land ownership is various National Forests (Prescott, Coconino and Tonto), State Land Department, State Parks, and various private entities. The area includes the communities of Clarkdale, Cottonwood, and Camp Verde. The stocking area is also adjacent to lands of the Yavapai Apache Tribe. There are multiple stocking locations along the reach which were originally chosen for ease of access for both the hatchery vehicles and anglers. The five trout stocking sites in descending order are Tuzigoot Bridge crossing, vicinity of Dead Horse Ranch State Park, vicinity of Cottonwood Riverside Park, Bignotti Beach (Thousand Trails) and the Highway 260 crossing (formerly known as the White Bridge) in Camp Verde.

Management of Water body

The stockings support a high-use winter trout fishery. An intensive creel survey was conducted from 1996 to 2003. Initially harvest rates were estimated to be fairly high at around 60%. However, as creel techniques and analysis became more refined, harvest rates came down and were estimated in the 40% range by 2000. Evaluations of the creel data in 2000 reflected dropping catch rates at certain sites. In addition changes in river flows, and access points due to flooding could greatly influence availability of trout for anglers. Because of this, the Region began reducing the number of trout requested and also cancelled stockings during high runoff events. By 2006, trout stocked had been cut almost in half. In contrast, because of newly created

lagoons, stockings at Deadhorse Ranch State Park increased to supplement the new trout fishing opportunity for the area.

Access is maintained by Arizona State Parks at some points along the Verde River Greenway. Extensive trails, parking areas and signage currently exist throughout the Verde Valley. Canoeing guides and maps also exist to direct recreational boaters, hikers and others on locations to recreate.

The upper and middle Verde River has historically been managed as a self-sustaining warm-water fishery with a seasonal trout stocking program through the Verde Valley. Initial stockings of nonnative sport fish species and support forage species began in the 1940's. A stocking history of the middle Verde River is listed below. The Department began stocking rainbow trout in the middle Verde River in 1989. By 1997, a more comprehensive trout-stocking program had evolved with 30,000 catchable sized trout stocked in 5 different locations. From 1999 to 2001 over 40,000 trout were stocked at these sites. In addition, West Clear Creek, Wet Beaver Creek and lower Oak Creek are also stocked in fall and spring each year. In 1996 because of concerns on how trout may affect spikedace; the Department began tagging trout to be stocked into the middle Verde. Coded wire tags were used in various tagging locations. Research into potential impacts of rainbow trout stocking on spikedace began. All trout were and still are stocked downstream of the Tuzigoot Bridge. Immediately upstream of the Tuzigoot Bridge is a diversion dam that feeds Peck's Lake. The Tuzigoot Diversion or Peck's Lake Diversion Dam is a barrier to upstream fish movement. Studies were done by the Department's Region III fisheries personnel, to monitor upstream movement of stocked rainbow trout, the presence or absence of larval native fish below the Tuzigoot Diversion and creel surveys were performed to monitor the harvest of stocked rainbow trout (Liles 1996, Kubacki 1998). Results from these studies indicated that there was no rainbow trout movement upstream and no larval threatened or endangered native fishes were floating into trout stockings areas during stocking times. The results of intensive creel surveys showed that between 60 to 70% of the stocked rainbow trout were harvested within two weeks of stocking. Stocked rainbow trout have been sampled in the river though July. However data suggest stocked trout do not persist through the end of summer. Temperatures over 75°F regularly occurred after July according to temperature data loggers installed and monitored by United States Forest Service (USFS). Rainbow trout do not persist above their incipient lethal temperature of 75°F (Raleigh et al. 1984). As a result of these studies the Service determined trout stockings would have no effect on spikedace or razorback sucker in the Verde River (Langley 1999). Other information on rainbow trout effects to razorback sucker indicate that stocked rainbow trout can prey upon larval razorback sucker in Lake Mohave (Mueller 1993) and in a laboratory setting (Carpenter and Mueller 2008) as well as on other native fishes in the Gila River (Propst et al 1998).

Table 70. Stocking history in the Middle Verde River

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Colorado Pikeminnow	1988	1992	3	60,005
Northern pike	1968	1968	1	44
Razorback sucker	1987	1994	6	70,107
Total			10	130,156

Table 71. Total numbers of rainbow trout stocked in the Middle Verde River since 1999.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Rainbow trout	40,500	40,501	36,832	30,060	22,631	33,766	13,605	26,640	24,510	21,671

Table 72. Creel Summaries for Middle Verde River trout fishery.

Place*	Creel Days	Num. of Anglers	Anglers/ Day	Hours	Success	Rbt Caught	Rbt/ Hour	Rbt/ angler
1995- 1996 Summary								
1	39	116	2.97	155.53	53	160	1.03	1.38
2	39	80	2.05	109.60	43	180	1.64	2.25
3	39	137	3.51	172.88	66	286	1.65	2.09
4	39	133	3.41	210.68	64	189	0.90	1.42
5	39	253	6.49	388.9	119	342	0.88	1.35
Totals	39	719	18.44	1037.6	345	1157	1.12	1.61
1996- 1997 Summary								
1	58	136	2.34	210.13	43	84	0.40	0.62
2	57	89	1.56	81.57	40	160	1.96	1.80
3	57	96	1.68	80.78	43	149	1.84	1.55
4	57	83	1.46	64.15	19	44	0.69	0.53
5	58	121	2.09	98.77	31	64	0.65	0.53
Totals	57.40	525	9.15	535.40	176	501	0.94	0.95
1997- 1998 Summary								
1	60	120	2	189.17	55	143	0.76	1.19
2	57	42	0.74	56.83	22	80	1.41	1.90

3	57	60	1.05	102.33	25	131	1.28	2.18
4	59	79	1.34	111.50	41	119	1.07	1.51
5	60	147	2.45	170	46	110	0.65	0.75
Totals	58.60	448	7.65	629.83	189	583	0.93	1.30
1998- 1999 Summary								
1	54	92	1.70	133.42	46	120	0.90	1.30
2	52	66	1.27	93.33	35	143	1.53	2.17
3	55	102	1.85	205.83	74	343	1.67	3.36
4	55	129	2.35	252.58	61	194	0.77	1.50
5	55	146	2.65	224.85	50	154	0.68	1.05
Totals	54.20	535	9.87	910.02	266	954	1.05	1.78
1999- 2000 Summary								
1	61	130	2.13	175.08	62	159	0.91	1.22
2	57	47	0.82	89.50	34	177	1.98	3.77
3	58	133	2.29	245.42	69	321	1.31	2.41
4	60	135	2.25	291.33	71	226	0.78	1.67
5	61	107	1.75	125.50	49	138	1.10	1.29
Totals	59.40	552	9.29	926.83	285	1021	1.10	1.85
2000- 2001 Summary								
1	62	111	1.79	146.82	48	107	0.73	0.96
2	61	28	0.46	32.75	16	82	2.50	2.93
3	61	131	2.15	209.83	82	297	1.42	2.27
4	62	121	1.95	155.08	38	125	0.81	1.03
5	61	77	1.26	84.18	14	25	0.30	0.32
6	45	630	14	973.42	353	1277	1.31	2.03
Totals	58	987	17.02	1602.1	551	1913	1.19	1.94

*1=Tuzigoot Bridge, 2= vicinity of Dead Horse Ranch State Park, 3=vicinity of Cottonwood Riverside Park, 3=Bignotti RM86 and 4 =White Bridge Crossing (Hwy 260) below Camp Verde. Site 6 was added in 2001 as creel data collection began at Deadhorse Ranch State Park lagoon.

Though the Verde River is an extremely important resource for native aquatic species conservation, human occupation and development within this reach (diversions, groundwater pumping, housing and business development etc.) dictate it is best managed as a recreational fishery using existing nonnative and native sport fish. This reach would be critical in balancing the dual Department mandate to enhance and conserve both native aquatic species as well as enhance and conserve sport fishing in Arizona.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times from November to March annually; numbers of trout stocked may be from 0 to 30,000 fish annually.

Water Distribution / Connectivity
This reach harbors several significant water diversion structures in the river channel that form barriers to upstream fish movement. These barriers are flow dependant but in low water times, are complete barriers to movement and remove nearly all surface flow from the main channel. The first of these is the Cottonwood Diversion at river mile 50.2. The next complete barrier during low water is Woods Ditch at river mile 71.6. Various other diversions exist in this stretch of the Verde but none prevent downstream movement of fishes in all life stages. Several main tributaries contribute to the Verde in this stretch including Wet Beaver Creek, Oak Creek, and West Clear Creek. No known barriers exist on these that would prevent upstream movement of fishes out of the Verde River and into the tributary.

Fish Movement
Refer to previous discussion above in the Water Distribution / Connectivity.

Community Description
The middle Verde River from the Peck's diversion to Beasley Flats has been sampled every 3 years since 2003. The stretch of the middle Verde from Beasley Flats to Childs had been sampled by the Region VI Fisheries Program prior to the year 2000 (Table 73, Table 74 and Table 75) (Jahrke and Clark 1999). The Region III Fisheries Program has surveyed that stretch in 2002, 2006 and 2009 (Table 76 and Table 77). Results from those surveys indicate this reach of river supports populations of desert sucker, Sonora sucker, roundtail chub, longfin dace, smallmouth bass, green sunfish, yellow bullhead, channel catfish, common carp, red shiner, bluegill, flathead catfish and largemouth bass. Other data are available in the AGFD Native Fish database, which adds the following species to the historic collections: rock bass, mosquitofish and Colorado pikeminnow. Black and white crappie were known from lakes in the watershed throughout the mid-late 1900's (Peck's, Watson and Bartlett lakes) but were not collected from the river. Northern Pike are also locally known to occur in Peck's Lake though no samples have confirmed pike presence.

The Region III Fisheries Program with assistance from Region VI, Prescott National Forest, local Wildlife Manager and Regional Law Enforcement Program Manager surveyed the Verde River from Beasley Flat to the Childs Power plant by electrofishing in May 2002. A Smith-Root 5.0 GPP mounted in a canoe was used to sample fishes in available habitats for 16.9 miles of stream. Eight sampling efforts were done in an average of one per every two miles of river. 203.13 minutes of effort were expended to sample 363 fishes of 13 species. This resulted in a catch per unit effort (CPUE) of 1.788 fish per minute. Unusually low base flow in the river (100 cfs @ Chasm Creek Gage) that year resulted in a reduced number of sample efforts. Notable

results were the collections of Colorado pikeminnow below Beasley Flat and razorback sucker just upstream of the former Childs Power plant. All were of sizes stocked the previous winter. Also worth noting was the apparent, continued abundance of desert and Sonora sucker (adults), and the lack of large flathead catfish. The following is a breakdown of relative abundance and percent of sample by species: largemouth bass 103 (28%), red shiner 54 (15%), flathead catfish 46 (13%), green sunfish 40 (11%), smallmouth bass 37 (10%), Sonora sucker 33 (9%), desert sucker 19 (5%), channel catfish 16 (4%), Colorado pikeminnow 6 (2%), razorback sucker 3 (1%), bluegill 3 (1%), roundtail chub 1 (.5%), common carp 1 (.5%). Numbers reported are from fish measured or enumerated by the survey crew. Common carp were neither netted or measured and were far more numerous than these numbers suggests. A more extensive data examination and summary is currently in progress. Data from other surveys in the middle Verde River can be found in Table 76.

Table 73. Summary of Region VI electrofishing data from the Verde River, Beasley Flat to Childs reach, 1997-1998.

Parentheses indicate relative abundance as a percent of total. Brackets indicate CPUE reported as fish per minute.

SPECIES	**1997 [440.7 minutes]**	**1998 [134.2 minutes]**
razorback sucker	3 (0.7) [07]	-
Colorado pikeminnow	6 (1.4) [0.01]	2 (0.7) [0.01]
desert sucker	3 (0.7) [0.07]	12 (6.6) [0.09]
Sonoran sucker	107 (25.7) [0.2]	47 (30.0) [0.4]
roundtail chub	7 (1.7) [0.02]	2 (1.1) [0.01]
largemouth bass	12 (2.8) [0.03]	13 (7.3) [0.1]
smallmouth bass	8 (1.9) [0.02]	14 (7.7) [0.1]
channel catfish	54 (13.0) [0.1]	12 (6.6) [0.09]
flathead catfish	36 (8.7) [0.08]	14 (7.7) [0.1]
carp	150 (36.2) [0.3]	58 (32.0) [0.4]
green sunfish	29 (7.0) [0.07]	6 (3.3) [0.05]
yellow bullhead	1 (0.2) [02]	-
walleye	-	2 (0.7) [0.01]
TOTAL	416 [0.9 fish/minute]	181 [1.3 fish/minute]

Table 74. Summary of Region VI trammel and gill netting data from the Verde River, Beasley Flat to Childs reach, 1997-1998.

Parentheses indicate relative abundance. Brackets indicate CPUE. A net unit (nu) is defined as a single net regardless of type or size deployed for 12 hours.

SPECIES	1997 [14.8 nu]	1998 [1.7 nu]
Sonoran sucker	2 (9.1) [0.1]	2 (33.3) [1.2]
smallmouth bass	4 (18.2) [0.3]	-
channel catfish	4 (18.2) [0.3]	1 (16.7) [0.6]
flathead catfish	8 (36.3) [0.5]	3 (50.0) [1.8]
carp	4 (18.2) [0.3]	
TOTAL	22 [1.5 fish/nu]	6 [3.5 fish/nu]

Table 75. Summary of Region VI seining data from the Verde River, Beasley Flat to Childs reach, 1997-1998. Parentheses indicate relative abundance. Brackets indicate CPUE.

SPECIES	1997 [202.6 M^2]	1998 [930.2 M^2]
desert sucker	7 (0.7) [0.03]	-
Sonoran sucker	7 (0.7) [0.03]	-
roundtail chub	3 (0.3) [0.01]	-
longfin dace	1 (0.1) [05]	-
largemouth bass	120 (11.6) [0.6]	4 (0.4) [04]
smallmouth bass	12 (1.2) [0.06]	1 (0.1) [01]
carp	-	1 (0.1) [01]
green sunfish	2 (0.2) [0.01]	6 (0.6) [06]
red shiner	768 (73.6) [3.8]	1,004 (97.9) [1.1]
mosquitofish	120 (11.6) [0.6]	9 (0.9) [0.01]
TOTAL	1,033 [5.1 fish/M^2]	1,025 [1.1 fish/M^2]

Table 76. Region III electrofishing data from Middle Verde River 1998-2009, including species and total numbers sampled by year.

Years prior to 2000 do not include the stretch from Beasley Flat to Childs.

Species	1998	2000	2002	2003	2004	2006	2009	Totals
yellow bullhead		1		4	11	13	10	39
rock bass						1	15	
Sonoran sucker	268	178	33	36	19	86	73	693
sucker hybrid				107				107
carp	71	478	1	8	23	145	86	812

Species	1998	2000	2002	2003	2004	2006	2009	Totals
red shiner	182	35	44	470	481	461	1095	2768
mosquitofish					5	5		10
channel catfish	3	22	16	1	14		24	80
green sunfish	4	24	37	27	87	61	63	303
bluegill		3	3	7		15	42	70
largemouth bass	27	44	91	198		208	191	759
rainbow trout		1		3			1	5
desert sucker	175	98	19	39	25	138	51	545
flathead catfish	11	177	44	10	10	15	17	284
razorback sucker		8	10			1		19
Totals	741	1069	298	910	675	1149	1668	6494

Table 77. Region III seine netting from the Middle Verde River 2003-2009, including species and total numbers sampled by year.

Species	2003	2006	2009	Totals
yellow bullhead			3	3
Sonoran sucker			1	1
hybrid sucker	106			106
carp	1			1
red shiner	56	34	650	740
mosquitofish	57	312	44	413
roundtail chub	8		8	16
green sunfish		1		1
bluegill			15	15
smallmouth bass			1	1
largemouth bass	133	18	3	154
desert sucker			8	8
Totals	361	365	733	1459

Consultation Species or Critical Habitat

Bald Eagle

Oak Creek Breeding Area is approximately 1.0 miles from Verde River Middle and is within the Bald Eagle DPS. The eagles were first observed in 2002 and were last observed 14 April, 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Oak Creek Breeding Area productivity data shows that the nest was successful in 2007

with one nestling found dead below the nest, was successful in 2008, and failed in 2009 when a nestling was found injured on the ground and taken to rehabilitation but was deemed not releasable (Jacobson et al. 2007, McCarty and Jacobson 2008, 2009).

Beaver Breeding Area is approximately 0.13 miles from the Verde River Middle and is within the Bald Eagle DPS. The eagles were first observed at the breeding area in 2006 and were last observed at the breeding area in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Beaver Breeding Area productivity data shows that the nest was successful in 2006, 2007, 2008, and 2009 (Jacobson et al 2006, 2007; McCarty and Jacobson 2008, 2009).

TAPCO Breeding Area is approximately 2.6 miles from the Verde River Middle and is within the Bald Eagle DPS. The eagles were first observed in 2009. Nest watchers have not been monitoring the breeding area so the prey base specifics are largely unknown. Tapco Breeding Area productivity data shows that the nest failed in 2009 (McCarty and Jacobson 2009). The Verde River Middle does not currently have monofilament bins present.

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site.

Continued stocking of rainbow trout into the middle Verde River may have adverse effects to the bald eagle prey base diversity that is important for the successful fledging of eaglets from this BA. The additive effect of rainbow trout predation on larval suckers to that from existing warm water fish populations is unknown. Alternatively, the benefit of an additional forage species through stocking of rainbow trout is also unknown.

Non-breeding bald eagles can occur within the vicinity of the stocking site and may be present at any time of the year. The amount of human disturbance at this site may result in effects to roosting or foraging that may affect the eagles' use of the site. Non-breeding eagles normally move between available sites so the reduction in use of a particular stocking site may not be significant.

MIDDLE VERDE SUB-WATERSHED ANALYSIS

Water Distribution / Connectivity
The major perennial streams contributing to the middle Verde River include: Verde River, Sycamore, Oak and Beaver Creeks. Hell Canyon is a major ephemeral stream with other smaller ephemeral washes that also feed into the middle Verde River. Described below is a summary of connectivity between all of the proposed stocking sites (with exception of Stoneman as it is a

closed system) with the middle Verde River. Refer to the individual sections for detailed information.
Oak Creek has permanent flow from its beginning near Sterling Springs Hatchery downstream to its confluence with the Verde River downstream of the town of Cornville.

Wet Beaver Creek flows downstream to the area near McGuireville where it joins Dry Beaver Creek to form Beaver Creek which flows to the Verde River thru Camp Verde. Beaver Creek is usually dry during the summer because of water diversions in the Camp Verde area.

Deadhorse Lake receives water from the middle Verde River when the Hickey Ditch is operable and the water is used for the upper lagoon through a canal with large drop and concrete spillway.

Runoff from Mingus Lake follows ephemeral drainages 12 miles through Gaddes and Black Canyons to the confluence with the Verde River.

Huffer Lake spill flows into Clover Creek (A major tributary of West Clear Creek).

West Clear Creek flows through a steep rocky canyon with large deep pools until it opens into the Verde Valley near the town of Camp Verde at its confluence with the Verde River.

Fish Movement
The potential impacts of stocking rainbow trout into the middle Verde River are similar to, and cannot with certainty be separated from, the potential impacts of stocking rainbow trout in Oak Creek, Wet Beaver Creek, Mingus Lake, Huffer Lake or West Clear Creek. However, the potential for the impacts to occur are more certain for the stocking action into the middle Verde River as compared to the other stocking sites. The probability of transport of rainbow trout out of the other stocking sites cannot be accurately determined, but is expected to occur at a much lower frequency, with a lower magnitude and for a shorter duration than the occurrence of rainbow trout in the middle Verde River resulting from their direct stocking there. Stocking of fish species other than trout in this complex are not expected to access the mainstem of the Verde River because they are all closed systems.

Middle Verde reach harbors several significant water diversion structures in the river channel that form barriers (Cottonwood diversion and Woods Ditch) to upstream fish movement. These barriers are flow dependant but in low water times, are complete barriers to movement and remove nearly all surface flow from the main channel. Various other diversions exist in this stretch of the Verde but none prevent downstream movement of fishes in all life stages.

In Oak Creek, fish can move freely throughout the system with a low flow natural barrier to potentially prevent upstream migration present at Grasshopper Point (refer to previous discussion within Oak Creek).

In Wet Beaver Creek, Fish can move freely throughout the system with small diversion on Walker Creek that appears to be an effective fish barrier to upstream movement since no nonnative fish have been caught during surveys in Walker Creek above the diversion (refer to previous discussion within Wet Beaver Creek).

Deadhorse Lake has no upstream movement of fishes between lagoons, only downstream movement of larval and small lifestages of fish is possible from upper lagoon to lower lagoon within the Park.

It would be possible for fish in Mingus Lake to move downstream out of the lake into drainages leading to the Verde River; however, this would be very rare as the lake does not maintain high water levels despite the liner installed in 1996 (refer to previous discussion for Deadhorse Lake).

Fish can move downstream of Huffer Lake via the culvert under Highway 87 eventually to West Clear Creek (refer to previous discussion for Huffer Lake).

In West Clear Creek, fish can move freely downstream to the Verde River, when flows are significant enough to make a connection. Additionally, fish can also move freely upstream from until they reach the waterfall approximately 7 miles upstream of the Bullpen stocking site (refer to previous discussion within West Clear Creek).

Community Description

The reach of the middle Verde River supports populations of desert sucker, Sonora sucker, roundtail chub, longfin dace, smallmouth bass, green sunfish, yellow bullhead, channel catfish, common carp, red shiner, bluegill, flathead catfish and largemouth bass. Other data are available in the AGFD Native Fish database, which adds the following species to the historic collections: rock bass, mosquitofish and Colorado pikeminnow. Black and white crappie were known from lakes in the watershed throughout the mid-late 1900's (Peck's, Watson and Bartlett lakes) but were not collected from the river. Northern Pike are also locally known to occur in Peck's Lake though no samples have confirmed pike presence. Threadfin shad have been documented from the Verde River downstream of this reach, but no records exist for their presence in the watershed upstream of the East Verde confluence. Refer to the previous discussion for the middle Verde River for detailed information and survey results.

Consultation Species or Critical Habitat

Potential impacts to Chiricahua and northern leopard frogs, Colorado pikeminnow, Gila chub and critical habitat, headwater chub, northern Mexican and narrow-headed gartersnakes, razorback sucker and critical habitat, roundtail chub Southwestern willow flycatcher and critical habitat, spikedace with critical habitat and Western yellow-billed cuckoo are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. The potential impacts from Mingus Lake, Wet Beaver Creek, Deadhorse Ranch State Park Lagoons and the Middle Verde River discussed below. Refer to Oak Creek Stoneman, Huffer Lake and West Clear Creek for site specific analysis.

Northern Mexican and narrow-headed gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Western Yellow-Billed Cuckoo

Several documented occurrences for cuckoo's are along the middle Verde River and entire Verde River Valley and its tributary streams from the headwaters to Horseshoe Lake. Several occurrences for migratory and breeding birds have been documented along the middle Verde River. Several occurrence records exist at Tavasci Marsh, Peck's Lake and along the Verde River, about 1 mile to the northwest of the lake. Suitable nesting habitat may exist in riparian gallery forests along the Verde River throughout this reach. Breeding birds have been documented near the confluence at Oak Creek and West Clear Creek with the Verde River. Cuckoos arrive on breeding grounds beginning in June; the earliest egg reported in Arizona is June 15. Nesting activity continues through August and frequently into September (Corman and Magill (2000). They also documented nests in four different tree species: Salt Cedar *Tamarix spp.*, Arizona alder, Fremont cottonwood, and Goodding willow. Nest heights varied between 2.5 – 12.2 m with a mean of 5.2 m. Nest height data indicates that cuckoos use vegetation taller and older.

Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts

Exposure between anglers pursuing the stocked rainbow trout and cuckoos may occur at some point over the life of this consultation. However, these interactions are not expected to result often because of the timing of the arrival of cuckoos in late May and the cessation of trout stocking by March 31.

There may be some limited amount of habitat degradation and some amount of disturbance to nesting from anglers using or creating new trails to access the stocking site. Please refer to site specific analysis for identification of habitat and/or disturbance impacts.

Potential impacts to migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance.

Southwestern Willow Flycatcher and Critical Habitat

The middle Verde River reach occurs within designated critical habitat and a documented occurrence in 2004 was recorded downstream within the stocked reach near the confluence at Gaddis Wash and upstream in the stocking reach from 1993-95-96, 1.5 miles upstream of Deadhorse Lake. An occurrence was also documented along the Verde River near Gaddis Wash. Deadhorse Lake and the middle Verde River reach are within designated critical habitat for the flycatcher.

Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts

The primary stocking and angling actions in the Verde Valley would primarily overlap the time when breeding flycatchers are on their wintering grounds in central and northern South America. This time frame would also occur when tree species that flycatchers rely upon are mostly dormant. However, there is some warm water fish stocking at Dead Horse State Park during the flycatcher's breeding season.

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site.

Impacts to migrant willow flycatchers can occur statewide and are most frequently found along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where willow flycatchers could not occur. Additionally, the habitat requirements for migrant flycatchers are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance. In fact as noted before migrating passerines typically remain at one

location for only one to three days before continuing their journey to breeding or wintering grounds (Carlisle et al. 2009).

Critical Habitat
Similar to areas where suitable nesting habitat occurs, critical habitat occurs within the action area along the Verde River in the middle Verde Valley. However, because of specific methodology used to designate critical habitat, it does not mirror all the locations where suitable nesting habitat is found or where all territories have been located.

There may be some limited amount of habitat degradation from anglers using or creating new trails to access the stocking site.

Chiricahua Leopard Frog
Local Analysis: Mingus Lake, Wet Beaver Creek, Deadhorse Ranch State Park Lagoons and the Middle Verde River are not within the historical range of the Chiricahua leopard frog and there are no records for frogs at the Lakes, reaches or within the buffered complex (Figure 78 and Figure 85; AGFD Riparian Herpetofauna Database; M.Sredl, pers. comm.). Refer to Oak Creek, Huffer Lake and West Clear Creek for local analysis.

Broad Scale Analysis: Mingus Lake, Wet Beaver Creek, Deadhorse Ranch State Park Lagoons Middle and the middle Verde River are not within the range for the Chiricahua leopard frog and there are no records of frogs in areas where frogs can disperse (AGFD Riparian Herpetofauna Database; M.Sredl, pers. comm.). Refer to Oak Creek, Stoneman, Huffer Lake and West Clear Creek for broad scale analysis.

Northern Leopard Frog
Local Analysis: Mingus Lake, Wet Beaver Creek, Deadhorse Ranch State Park Lagoons and the Middle Verde River are not within the historical range of the northern leopard frog and there are no historical or recent records for frogs at the Lakes, reaches or within the buffered complex (Figure 78 and Figure 85; AGFD Riparian Herpetofauna Database; M.Sredl, pers. comm.). Refer to Oak Creek, Stoneman, Huffer Lake and West Clear Creek for local analysis.

Broad Scale Analysis: Mingus Lake, Wet Beaver Creek, Deadhorse Ranch State Park Lagoons and the Middle Verde River are not within the range for the northern leopard frog and there are no records of frogs in areas where frogs can disperse (AGFD Riparian Herpetofauna Database; M.Sredl, pers. comm.). Refer to Oak Creek, Stoneman, Huffer Lake and West Clear Creek for broad scale analysis.

Northern Mexican Gartersnake
Stocking complex analysis: Northern Mexican gartersnakes occupy the Middle Verde River buffered stocking complex, much of which lies within the current and historical range of the

species. In addition to recent northern Mexican gartersnake records from Oak Creek near the Page Springs and Bubbling Ponds state fish hatcheries, there are recent records of gartersnakes from the Middle Verde River near Dead Horse Ranch State Park. Northern Mexican gartersnakes are not known from Stoneman, Mingus, or Huffer Lakes, which likely lie outside the historical range of the species.

Northern Mexican gartersnakes have been documented within and downstream of the Oak Creek stocking reach and they are likely to be exposed to stocked rainbow trout (HDMS, AGFD Riparian Herpetofauna Database, V. Boyarski pers. comm.). Currently, northern Mexican gartersnakes are primarily found in and around the Page Springs and Bubbling Ponds state fish hatcheries with records from 1950, 1985-86, 2004, and 2007-09 (Rosen and Schwalbe 1988, Holycross et al. 2006, V. Boyarski pers. comm.). A 1975 record along Oak Creek near Midgley Bridge indicates that they once occurred farther upstream and potentially as far upstream as Manzanita Campground where an unvouchered observation was reported as recently as 1992 (Holycross et al. 2006, HDMS). Northern Mexican gartersnakes have also been observed downstream of the Oak Creek stocking reach. There are unvouchered, though reliable, records from Spring Creek which joins Oak Creek downstream of Page Springs and Bubbling Ponds fish hatcheries (Holycross et al. 2006). In addition to the community of nonnative fishes that persist along Oak Creek, bullfrogs and crayfish are also present (V. Boyarski pers. comm.).

Northern Mexican gartersnakes are not known to occupy Stoneman Lake or the surrounding area. The nearest gartersnake records are from Page Springs and Bubbling Ponds state fish hatcheries along Oak Creek and the Middle Verde River, both of which are >20 air miles away. Stoneman Lake is a closed basin and stocked yellow perch, bluegill, and redear sunfish would not be able to disperse downstream. Therefore, northern Mexican gartersnakes would not be exposed to fish stocked into Stoneman Lake.

There are no northern Mexican gartersnake records from Wet Beaver Creek or any of its tributaries, though the area has not been systematically surveyed for gartersnakes. Northern Mexican gartersnakes likely do not occupy the Wet Beaver Creek stocking reach, though they persist in the Verde River with a recent (2003) record near Camp Verde (HDMS). Northern Mexican gartersnakes persist in low numbers within the Middle Verde River, thus, the likelihood that gartersnakes would disperse from the Verde River into Wet Beaver Creek and encounter stocked rainbow trout is low. Additionally, the likelihood that stocked rainbow trout that disperse downstream would encounter northern Mexican gartersnakes is low because the snakes persist at low densities. Holycross et al. (2006) suggest that Wet Beaver Creek may provide suitable habitat for northern Mexican gartersnakes, however, a nonnative fish community, including spiny-rayed fishes, is present, thus making the habitat less suitable.

Northern Mexican gartersnakes occupy Dead Horse Ranch State Park and the neighboring Middle Verde River and gartersnakes would likely be exposed to rainbow trout, largemouth bass, black crappie, channel catfish, bluegill, and threadfin shad stocked into the State Park's lagoons (HDMS, AGFD Riparian Herpetofauna Database, V. Boyarski pers. comm.). In 2003, a northern Mexican gartersnake was observed from the Verde River immediately adjacent to Dead Horse Ranch State Park (Holycross et al. 2006, HDMS), and in 2004 in the park. The species has been observed above Tapco in 1987 (Holycross et al. 2006, HDMS), and along the Verde River near Cottonwood, approximately 3 river miles downstream of Pecks Lake in 2003 and 2004. The presence of crayfish and a community of nonnative fish, including spiny-rayed fishes, within the Verde River make the habitat less suitable for northern Mexican gartersnakes, but the species appears to persist in the Verde River below Clarkdale, at least in low numbers (Holycross et al. 2006, USFWS 2008, HDMS). Even though there is no surface water connection to the Verde River and stocked fish would not be able to disperse out of the lagoons, northern Mexican gartersnakes would be exposed to stocked fish because the snakes can move into the stocking sites.

Northern Mexican gartersnakes are not known to occupy Mingus Lake. Though there are records for the species along the Verde River near Dead Horse Ranch State Park, approximately 12 miles away through ephemeral drainages, northern Mexican gartersnakes are unlikely to disperse to the high elevation lake, which is considered outside its historical range in Arizona. If the lake spills, which occurs infrequently, northern Mexican gartersnakes within the Verde River are likely to be exposed to dispersing stocked rainbow trout, bluegill, and black crappie.

Northern Mexican gartersnakes are not known to occupy Huffer Lake or the surrounding area, nor is the high elevation habitat in and around the lake appropriate (Holycross et al. 2006). There is a single, possibly misidentified, northern Mexican gartersnake record (1970) from upper Willow Creek, a tributary to West Clear Creek, approximately 12 air miles from Huffer Lake (HDMS). Most of upper West Clear Creek and its tributaries, Tom's and Clover creeks, are deeply incised canyon habitat unsuitable for northern Mexican gartersnakes. There are no substantiated northern Mexican gartersnake records from West Clear Creek, although they occur in the Verde River. Therefore, even though stocked rainbow trout might disperse through the nearly 14 river miles to reach West Clear Creek if Huffer Lake spills, northern Mexican gartersnakes are not likely to be exposed to stocked fish escaping from Huffer Lake.

Northern Mexican gartersnakes do not likely occupy the West Clear Creek stocking reach, though they persist in the Verde River. Aside from the possibly misidentified gartersnake record listed above, there are no substantiated northern Mexican gartersnake records from West Clear Creek (HDMS). There is also a (*ca*. 1984) gartersnake record along the Verde River near the confluence with West Clear Creek (HDMS). There are no other northern Mexican gartersnake records from West Clear Creek or the proposed stocking reach, though no recent systematic

surveys for gartersnakes have been conducted in this area. Northern Mexican gartersnakes persist in low numbers within the Middle Verde River, thus, the likelihood that gartersnakes would disperse from the Verde River into West Clear Creek and encounter stocked rainbow trout is low. Additionally, the likelihood that stocked rainbow trout that disperse upstream or downstream would encounter northern Mexican gartersnakes is low because the snakes persist at low densities or do not occur (i.e., upstream). The presence of a nonnative fish community, including spiny-rayed fishes, makes the habitat along West Clear Creek less suitable for the species.

Northern Mexican gartersnakes occupy the Middle Verde River stocking reach and have been observed near Cottonwood, approx. 3 river miles downstream of Pecks Lake in 2003 and 2004, at Dead Horse Ranch State Park in 2004, and from the Verde River immediately adjacent to the park in 2003 (Holycross et al. 2006, HDMS). In 2003, a northern Mexican gartersnake was observed near Camp Verde, approx. 25 river miles downstream of Pecks Lake (HDMS). An extant population persists along Oak Creek, a tributary to the Verde River, at Page Springs and Bubbling Ponds fish hatcheries and gartersnakes may disperse downstream to the stocking reach. Additionally, there are 3 historical (1954-1986) northern Mexican gartersnake records downstream of the lower end of the stocking reach on the Verde River between West Clear Creek and the East Verde River (HDMS, Rosen and Schwalbe 1988). The presence of crayfish and a community of nonnative fish, including spiny-rayed fish, within the Verde River make the habitat less suitable for northern Mexican gartersnakes, but the species appears to persist in the Verde River below Clarkdale, at least in low numbers (Holycross et al. 2006; HDMS). Therefore, northern Mexican gartersnakes would be exposed to stocked fish because the snakes occupy the Middle Verde River.

Downstream analysis:
Northern Mexican gartersnakes occupy the Middle and Lower Verde River, which lies within the current and historical range of the species, although likely in low numbers (Holycross et al. 2006, HDMS). Downstream of the Middle Verde River buffered stocking complex, there are two unvouchered, though reliable, northern Mexican gartersnake observations. In 1986, a northern Mexican gartersnake was observed at the confluence of the East Verde and Verde Rivers and another at Horse Creek, north of Horseshoe Reservoir (Rosen and Schwalbe 1988, HDMS). The likelihood that northern Mexican gartersnakes downstream of the Middle Verde River buffered stocking complex would be exposed to stocked sport fish dispersing from the Oak Creek, Wet Beaver Creek, West Clear Creek and Middle Verde River stocking reaches, and Mingus and Huffer Lakes is low because gartersnakes persist in low numbers. Stoneman Lake is a closed basin and fish cannot escape. (See methods for discussion of habitat.)

Narrow-headed Gartersnake

Stocking complex analysis: Narrow-headed gartersnakes occupy the Middle Verde River stocking complex, though in most locations they persist in low numbers. Narrow-headed gartersnakes are found throughout Oak Creek Canyon above Sedona, however, they are not known from Stoneman, Mingus, or Huffer Lakes, which do not provide suitable habitat for the species.

Narrow-headed gartersnakes have been documented within and upstream of the Oak Creek stocking reach and they would be exposed to stocked rainbow trout (HDMS, AGFD Riparian Herpetofauna Database, V. Boyarski pers. comm.). Most of the observations (>80%) for this species have been documented from Oak Creek. There are historical and current narrow-headed gartersnake records along Oak Creek from above Sterling Springs state fish hatchery and the upper end of the stocking reach near Cave Springs Campground downstream to the Midgley Bridge area and the West Fork tributary to Oak Creek (Nowak and Santana-Bendix 2002, Brennan and Rosen 2009, HDMS, AGFD Riparian Herpetofauna Database). Historically, narrow-headed gartersnakes likely occupied all of Oak Creek, but habitat has been made less suitable by introduced fishes and crayfish. During surveys from 1999-2001, Nowak and Santana-Bendix (2002) did not find narrow-headed gartersnakes downstream of Oak Creek Canyon, though prior records and unvouchered (but reliable) observations exist from those areas. There are historical (1954, 1957) narrow-headed gartersnake observations from Oak Creek at Chavez Crossing in Sedona (Schwalbe and Rosen 1988). Nowak and Santana-Bendix (2002) also summarized additional narrow-headed gartersnake records and they include the following: "Fowlie (1965) lists one locality from 'Maury Ranch, 7 mi. S. of Sedona.' In addition, a snake in the Yavapai College collection was collected dead on SR 89 three miles west of Sedona on June 30, 1989, although it is possible this animal was originally collected elsewhere (Nowak and Santana-Bendix 2002). However, George Bradley, collection manager of herpetology at the University of Arizona, also collected a *T. rufipuntatus* two miles south of Sedona on SR 179 in February 1981 and noted the species in lower Oak Creek in the 1970's (pers. comm.). John Schreiber, park ranger at Red Rock State Park, informed us that a young *T. rufipunctatus* was found in an irrigation ditch in the park sometime in the early to mid-1990's (pers. comm.)." Though Nowak and Santana-Bendix (2002) suggest that narrow-headed gartersnake numbers below Oak Creek Canyon are low or the species is potentially extirpated, snakes could disperse downstream of Oak Creek Canyon and throughout the stocking reach. While suitable physical habitat exists for gartersnakes within the stocking reach, nonnative and predatory fishes, especially spiny-rayed sunfishes and catfishes, are also present.

Narrow-headed gartersnakes are not known to occupy Stoneman Lake, which does not provide suitable habitat for the species. The nearest gartersnake records are from Oak Creek Canyon, approximately 14 air miles away. Stoneman Lake is a closed basin and stocked yellow perch,

bluegill, and redear sunfish would not be able to disperse downstream. Therefore, narrow-headed gartersnakes would not be exposed to fish stocked into Stoneman Lake.

There are no narrow-headed gartersnake records from Wet Beaver Creek or any of its tributaries, though the area has not been systematically surveyed for gartersnakes recently. Narrow-headed gartersnakes likely do not occupy the Wet Beaver Creek stocking reach, though they persist in the Verde River. Narrow-headed gartersnakes persist in low numbers within the Middle Verde River, thus, the likelihood that gartersnakes would disperse from the Verde River into Wet Beaver Creek and encounter stocked rainbow trout is low. Additionally, the likelihood that stocked rainbow trout that disperse downstream would encounter narrow-headed gartersnakes is low because the snakes persist at low densities in the Verde. Holycross et al. (2006) suggest that Wet Beaver Creek might provide suitable habitat for narrow-headed gartersnakes, however, a nonnative fish community, including spiny-rayed fishes, persists and may make the habitat less suitable for the species.

There are no narrow-headed gartersnake records from Dead Horse Ranch State Park or its lagoons, which do not provide suitable habitat for the species. Narrow-headed gartersnakes are extant in the Upper Verde River and also occupy the Middle and Lower Verde River in low numbers (Holycross et al. 2006, HDMS). Since there is no surface water connection to the Verde River and stocked fish would not be able to disperse out of the lagoons, narrow-headed gartersnakes would not be exposed to those stocked fish.

Narrow-headed gartersnakes are not known to occupy Mingus Lake, which does not provide suitable habitat for the species. Though narrow-headed gartersnakes persist in the Upper Verde River and may occur in low numbers along the Middle Verde River, the species would not disperse through approximately 12 miles of ephemeral drainages from the Verde River to the high elevation lake. If the lake spills, which occurs infrequently, stocked rainbow trout, bluegill, and black crappie can disperse to the Middle Verde River and then move upstream and downstream. But, because densities of narrow-headed gartersnakes in the Verde are low, the likelihood that narrow-headed gartersnakes would be exposed to dispersing fish stocked into Mingus Lake is low.

Narrow-headed gartersnakes are not known to occupy Huffer Lake or the surrounding area, which does not provide suitable habitat for the species. The unsubstantiated narrow-headed gartersnake record reported in HDMS from Baker Lake is likely a misidentification because the sinkhole pond does not provide suitable habitat for the species. Holycross et al. (2006) also reported on an apparent narrow-headed gartersnake record from Pine Creek and provided this analysis: “specimens from ‘Payson’ and ‘Pine’….might have been collected from the East Verde River and Pine Creek respectively, but are not plotted due to the vague locality information.” Additionally, Holycross et al. (2006) surveyed for gartersnakes in Pine Creek upstream and

downstream of Tonto Bridge State park in 2003 and 2004, but found no narrow-headed gartersnakes. It is highly unlikely that narrow-headed gartersnakes that might be in Pine Creek would surmount the Mogollon Rim and move overland to Huffer Lake. Also, there are no records of narrow-headed gartersnakes from West Clear Creek, into which Huffer Lake eventually drains, or its tributaries (HDMS). Even though stocked rainbow trout could disperse through nearly 14 river miles to reach West Clear Creek if the lake spilled, narrow-headed gartersnakes would not be exposed to those stocked fish.

Holycross et al. (2006) suggest that West Clear Creek may provide suitable habitat for gartersnakes, though nonnative fishes, including spiny-rayed fishes, are present. Narrow-headed gartersnakes do not likely occupy the West Clear Creek stocking reach, nor are there any records of the species from elsewhere in West Clear Creek or its tributaries (HDMS). As described above, the narrow-headed gartersnake record from Baker Lake was likely misidentified. If narrow-headed gartersnakes persist in Pine Creek, it is highly unlikely that they would surmount the Mogollon Rim and move overland into the West Clear Creek stocking reach. Narrow-headed gartersnakes persist in low numbers within the Middle Verde River, thus, the likelihood that gartersnakes would disperse from the Verde River into West Clear Creek and encounter stocked rainbow trout is low. However, the gartersnakes that persist in these areas would be exposed to dispersing stocked rainbow trout.

Narrow-headed gartersnakes occupy the Middle Verde River, though likely in low numbers. There is a 1987 gartersnake record from the Verde River at The Falls, nearly 12 river miles downstream of the lower end of the proposed stocking reach (HDMS). There are also recent verified narrow-headed gartersnake records from the Upper Verde River at Bear Siding (1996, 2000) and Mormon Pocket between Perkinsville and the Verde River confluence with Sycamore Creek (2001), and a photo vouchered 1988 record from north of Tapco (Holycross et al. 2006, HDMS, T. Jones pers. comm.). Holycross et al. (2006) surveyed extensively for gartersnakes in 2004 and 2005, but found no narrow-headed gartersnakes along the Middle Verde River. The community of nonnative fishes, including spiny-rayed fishes, and crayfish present throughout the Middle Verde River has reduced habitat suitability for the snakes. Narrow-headed gartersnakes that occupy the Upper Verde River could disperse downstream to the Middle Verde River where they are likely to encounter stocked rainbow trout. Additionally, narrow-headed gartersnakes from Oak Creek Canyon, a tributary of the Verde River, could disperse downstream to the confluence of Oak Creek and the Verde River where they are likely to encounter stocked rainbow trout. Narrow-headed gartersnakes persisting in the Middle Verde River would be exposed to rainbow trout stocked into the stocking reach.

Downstream analysis:
Narrow-headed gartersnakes occupy the Middle and Lower Verde River, which lies within the current and historical range of the species, although likely in low numbers. There is a 1987

gartersnake record from the Verde River at The Falls, nearly 12 river miles downstream of the lower end of the proposed stocking reach (HDMS). Another was observed in 2005 along the Verde River *ca*. 1 mile downstream from the confluence of Fossil Creek (Holycross et al. 2006, HDMS). Narrow-headed gartersnakes persisting downstream of the Middle Verde stocking sites would be exposed to stocked sport fish dispersing from the Oak Creek, Wet Beaver Creek, West Clear Creek and Middle Verde River stocking reaches, and Mingus and Huffer Lakes. Stoneman Lake is a closed basin and fish cannot escape.

Colorado Pikeminnow

Colorado pikeminnow were extirpated from central Arizona before about 1950. They have never been detected as a reproducing population in the Verde River. The only historic natural occurrence of them in the vicinity is reported in Minckley and Alger (1968) as bone fragments discovered in an archaeological site near Perkinsville. Since the early 1980's, reintroductions of pikeminnow (previously known as Colorado River squawfish) have occurred throughout the Verde River from the headwaters down to Childs. Colorado pikeminnow in the Verde River and Salt River are designated experimental non-essential under the Endangered Species Act (10j). The species appears to only occur as a result of stocking action by the Arizona Game and Fish Department. No attempts at reproduction have been documented (lack of collection of ripe fish or spawning evidence) and no young have been detected within the Verde River. The USFWS has drafted recovery guidelines for squawfish throughout their range (USFWS 2008). No recovery potential or requirement is provided in those guidelines for a population of squawfish in Arizona.

Colorado pikeminnow were stocked into the Middle Verde River twice in 1985 at West Clear Creek (Table 78). Pikeminnow were stocked into the Upper Verde River in 1985-1988 (Hendrickson 1993) at sites near FR 638, Morgan Ranch, Perkinsville, Sycamore Creek, and near Tapco. Pikeminnow records from near Bridgeport (Ziebell and Roy 1989) and the OK Ditch in 1987 and 1988 likely came from those stockings. Stockings into the Upper Verde River of fish over 300mm continued in 1991-1993 (Hyatt 2004), but none were stocked in the Middle Verde after 1985. Two pikeminnow were collected in May 2001 by EPA EMAP crews just upstream of the Oak Creek confluence (in conjunction with bass, suckers, shiner and stocked rainbow trout). Surveys from Tuzigoot to Beasley Flat in June, 2003 (Clark 2003d), and July, 2006 (Chmiel 2006b) did not locate any pikeminnows. The last record of pikeminnow in the Middle Verde was the May 2001 collection from near Oak Creek (AGFD Scientific collecting permit report).

Table 78. Stockings of Colorado pikeminnow into the Middle Verde River

Location	Year	Number	Average Size (millimeters)
West Clear Creek	1985	8,000	76
Total	1985	5,000	76

Beginning in 1995, larger pikeminnow were stocked outside of the Middle Verde River in the Lower Verde River reach below West Clear Creek between Beasley Flats and Childs (summarized in Hyatt 2004, Gill 2007c). Pikeminnow are currently found downstream in the Lower Verde River near the stocking sites at Childs and Beasley Flats and in Horseshoe Reservoir (Table 79). There are also reports of anglers catching pikeminnow near Beasley Flats. Successful establishment of an adult population in this reach is difficult to assess, as the numbers of fish recaptured over time has not maintained the numbers seen in the late-1990s, and the fish that are captured are recently stocked, at large only a few months (Hyatt 2004, Robinson 2007). No reproduction or recruitment has been documented.

Table 79. Recaptures (post-stocking) of Colorado pikeminnow in the Lower Verde River since larger (300mm) fish began to be stocked in 1995

Year	Location	Number	Source
1995	Childs to Sheep Bridge	0	Cited in Jahrke and Clark 1999
1996	Childs to Sheep Bridge	5	Cited in Jahrke and Clark 1999
1996	Horseshoe Reservoir	22	Cited in Jahrke and Clark 1999
1997	Beasley Flats to Childs	6	Cited in Jahrke and Clark 1999
1997	Childs to Sheep Bridge	17	Cited in Jahrke and Clark 1999
1997	Horseshoe Reservoir	0	Cited in Jahrke and Clark 1999
1998	Beasley Flats to Childs	2	Cited in Jahrke and Clark 1999
1998	Childs to Sheep Bridge	37	Cited in Jahrke and Clark 1999
1998	Horseshoe Reservoir	0	Cited in Jahrke and Clark 1999
1999	Childs to Sheep Bridge	3	Cited in Jahrke and Clark 1999
1999	Horseshoe Reservoir	0	Cited in Jahrke and Clark 1999
2000	No captures noted		Cited in Hyatt 2004
2001	Unknown, probably Childs to Sheep Bridge	0	Cited in Gill 2007, probably Weedman 2001
2002	Childs to Sheep Bridge	0	Cited in Gill 2007, probably Weedman 2002
2003	Childs to Sheep Bridge	1	Cited in Gill 2007, probably Weedman 2003
2004	Childs to Sheep Bridge	0	Cited in Gill 2007, probably Weedman 2004a
2005	Childs to Sheep Bridge	0	Cited in Gill 2007: probably Duffy and Weedman 2005
2006	Childs to Sheep Bridge	0	Cited in Gill 2007
2006	Horseshoe Reservoir	4	Robinson 2007
2007	Childs to Sheep Bridge	0	Cited in Gill 2007

Potential Impacts
Colorado pikeminnow are not likely present or are in very low numbers in the Middle Verde River because they are now only stocked in the lower portion of the Verde River. No long-term survival or recruitment has been documented for stocked fish. Stocked trout are rare in what is likely to be occupied habitat (lower Verde River). Interaction would include competition for space and food; however, pikeminnow may be able to prey on trout.

Colorado pikeminnow are stocked at either Beasley Flats Recreation Area or at Childs on the Prescott and Tonto National Forests. Pikeminnow are raised at Bubbling Ponds State Fish Hatchery using State dollars and facilities. They are grown to a size exceeding 300 mm before they are stocked in the river. Potential beneficial and adverse impacts may occur to pikeminnow from stocking of rainbow trout. Trout could serve as added forage for pikeminnow or there could be competition for food or space between them. Direct predation of trout on pikeminnow is not expected to occur because there are no young pikeminnow in the river system and trout die off every year before they would be of the size to prey on a stocked 300 mm or larger pikeminnow.

Gila Chub and Critical Habitat
Gila chub populations are known to occur in several tributaries of the Verde River but have never been and do not expect to be found in the mainstem of the middle Verde River. Gila chub are known from Walker Creek and Red Tank Draw, tributaries to Wet Beaver Creek and in Spring Creek, a tributary to Oak Creek. Rainbow trout are also proposed for stocking in Wet Beaver Creek below Walker and Red Tank Draw and in Oak Creek upstream from the confluence with Spring Creek. Past surveys in Gila chub habitat have not encountered rainbow trout in any of the occupied areas. Additionally, the limited information from past surveys in streams downstream from known populations of Gila chub have failed to document their movement out of those systems or their occurrence in the downstream river systems.

Critical habitat is not designated in the Verde River. The nearest critical habitat is near Oak Creek at the confluence of Coffee and Spring Creeks and near Wet Beaver Creek confluences with Walker Creek and Rarick Canyon.

Potential Impacts
Rainbow trout may compete with Gila chub for food and space if they were to occupy the same habitats. Predation by stocked trout on age 0+ chub might occur during the stocking season if they were to occupy the same habitats. Rainbow trout do not persist in the middle Verde River stocked reach much beyond early June due to thermal limits for trout. Gila chub may actively or passively leave their occupied area and wind up in the Verde River. The middle Verde River is occupied by many nonnative and predatory species of fish that would also have negative impacts to Gila chub independent of the stocking action. Due to the presence of physical barriers (dry

reaches or vertical drops) stocked rainbow trout are not expected to access designated Gila chub Critical Habitat.

Exposure to stocked species is unlikely to occur based on the distance from occupied habitat and existing nonnative fish assemblage separating Gila chub from the rainbow trout stocking areas. This is supported by fisheries survey data indicating Gila chub not persisting outside known occupied areas and stocked rainbow trout are not being found within those occupied areas (AGFD Native Fish Database, Bagley 2002).

Critical Habitat
No impacts to critical habitats would be anticipated as stated above, due to the existing nonnative fish assemblage separating the chub from stocked trout.

Razorback Sucker and Critical Habitat
Razorback suckers were stocked into the mainstem Verde River, Oak Creek, Wet Beaver Creek, and West Clear Creek several times from 1981 to 1988 (Table 80) (Hendrickson 1993). Stockings into the Upper Verde River also occurred during this time, and stocking of fish over 300mm continued in 1991-1993 (Hyatt 2004), but none were stocked in the Middle Verde after 1988. One adult razorback sucker was captured between TAPCO and Peck's Lake in 1997 (Kubacki 1998). The stocking site for this fish is unknown. Surveys from Tuzigoot to Beasley Flat in June 2003 (Clark 2003d) and July 2006 (Chmiel 2006b) did not locate any razorback suckers. The paucity of survey data from the Middle Verde River reach makes a determination of the presence or absence of razorback suckers in the reach difficult. As with the Upper Verde River, the razorback may not be currently present in this reach.

Table 80. Stockings of razorback suckers into the Middle Verde River.

Location	Year	Number	Average Size (millimeters)
Camp Verde	1982	6,763	127
	1983	16,370	76
	1984	12,125	127
Oak Creek near Page Springs Hatchery	1981	1,000	81
	1981	1,000	81
	1982	3,000	76
	1983	10,000	76
	1986	1,000	65
	1986	145	Si
West Clear Creek (lower end)	1981	1,000	81

Location	Year	Number	Average Size (millimeters)
	1982	3,000	176
	1983	10,000	76
	1987	17,151	64
Wet Beaver Creek	1987	17,150	64
	1988	10,000	76

Source: Hendrickson 1993

Beginning in 1993, larger razorback suckers were stocked outside of the Middle Verde River in the Lower Verde River reach below West Clear Creek between Beasley Flats and Childs (summarized in Hyatt 2004, Gill 2007c). Razorback suckers are currently found downstream in the Lower Verde River near the stocking sites at Childs and Beasley Flats and in Horseshoe Reservoir (Table 81). Successful establishment of an adult population in this reach is difficult to assess, as the numbers of fish recaptured over time does not reflect the numbers seen in the late-1990s. The presence of seven ripe adult males in Horseshoe Lake in 2005 (Robinson 2007) was a promising sign.

Table 81. Recaptures (post-stocking) of razorback suckers in the Lower Verde River since larger (300mm) fish began to be stocked in 1993

Year	Location	Number	Source
1994	Unspecified	1	Cited in Hyatt 2004
1995	Childs to Sheep Bridge	0	Cited in Jahrke and Clark 1999
1996	Childs to Sheep Bridge	12	Cited in Jahrke and Clark 1999
1997	Beasley Flats to Childs	3	Cited in Jahrke and Clark 1999
1997	Childs to Sheep Bridge	27	Cited in Jahrke and Clark 1999
1998	Beasley Flats to Childs	0	Cited in Jahrke and Clark 1999
1998	Childs to Sheep Bridge	61	Cited in Jahrke and Clark 1999
1999	Childs to Sheep Bridge	17	Cited in Jahrke and Clark 1999
2000	Unknown, probably Childs to Sheep Bridge	12	Cited in Hyatt 2004
2001	Unknown, probably Childs to Sheep Bridge	2	Cited in Hyatt 2004 probably Weedman 2001,
2002	Childs to Sheep Bridge	9	Cited in Gill 2007, probably Weedman 2002
2002-2003	Beasley Flats to Horseshoe Dam	17	Bonar et al. 2004
2003	Childs to Sheep Bridge	3	Cited in Gill 2007, probably Weedman 2003

Year	Location	Number	Source
2004	Childs to Sheep Bridge	4	Cited in Gill 2007, probably Weedman 2004a
2005	Childs to Sheep Bridge	2	Cited in Gill 2007, probably Duffy and Weedman 2005
2005	Horseshoe Reservoir	7	Robinson 2007
2006	Childs to Sheep Bridge	2	Cited in Gill 2007
2006	Horseshoe Reservoir	4	Robinson 2007
2007	Childs to Sheep Bridge	0	Cited in Gill 2007

Critical habitat for the razorback sucker on the Verde River was designated in 1995 and extends from the western boundary of the Prescott National Forest west of Perkinsville to Horseshoe Dam. The biological support document for the designation said that the Verde River critical habitat unit would contribute to the delisting of the species and was, therefore, important for recovery (Maddux et al. 1993). The Middle Verde River reach was described as altered by diversions, sand and gravel operations, and agricultural and residential development adjacent to the channel and that these activities may have affected channel morphology, especially in restricting the river from meandering. The document also characterized backwaters and riparian areas as degraded and noted that the Middle Verde River supported a diverse nonnative fish community.

At the time of designation, the Middle Verde River supported several constituent elements of critical habitat as described below:

> Water: The Middle Verde River base flow is affected by the diversions that at times, can take all the flow from the river and leave it dry in spots (Kubacki 1998). Inflows from perennial tributaries provides some relief, but also are subject to diversions. There is sufficient flow through the reach to support fish populations.
>
> Physical habitat: The Middle Verde River contained mainstem and backwater habitats, with shallow waters available at the lower ends of perennial tributaries.
>
> Biological environment: At the time of designation, nonnative fish species were common in the Middle Verde River with native fishes such as Sonora and desert sucker, roundtail chub, and longfin dace also present. These native species are still present; however, with the lack of consistent surveys in the reach it is not possible to document any population trends for either native or nonnative species.
>
> Additional selection criteria besides the primary constituent elements were developed to assist in selecting critical habitat areas for the razorback sucker:

Presence of spawning population: There was no spawning population in the Verde River at the time of designation. The Verde River may have supported a spawning population of razorback suckers later in time than did the Gila or Salt Rivers. The last razorback sucker from the Verde River was documented in 1954, several years after the species was gone from the other central Arizona rivers.

Nursery habitat: Nursery habitat is available in all reaches of the Verde River.

Historic or present distribution: The reintroduction of razorback sucker into the Verde River began in the 1980s, and the river was considered occupied at the time of designation of critical habitat.

Maintenance of rangewide distribution: The last of the central Arizona rivers to support razorback suckers, the Verde River shares some physical characteristics with the Gila River in terms of elevational changes and the mixture of canyon and open alluvial floodplain areas. The Gila River is also free-flowing in the critical habitat reach. The Gila River supported a large and dominant nonnative fish community at the time of designation, similar to the nonnative fish community in the Middle Verde River.

Special management: Maintenance of a natural flow regime that would encourage native fish and discourage nonnative fish was also identified as an important management need.

Potential Impacts

Potential impacts to the razorback sucker in the Middle Verde River may result from the stocking of rainbow trout into the mainstem Verde River, Oak Creek, Wet Beaver Creek and West Clear Creek. Effects from stockings in tributaries would occur if the stocked fish moved down into the mainstem or if razorback suckers moved into the stocking reaches of Oak Creek, Wet Beaver Creek, and West Clear Creek, particularly during the spawning period.

Catchable sized rainbow trout are proposed for stocking in the mainstem from November to March and in the tributaries from March to May and October to November. All fisheries are intended for high intensity use with repeated stockings during the period to maintain sufficient fish for anglers. Kubacki (1998) estimated a return to the creel of stocked trout of 50% in 1997 and 61% in 1998. He also notes that the 78% return from 1996 was done under a different census and should not be compared with the later results. Later creel results from 2000 indicated a return of 40%.

Rainbow trout are stocked before, during and after the probable spawning period for razorback suckers in the Verde River. Robinson (2007) caught seven tuberculate, ripe males in one gill net set in Horseshoe Reservoir in April 2005 where the water had a surface temperature of 19°C. The cluster of males is indicative of staging behavior during the spawning period. No ripe

females have been found in any survey at any time. No surveys for larval razorback suckers has been initiated, so it is unknown if there is any spawning occurring. Persistence of trout until May in the river is documented and temperatures in the area currently known to be occupied by razorback suckers remain suitable for rainbow trout until at least April (Robinson 2007).

Rainbow trout in the Verde River prefer pools and runs, with razorback suckers preferring pools. Larval and young of the year razorback suckers use quiet waters, either in pools, backwaters, or shallow side channels with vegetative or rock cover for nursery habitat.

Studies in the mid-1990s indicated that stocked trout in the Middle Verde River did not move upstream (Kubacki 1998); however, there is limited information on the downstream movement of rainbow trout post-stocking into the mainstem and tributaries. Survey information on the Middle Verde River is limited; Kubacki (1998) found rainbow trout at the stocking sites, with two caught as late as May. Bonar et al. (2004) did find rainbow trout in this reach but it is not clear if captures were made in both spring (March-May) and winter (October-November). He did observe rainbow trout in the Verde River in August (four months after final stockings were done in April), but none were captured in June-September. His survey sites were on the mainstem near Wet Beaver Creek and West Clear Creek and states that rainbow trout were found near the stocking sites. Clark (2003d) surveyed between Tuzigoot Bridge and Beasley Flats in June, 2003, and did not detect any rainbow trout. Chmiel (2006b) repeated that survey in July, 2006, and did not find any rainbow trout. Water temperatures in the Middle Verde River can exceed 25°C during the summer months, reducing the opportunity for rainbow trout to persist through the summer. Wild trout (both rainbow and brown) do persist in upper Oak Creek, but the lower reaches of the three stocked tributaries also have high summer temperatures that reduce the opportunity for over-summer persistence.

In the 1996 intra-service consultation, rainbow trout were approved for stocking with a requirement for post stocking monitoring to be conducted 1995-1996 to evaluate trout movements upstream above Peck Lake Diversion, razorback and spikedace larval drift into the stocking area, and maximum summer water temperature (that would limit trout persistence). Temperatures were found to exceed 25°C from June 1 through August 15. No trout were collected above Peck's Lake Diversion Dam. No Larval drift from razorback sucker (or spikdedace) was found in the trout stocking area. Only one adult razorback sucker was collected in the stocking area (May 1996) (Kubacki 1998). After the Department submitted the report, Federal Aid lifted the requirements for further monitoring. (Langley 1999).

The distribution of rainbow trout below West Clear Creek to Horseshoe Reservoir is unclear. Bonar et al. (2004) had a survey site at West Clear Creek and the Verde River, and likely West Clear Creek is the source of the rainbow trout they captured in their Reach III, although the specific record is not included in their report. The series of surveys in the Childs to Sheep Bridge

and in Horseshoe Reservoir have not documented rainbow trout in that area (Table 82), even with some surveys done at the times of the year that rainbow trout could be expected to be in the system.

Table 82. Surveys in the Lower Verde River (Childs to Horseshoe Reservoir) that did not document rainbow trout in occupied razorback sucker habitat

Date of Survey	Location	Source
1995	Childs to Sheep Bridge	Jahrke and Clark 1999
1996	Childs to Sheep Bridge	Jahrke and Clark 1999
1997	Childs to Sheep Bridge	Jahrke and Clark 1999
1998	Childs to Sheep Bridge	Jahrke and Clark 1999
1999	Childs to Sheep Bridge	Jahrke and Clark 1999
10/2001	Childs to Sheep Bridge	Weedman 2001
5/2002	Childs to Sheep Bridge	Weedman 2002
5/2003	Childs to Sheep Bridge	Weedman 2003
6/2004	Childs to Sheep Bridge	Weedman 2004a
2/2004	Horseshoe Reservoir	Weedman 2004b
10/2005	Childs to Sheep Bridge	Robinson 2007
3 and 10/2006	Childs to Sheep Bridge	Robinson 2007
4 and 10/2005	Horseshoe Reservoir	Robinson 2007
3 and 10/2006	Horseshoe Reservoir	Robinson 2007
5/2007	Childs to Sheep Bridge	Gill 2007

For the Lower Verde, there are no records in the dataset (LCRGAP database 2009) examined of stocked rainbow trout in the current razorback sucker stocking area. If there is spawning by razorback suckers, it is most likely in the Lower Verde. Temperatures at that time are suitable for trout to survive, though they won't over-summer in the Lower Verde. The Lower Verde River is also occupied by many centrarchids, ictalurids and cyprinids (esp. carp and red shiner, known predators on razorback eggs and larvae).

Rainbow trout are documented to prey on razorback sucker larvae in the wild (Mueller 1993) and in a laboratory setting (Carpenter and Mueller 2008). While rainbow trout are not considered particularly piscivorous, they do prey on small fish (Bonar et al. 2004, Propst et al. 1998) and once stocked, can apparently turn to feeding on natural food quickly (Propst et al. 1998). Bonar et al. (2004) also noted that stocked rainbow trout were primarily feeding on insects.

Critical Habitat

Trout stocked into critical habitat for razorback sucker, the Verde River between just west of Perkinsville to Horseshoe Reservoir, or that reached critical habitat from the stocking sites in Oak Creek or West Clear Creek could impact the biological environment by adding non-native trout to the non-native assemblage that already exists in the Verde River. The critical habitat designation noted that competition and predation are elements of the biological environment but that it is out of balance due to the existing non-native fish species.

While in the river, before they mostly are caught out or succumb to summer temperatures, trout are an additional source of competition for space and to a lesser extent competition for food. This impact is somewhat minimized, however, because anglers in this reach also reduce, by some unknown quantity, the warm water fish assemblage. Anglers come to fish for the stocked trout but also catch out and keep other non-natives that are not stocked.

Roundtail Chub

Roundtail chub are known from the Upper Verde River beginning below Sullivan Dam and extending down the Verde River past Granite Creek and throughout its entirety to the confluence with the Salt River. Roundtail chub have been documented occupying the entire reach proposed for stocking of rainbow trout.

Potential Impacts

Potential impacts to roundtail chub could result from the direct predation on larval or juvenile roundtail chub by stocked trout, competition for food or competition for space. Rainbow trout are primarily insectivorous, but may consume small fish. Trout have not been found to persist in the Verde River and the area proposed for stocking is occupied by several other competing and predatory nonnative species that occur independent of stocking actions (smallmouth bass, flathead catfish, green sunfish, red shiner, crayfish, bullfrogs, etc.).

These effects may occur over the period covered by this consultation. Exposure of roundtail chub to stocked trout is likely to occur based on the location and timing of the stocking action and the known distribution of roundtail chub.

Spikedace and Critical Habitat

The nearest documented occurrence of spikedace is in the Upper Verde River between Sullivan Dam and the confluence with Sycamore Creek in 1999. Critical habitat is also present in the Upper Verde River from Sullivan Dam downstream to near Pecks Lake. There is no suitable habitat for spikedace in the reach proposed for rainbow trout stocking because of the existing warmwater nonnative species assemblage. Spikedace were last documented from the Upper Verde River in 1999, despite multiple general surveys (AGFD data) and targeted spikedace surveys (Richardson 2006). The number of spikedace has fallen to the level where detection of individuals by surveys is very difficult and it is possible they may no longer persist.

Potential Impacts
Potential impacts to spikedace could result from the movement of stocked rainbow trout upstream into formerly occupied habitat or from the downstream movement of spikedace over the diversion into the areas stocked with trout. The response would be potential predation by the stocked trout on the spikedace or potential competition for food or space. The transport of the stocked trout from the stocked locations to the occupied habitat is limited by the diversion dam and rainbow trout have not been found in the Upper Verde River above the dam (see previous discussion on Upper Verde River Impacts analysis). Results from Department research into the movement of rainbow trout show that the Peck's Lake diversion is a viable barrier to their movement (Kubacki 1998). Significance of potential movement of trout is also minimized by the fact that the Upper Verde River is occupied by several other competing and predatory nonnative species occur independent of stocking actions (smallmouth bass, flathead catfish, green sunfish, red shiner, crayfish etc.). If the Peck's Lake Diversion dam is washed out during a large scale flood event, stockings are halted and would not commence until the dam is re-constructed, as was requested by the Service in a 1999 concurrence letter (Langley 1999). This practice is proposed to continue into the future and would minimize the potential effects of the proposed action to spikedace.

Critical Habitat
Exposure to stocked trout is unlikely to occur based on the presence of the Peck's Lake diversion dam, which acts as a barrier to upstream trout movement into critical habitat.

LOWER VERDE RIVER SUB-WATERSHED

Physical Geographic Description
The lower Verde River Sub-Watershed contains two proposed stocking locations, forming one distinct complex (East Verde River Complex).

Drainage Area
The Lower Verde River watershed for the purposes of this consultation begins at Childs and extends to Horseshoe Dam and includes all tributaries within this reach of stream. The lower Verde River Sub Watershed drains approximately 2506 mi^2 of surface area.

Range of Elevations
Elevations range from a high of nearly 2590 m (8500 ft) down to approximately 600 m (1968 ft) at Horseshoe dam.

Tributaries
Major tributaries to the Verde River in this sub-watershed are Fossil Creek, East Verde River, Red Creek, Wet Bottom Creek, and Tangle Creek.

EAST VERDE RIVER COMPLEX

Site Description

The East Verde River watershed drains and area of 220 mi^2. The East Verde River is located 5 miles north of Payson, in Gila County, Arizona within the Tonto National Forest. It begins just below the Mogollon Rim at 2200 m (7200 ft) in elevation and drains into the Verde River at 800 m (2600 ft) of elevation, approximately 7 miles downstream of Childs, Arizona.

The East Verde River Complex contains two proposed stocking locations (Figure 86); the East Verde River from Highway 87 upstream to the East Clear Creek diversion, and Green Valley Lake. The East Verde River is the most upstream proposed stocking site and Green Valley Lake drains into the East Verde River via American Gulch roughly 9 miles downstream from Green Valley Lake.

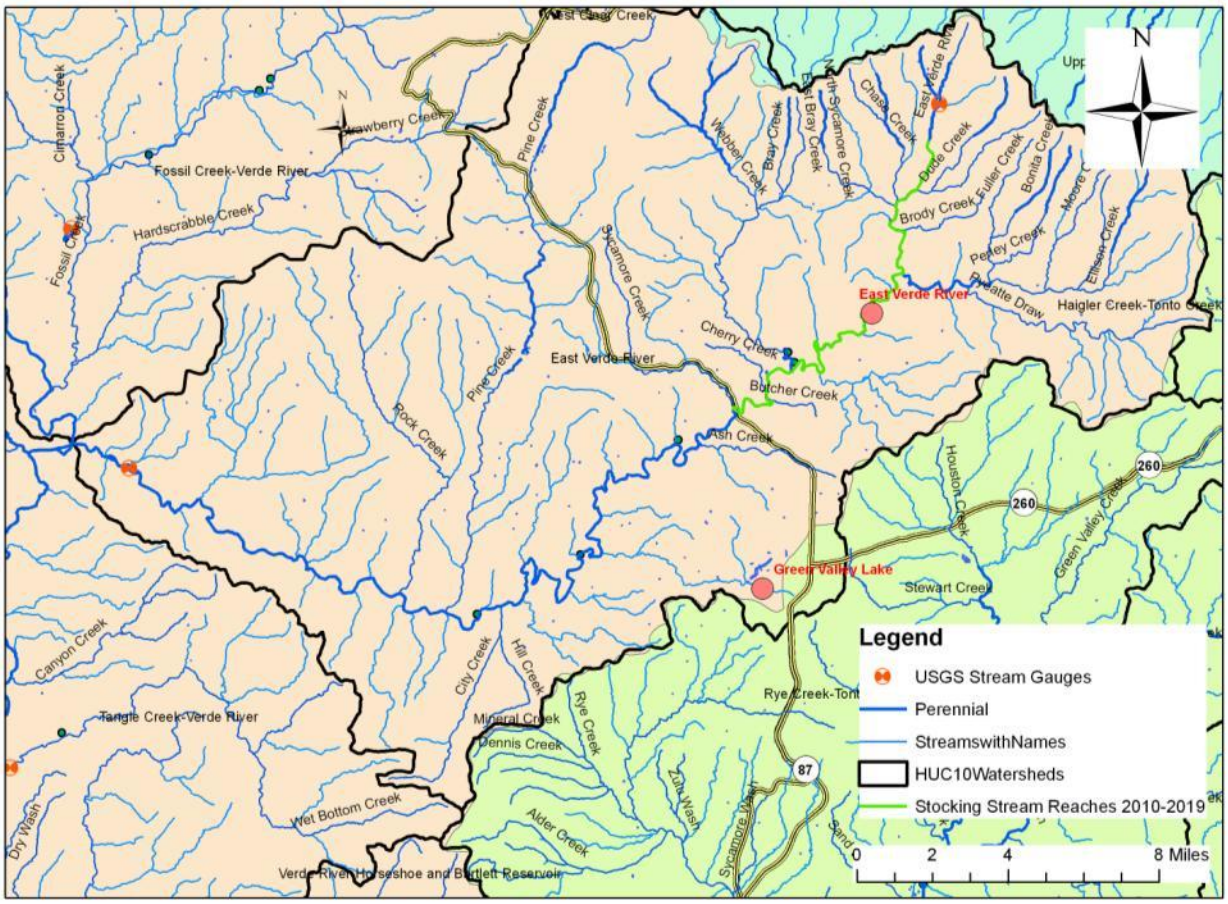

Figure 86. East Verde River watershed overview map with proposed stocking locations in red.

East Verde River

Site Description
The watershed of the East Verde River lies immediately below the Mogollon Rim. The proposed stocking reach begins at the East Clear Creek water diversion and continues downstream to Highway 87 (Figure 86). There are multiple stocking sites throughout this stretch, which include areas known as pump house, water wheel, first crossing, second crossing, third crossing, flowing springs, East Verde Estates, Beaver Valley, cold spring, waterfalls, and above highway 87. Land ownership within the stocking area is 100% owned by the Tonto National Forest.

Management of Waterbody
The East Verde River is an extremely high use cold water fishery, managed as a put-and-take rainbow trout fishery in the spring and summer months. Densities, timing, and fish size are adjusted depending on fish availability, stocking conditions, angler demands, or shifts in management strategy. A history of stocking in the East Verde River is provided in Table 83.

There is angler access where the East Verde River intersects with Highway 87 and then at several road crossings along Forest Rd 199. From a 1995 Angler Postal Questionnaire, approximately 50,700 angler use days were spent on the East Verde River that year. Creel surveys have not been conducted since 1987. The stretch of the East Verde above the pump house is managed as a naturally reproducing rainbow trout fishery.

Table 83. Stocking History for the East Verde River.

Species	**First Year**	**Last Year**	**Number of Stockings**	**Num. Stocked**
Black Crappie	1975	1975	1	6,000
Brook Trout	1935	1980	7	24,492
Brown Trout	1933	1993	10	27,290
Native Trout	1939	1939	1	15,200
Rainbow trout	1933	2008	72	1,404,642
Razorback sucker	1988	1988	1	20,000
Total			92	1,497,624

The East Verde River is managed by the Tonto National Forest for extensive recreational use including: camping, fishing, hiking, and day use are common throughout the area. It is popular with people from the Phoenix area and it is rare that all camping areas are not occupied during the summer.

Proposed action

The Department proposes to stock rainbow trout (catchable and sub-catchables) from April thru August annually; numbers of trout may be from 0 to 32,000 fish annually for the period covered under this consultation.

Water Distribution / Connectivity

The major tributaries connected to the stocking area (Figure 87), beginning at the headwaters, are Mail Creek (interrupted perennial), Dude Creek (perennial in upper end), Chase Creek (perennial in upper end), North Sycamore (intermittent in upper end only), Ellison Creek (perennial in lower end), Webber Creek (intermittent), Cherry Creek, and Butcher Creek.

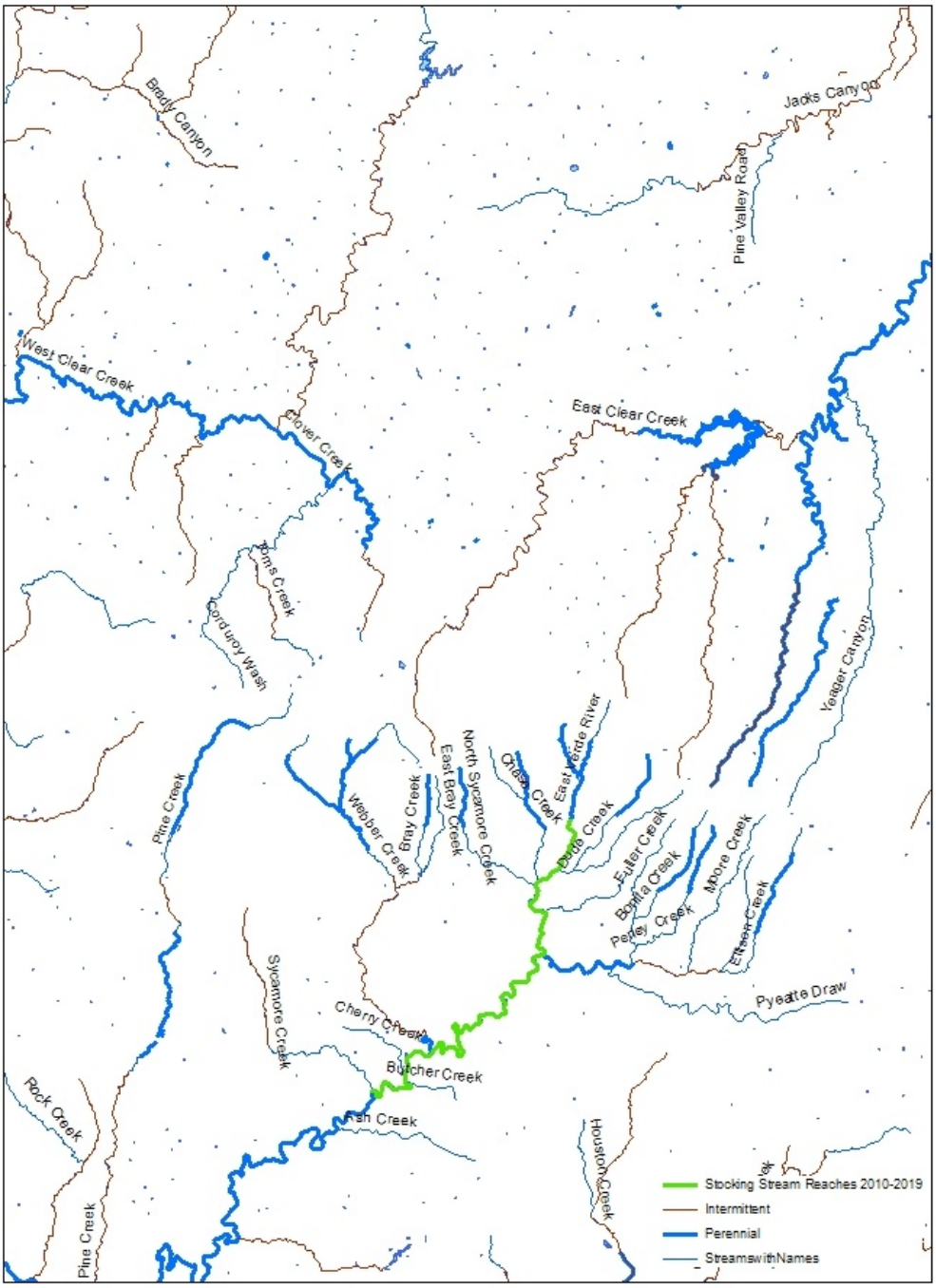

Figure 87. East Verde tributaries and connectivity.

The East Verde River is perennial or interrupted-perennial for most of its length, but is sometimes dry near the confluence with the Verde River, based on USGS gage data. Typical flows in the stream average less than 5 cfs in the winter and spring and are nearly 0 cfs in the

summer. In the summer, the East Verde River went dry in stretches at Beaver Valley (H. Apfel, pers. comm.). In the past, East Verde River flows have been augmented with Little Colorado River drainage water by a water diversion coming from Blue Ridge Reservoir, built in the 1940's by Phelps Dodge, via East Clear Creek. This has added significant flows to the East Verde River allowing trout stocking during the summer months. An average of 15 to 21 cfs was pumped from Blue Ridge Reservoir above the Mogollon Rim into the East Verde River. In 2002, SRP took over the water facilities and stopped pumping. They began making repairs to the system and testing the system in 2009 (Figure 88). Tentatively, SRP plans to divert water from Blue Ridge Reservoir to the East Verde River in 2010. They plan to add 30 cfs from early April to late September annually as Blue Ridge Reservoir levels permit (down to inlet tunnel elevation), as total SRP system storage allows, and the amount of space in Horseshoe/Bartlett is available. Payson is predicted to take between 0 - 10 cfs, probably averaging 6.5 cfs over the season. The amount diverted overall and the amount routed to Payson would likely be managed and would fluctuate in response to available storage in Blue Ridge Reservoir and seasonal demand (e.g., lower in early spring & late fall and higher during peak summer use in Payson). Historically, flows from Blue Ridge Reservoir have been highest late spring through fall and lowest in the winter months (Figure 89).

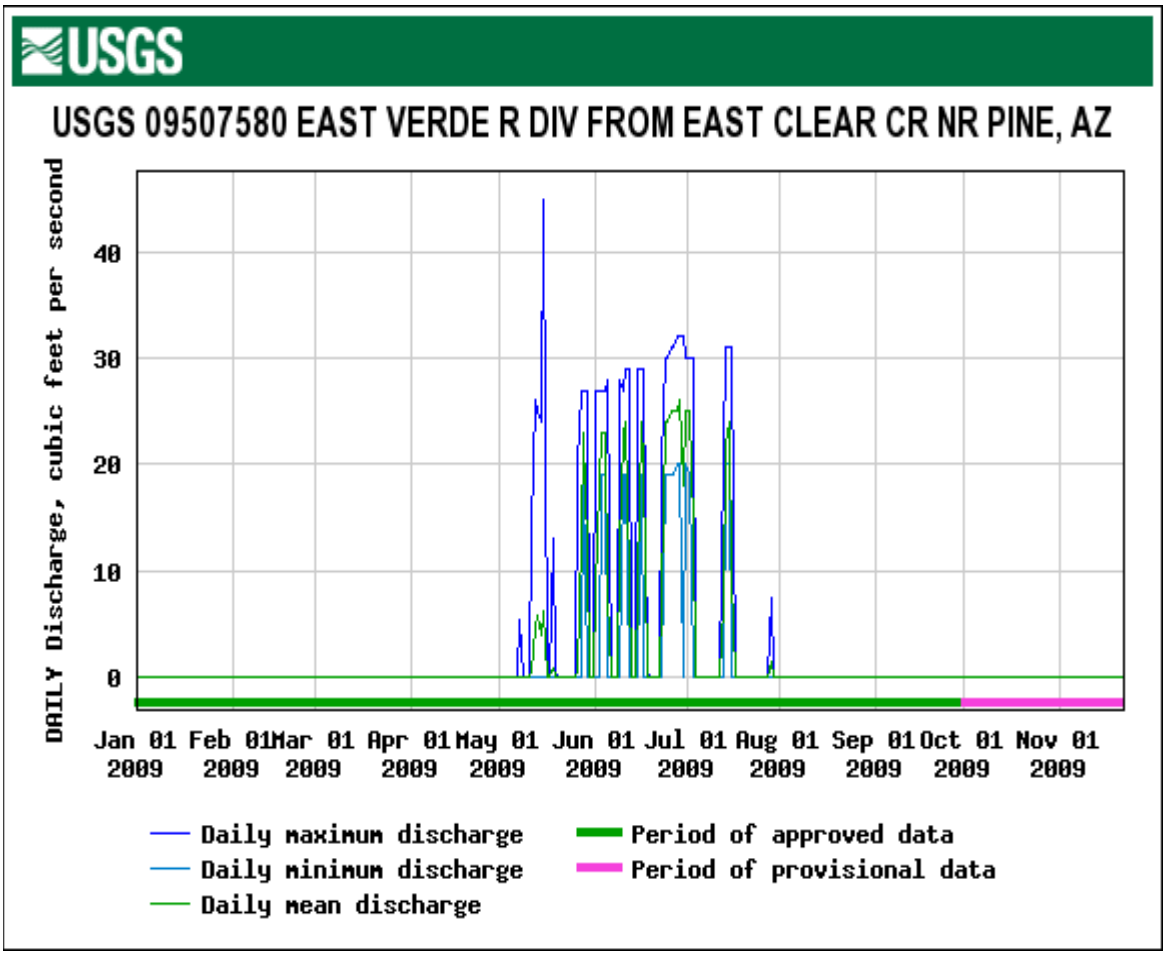

Figure 88. Daily discharge (cfs) for the East Verde River diversion from East Clear Creek during 2009.

The East Verde River flows for roughly 1.8 miles before Mail Creek enters the river. Mail Creek is a small interrupted perennial stream that enters the East Verde River from the West. Mail Creek dries before its confluence with the East Verde River.

The East Verde River flows another 2.5 miles before Dude Creek enters from the east. Dude Creek enters the East Verde River approximately 0.6 miles downstream of the East Clear Creek diversion. The confluence is within the proposed stocking reach of the East Verde River. Dude Creek is an interrupted perennial stream, with the lower portion of the stream typically dry to its confluence with the East Verde River, except during periods of high flow typically occurring in the winter. Dude Creek is a Gila trout recovery stream. The recovery section is protected by a barrier to prevent upstream fish migration from the East Verde River.

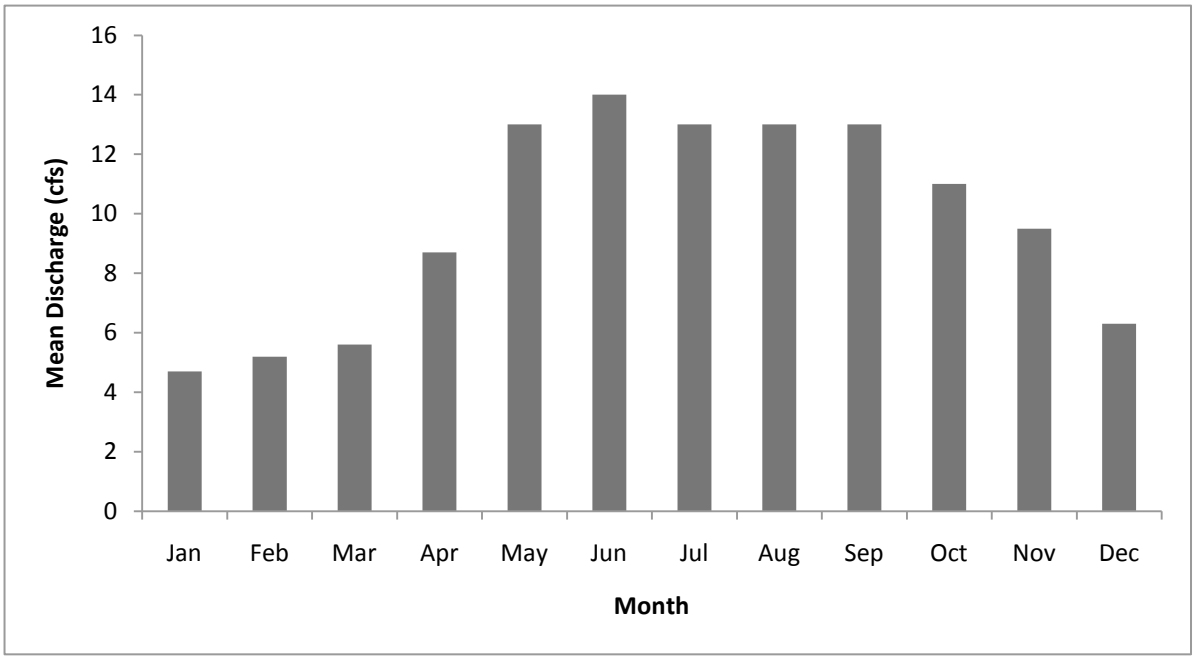

Figure 89. Mean monthly discharge (cfs) for the USGS gage at the East Clear Creek Diversion into upper East Verde River for the period from 11-1-65 to 9-30-08.

The East Verde River flows another 0.6 miles from here to the Chase Creek confluence on the west, and North Sycamore Creek enters 170 m (185 yards) farther downstream. Both of these are interrupted perennial streams that dry before reaching the East Verde River.

Ellison Creek is an approximately 10-mile long tributary that flows into the East Verde River another 2.4 miles farther downstream. Ellison Creek in another interrupted perennial stream. Ellison Creek has a roughly 2.5 miles perennial section near the base of the Mogollon Rim, dries for a long stretch, and then becomes perennial again for about 1.2 miles before entering the East Verde River.

Another 7.1 miles downstream from the Ellison Creek confluence is the Webber Creek confluence. Webber Creek is roughly 12 miles long tributary entering the East Verde River from the North. The stream is perennial from just below the Mogollon Rim to the vicinity of the Highline Train, a roughly 3 miles reach. The stream the dries until Webber Spring, which is just over 0.6 miles upstream from the East Verde River confluence.

The East Verde then travels downstream from the Webber Creek Confluence to Highway 87 through the confluences of Cherry Creek and Butcher Creek, two ephemeral drainages connected to the stocking area in this reach. This section of river is roughly estimated to be 3 miles. For the

purposes of this consultation this is the end of this stocking area. Downstream areas are addressed in the East Verde River Complex Analysis.

Fish Movement

There are at least two barriers to upstream fish movement on the East Verde River. The first is a modified natural barrier on the border of Forest Service and private land just downstream of Rim Trail Estates. It is about 1.5 m (5 ft) high and is likely a barrier to fish movement only at base flow. During storm events it may be possible for fish to circumvent this barrier. The second barrier is a natural barrier about 9 m (30 ft) high just downstream of the Ellison Creek confluence. It is a definite barrier to all upstream fish movement at all flows. Both of these barriers are within the proposed stocking reach.

Stocked fish have the ability to move upstream from stocked locations to the above described barriers. Fish stocked at the uppermost stocking location have the ability to move upstream to the headwaters, as this location is above the upstream-most barrier. Although this is possible, a recent survey from two sites upstream of the uppermost stocking location did not identify any stocked rainbow trout (Gill 2009c). As stated above, the East Verde River is perennial or interrupted-perennial for most of its length, but is sometimes dry near the confluence with the Verde River, based on USGS gauge data. Stocked fish also have the ability to move freely downstream all the way to the confluence with the Verde River. This would most likely only occur during high winter flows from rain events or spring snowmelt. A gauging station on the lower East Verde River shows that the highest flows occur during this period (Figure 92) and stream temperatures would be more amenable to trout survival at this time. The East Verde River dries in the lower portions at base flow and temperatures become too warm for trout at this time. Burger and Gill (2009) did not document any trout on a survey that began just upstream of LF Ranch (located approximately 19 miles below the stocking reach) and extended downstream to the Verde River confluence in March 2009.

Community Description

LCRB Aquatic GAP data records have indentified 11 species of fish that have at one time occupied the East Verde Stocking Area. These fish are longfin dace, yellow bullhead, goldfish, desert sucker, Sonora sucker, red shiner, headwater chub, green sunfish, smallmouth bass, rainbow trout, and speckled dace. The records are comprised of data collected from 1926 to 2000.

There is no recent fish survey data of the East Verde River within the proposed stocking reach. However, surveys have been conducted upstream and downstream of the proposed stocking reach in recent years. Self sustaining populations of wild rainbow trout have been observed in the headwaters of the mainstem East Verde River from Piper Hatchery Spring downstream to at least Mail Creek (Gill 2009c). In addition, anglers have reported numerous headwater chub being caught by hook and line around the confluence of the East Verde River and Ellison Creek (C.

Cantrell, pers. comm.). A number of recent surveys have been conducted in many of the tributaries (Table 84).

Historically, Dude Creek supported a viable population of introduced brook and rainbow trout, which were stocked between 1939 and 1942. A total of 3,500 rainbow trout were stocked in 1939 and 13,236 brook trout were stocked between 1939 and 1942. Both species maintained populations for over 50 years (Rinne and Medina 1988) until the Dude Wildfire occurred in 1990. Subsequent rains caused sediment and ash flows within the streams, eliminating all fishes (Rinne 1996). After the fire Dude Creek was identified as a Gila trout recovery stream. Dude creek was stocked with Gila trout in 1999 and 2000, however, these fish did not persist and the stream is currently fishless (Meka 2006).

Chase Creek was most recently surveyed in 1986 (Table 84). At that time young-of-the-year rainbow trout were collected, indicating natural reproduction. North Sycamore Creek was sampled in 2008 (Evans 2008) and no fish were observed (Table 84).

The upper portion of Ellison Creek, just downstream of the Highline Trail, contains a self-sustaining population of rainbow trout (Burger 2006). Rainbow trout was the only species documented in this survey.

The upper portion of Webber Creek, upstream of the Highline Trail, was surveyed by Gill (2008). He noted a self-sustaining population of rainbow trout near the Patton Spring draw confluence and speckled dace at the Highline Trail.

Narrow-headed and northern Mexican gartersnakes are present in the Verde River watershed (refer to East Verde complex and Lower Verde watershed analyses below).

Table 84. Summary of the most recent fish surveys in East Verde River Tributaries connected to the proposed stocking area.

Year	Collector(s)	Stream	Survey Type	Source	Species
1986	Henry Apfel	Chase Creek	Spot check - Backpack shocker	Data sheet	Rainbow trout Low #'s (25-127mm)
2006	Julie Meka	Dude Creek	Visual	Meka 2006. Dude Creek sampling report.	No fish seen
2006	Bill Burger Dana Warnecke Suzanne Goforth Chris Nyhart Jennifer Spawn	Ellison Creek	Visual Dipnets	Burger 2006. Ellison Creek Headwaters Survey.	Rainbow trout *Noted natural reproduction

2008	Curt Gill Aaron Kern	Webber Creek	Backpack shocker	Gill 2008. Webber Creek Fish Survey.	Rainbow trout N = 22 (138-240mm) Speckled dace

Consultation species or Critical Habitat
Potential impacts to Chiricahua and northern leopard frogs, headwater chub and Gila trout are discussed below. Potential downstream impacts to northern Mexican and narrow-headed gartersnakes, loach minnow and critical habitat, spikedace and critical habitat and roundtail chub further downstream are discussed in the East Verde Complex and Lower Verde River analysis later in the document.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua leopard frog
Local Analysis: Although the East Verde River is within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to stocked fish in the buffered stocking reach is low. There is one historical record for Chiricahua leopard frogs in the East Verde River and there are historical records from 3 sites in the buffered stocking reach: Unnamed Pond (=Diller's Pond) (1972), Ellison Creek (=Highline Trail) (1995), Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (1997) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 68 surveys at 36 sites within the buffered stocking complex between 1926 and 2007 with most surveys conducted between 1972 and 2007 (Figure 90; HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Chiricahua leopard frogs were observed during subsequent surveys at Ellison Creek (=Highline Trail) (1997, 1998 and 2006) and likely occupy the site. Although Unnamed Pond (=Diller's Pond) (1972) is approximately 165 meters from the East Verde stocking area, Chiricahua leopard frogs were not observed

during subsequent surveys in 1972 and 1992 or at Unnamed Trib. of Ellison Creek (East of Pyle Ranch) (2005 and 2007). It is unlikely that Chiricahua leopard frogs still occupy sites within the buffered stocking reach (Figure 90AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: Given water connectivity in the stocking complex, the likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from the East Verde River buffered reach is high. Recent observations show that Ellison Creek provides suitable habitat for frogs (AGFD Region VI Fish Riparian Herpetofauna Database, B. Burger pers. comm.). Because of the 9 meter natural barrier, fish stocked downstream of the confluence of the East Verde River and Ellison Creek cannot travel upstream into Ellison Creek to Ellison Creek (=Highline Trail) (1995) and impact Chiricahua leopard frogs. In contrast, fish stocked above the 9 meter barrier may be able to disperse into Ellison Creek and its tributaries during high flows and encounter Chiricahua leopard frogs. The Chiricahua leopard frog Upper East Verde Management Area (UEVMA), an actively managed Chiricahua leopard frog recovery area, is located in Ellison Creek and 3 of its tributaries (AGFD Region VI Fish Riparian Herpetofauna Database, B. Burger pers. comm.). Dispersing fish moving into Ellison Creek and its tributaries may likely encounter released Chiricahua leopard frogs.

Northern Leopard Frog

Local Analysis: Although the East Verde River is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in the buffered stocking reach is low. There are no historical records for northern leopard frogs in the East Verde River; however, there is 1 historical record for northern leopard frogs from 1 site in the buffered stocking reach; Unmarked Pond (= Cindy's Pond) (1984) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 68 surveys at 36 sites within the buffered stocking complex between 1926 and 2007 with most with most surveys conducted between 1972 and 2007 (Figure 90; HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Northern leopard frogs were not observed during subsequent surveys at Unmarked Pond (= Cindy's Pond) (1997 and 1998). Although some available habitats have not been surveyed within the buffered complex, it is likely that northern leopard frogs no longer occupy (= Cindy's Pond) (1984) because of negative subsequent surveys. In addition, salamanders have been documented at (= Cindy's Pond) (1984), making this area less suitable for northern leopard frogs (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to fish stocked in the East Verde River is low because there are no historical records for northern leopard frogs in the East Verde River and its tributaries where fish may disperse outside the buffered reach. In addition, these drainages are below the elevational range of the frog

(approximately 5,300 ft) (Sredl 1997) and the habitat is less suitable for northern leopard frogs due to the presence of non-native fish, crayfish and salamanders.

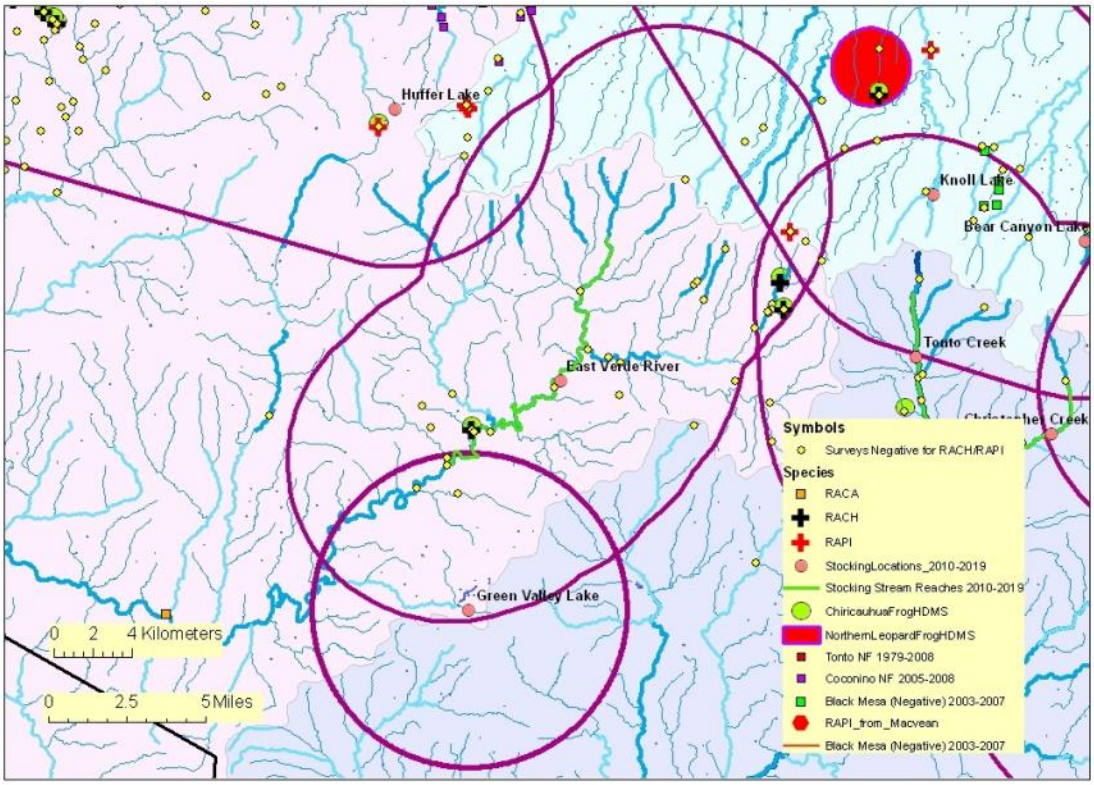

Figure 90. Lower Verde buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Headwater Chub

Headwater chub have been documented to historically occupy the East Verde River Drainage (Minckley 1973). During the first status assessment of headwater chub, chub were documented near the confluence of Webber Creek in both Webber Creek and the East Verde River (Voeltz 2002). This population was identified as an Unstable and Threatened population, due to the low numbers detected and the presence of green sunfish along with other identified threats. Headwater chub were confirmed to be the species of chub occupying upper and middle portions of East Verde River in 2006 (Schwemm 2006). More recently, the reach proposed for stocking

rainbow trout is occupied by headwater chub. According to recent discussions with angler groups that frequently fish within the stocking area of the East Verde River, headwater chub are abundant and often caught with a hook and line (C. Cantrell pers. comm.).

Potential impacts

Potential impacts to chub could result from the predation on small headwater chub, larvae or eggs by stocked rainbow trout. Rainbow trout are primarily insectivorous, but may consume small fish. The area proposed for stocking is occupied by several other competing and predatory non-native species that occur independent of stocking actions (smallmouth bass, green sunfish, crayfish, bullfrogs, etc.). Rainbow trout do not survive the summer, except in the most extreme upstream portions of the East Verde River above the Mail Creek confluence (Gill 2009c).

Gila Trout

Gila trout have been stocked previously into Dude Creek, a tributary to the East Verde River but are not being considered for future stockings as part of this consultation. The last stocking occurred in Dude Creek in 2000 and recent surveys suggest that these fish no longer exist in the stream (Meka 2006). No surveys from the East Verde River have documented Gila Trout within the stocking action area.

Potential impacts

Behnke (2002) reports the maximum known age of Gila trout to be six years. The last stocking of Gila trout into Dude Creek occurred in 2000, suggesting that these fish have all died. The only way that stocked rainbow trout could have an effect on previously stocked Gila trout is if the Gila trout stocked successfully reproduced, which is not to be expected because they have not been found in surveys (Meka 2006).

Green Valley Lakes (Urban Fishing Program water)

Site Description

Green Valley Lakes are a group of three interconnected ponds totaling 13 acres located at Main Street and Green Valley Parkway in Payson (Figure 91). Constructed by the Town of Payson in 1998 as part of their urban park system, the lake was built for: park aesthetics; recreational fishing; reclaimed water use, storage and distribution; groundwater recharge; and for minor flood retention. These artificial lakes have a dirt bottom and have well maintained and grassy edges typical of urban park settings. The main, 10-acre fishing lake has an average depth of 14 feet with a maximum of 21 feet. The upper lake is 2 acres with an average depth of 7 feet and maximum of 12. The middle lake is one acre with a maximum depth of 10 feet. Green Valley Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, fishing dock, parks department office, historic buildings and museum, ball fields, playgrounds and a boat ramp.

Management of Water Body

Since its beginning in 1998, Green Valley Lakes have been managed as an Urban Fishing Program (UFP) lake that is a put-and take trout fishery intensively stocked to provide seasonal high use fishing opportunities for anglers of all ages and abilities. Special regulations are in place for this UFP water, which govern the harvest of trout, catfish, bass, sunfish, and white amur. No live baitfish use is allowed. The newly constructed Green Valley Lakes were approved for the stocking of rainbow trout. No other fish species have been stocked by the Department.

Put-and-take rainbow trout stockings occur every other week from October through May each year. Due to high temperatures, few, if any, rainbow trout persist through the summer. The origin of the existing warm water fish species is unknown.

Creel survey results from 2005 found 20,000 angler use days per year, an angler satisfaction rate of 90% and a 40% youth participation rate. The 2005 creel survey found that 56% of the angling pressure at Green Valley lakes is for rainbow trout. Angler catch rates for trout were 0.53 fish per hour (twice as high as any other Urban Fishing Program water). Over 9,000 rainbow trout were stocked in 2005 and anglers caught more than 14,000 over the year, releasing many of them to be caught again. The return to creel of the stocked trout (number kept versus number stocked) was 98%.

The only fish stocked by the Arizona Game and Fish Department since construction of the lakes has been rainbow trout (Table 85). Many other fish species have been documented from the lake over time (see Community Description below). After installing grating structures at the outflows, the Town of Payson stocked adult white amur into the upper and middle lakes for the biological control of nuisance aquatic vegetation and filamentous algae.

Table 85. Historic Urban Fishing Program fish stocking of Green Valley Lakes

Species	**Years**	**Num. of Stockings**	**Num. of Fish Stocked**
Rainbow trout	1998-2008	150	83,780

Figure 91. Green Valley Lake aerial photo showing upper middle and lower lakes, and the golf course and ponds downstream.

Proposed Action

The Department proposes to stock rainbow trout and channel catfish for the period covered by this consultation.

Catchable rainbow trout would be stocked from multiple times on a seasonal basis (October to May); numbers of trout stocked would range from 0 to 15,000 fish annually.

Catchable channel catfish would be stocked multiple times in the spring and fall seasons; numbers of catfish stocked would range from 0 to 3,500 fish annually.

Water Distribution / Connectivity
Green Valley Lake is an open system water body because it has a large urban watershed inflow and a spillway/overflow and is situated in the ephemeral American Gulch drainage. The main and upper lakes were constructed in the American Gulch drainage, a 3.1 mi^2 urban watershed, to collect storm water runoff for groundwater recharge and flood control. The middle lake is separated from the American Gulch floodplain, but is interconnected to the upper lake by a controlled gate structure that supplies water. A grated outflow structure at the middle lake passes water down to the main lake. The primary source water for all lakes is reclaimed water from the Gila County Wastewater Treatment facility in Payson. Reclaimed water is pumped via pipeline into the upper lake, and then goes through two outflows; a small one into the middle lake, and a large one into the main lake. A pump house is located on the main lake to withdraw water from the lake for park landscape and turf irrigation, and for pipeline deliveries to various municipal and private customers. During precipitation events typical of a 1-year storm event the upper lake spills through a large grated structure/outflow into the main lake. For small to moderate storm events, the main lake spills through a grated overflow culvert, or for larger events flows over the earthen spillway/dam into American Gulch. From Green Valley Lakes, the ephemeral American Gulch is 7 miles long before it joins the East Verde River.

Fish Movement
Because the main Green Valley Lake is part of the American Gulch drainage and floodway and can overflow and spill, stocked fish or their smaller progeny may escape and be flushed downstream traveling the same pathway described in the Water Connectivity section above. During summer or winter runoff events, Green Valley Lake overflows into ephemeral American Gulch which is 7 miles long before connecting to the East Verde River. This drainage connection could conceivably transport stocked fish and their progeny downstream to the East Verde River. No records exist for sampling on American Gulch. An attempt was made to sample American Gulch in summer 2009 but at the time of the visit the stream was dry (N. Robb, pers. comm.).

Community Description
Swanson and Hill (2006) and Rogers (2009b) report rainbow trout (seasonally); channel catfish, flathead catfish, largemouth bass, bluegill, black crappie, and red shiners are present in the lakes.

White amur are present only in the Upper and Middle lakes as a biological method of controlling nuisance aquatic vegetation.

Consultation Species or Critical Habitat
Potential impacts to Chiricahua and northern leopard frogs, headwater chub and Gila trout are discussed below. Potential downstream impacts to northern Mexican and narrow-headed gartersnakes, loach minnow and critical habitat, spikedace and critical habitat and roundtail chub further downstream are discussed in the East Verde Complex and Lower Verde River analysis later in the document.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua leopard frog
Local Analysis: Although Green Valley Lake is within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to stocked fish in the buffered stocking site is low. There have been 9 surveys at 4 sites within the buffered stocking site between 1935 and 2009 with no reported observations of Chiricahua leopard frogs at Green Valley Lake or the buffered stocking complex (Figure 90, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) Although available habitats have not been adequately surveyed, it is unlikely that Chiricahua leopard frogs occupy Green Valley Lake and its buffered complex because the area is below the range of the frog (5,300 ft) (Sredl 1997). In addition, the presence of non-native fish in Green Valley Lake and the East Verde River reduce the likelihood that northern leopard frogs can persist within the buffered stocking site.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish stocked in Green Valley Lake is low, because there are no historical records and areas where fish can disperse are below the range of the Chiricahua leopard frog (approximately

5,300 ft) (Sredl 1997). In addition, the habitat in these drainages is less suitable for Chiricahua leopard frogs due to the presence of non-native fish.

Northern Leopard Frog

Local Analysis: Although Green Valley Lake is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to stocked fish in the buffered stocking site is low. There have been 9 surveys at 4 sites within the buffered stocking site between 1935 and 2009, with no reported observations of northern leopard frogs at Green Valley Lake or within the buffered stocking site (Figure 90, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) Although available habitats have not been adequately surveyed, it is unlikely that northern leopard frogs occupy Green Valley Lake and its buffered complex because the area is below the range of the frog (5,300 ft) (Sredl 1997). In addition, presence of non-native fish in Green Valley Lake and the East Verde River make the habitat within the buffered stocking site less suitable for northern leopard frogs.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish stocked in Green Valley Lake is low, because there are no historical records and areas where fish can disperse are below the range of the northern leopard frog (approximately 5,300 ft) (Sredl 1997). In addition, the habitat in these drainages is less suitable for northern leopard frogs due to the presence of non-native fish.

Headwater Chub

Headwater chub are not present in Green Valley Lake or in American Gulch. They are documented near the headwaters of the East Verde River, as stated above in the East Verde River stocking site consultation species description. Headwater chub have also been historically documented in some tributaries of the East Verde River (i.e. Pine Creek, the Gorge).

Potential Impacts

Potential impacts to headwater chub resulting from the stocking of rainbow trout and channel catfish in Green Valley Lake may result if those fish move out of and have access to occupied habitat in the East Verde River. Potential impacts for roundtail chub will be assessed in the East Verde River Complex Analysis, below.

EAST VERDE RIVER COMPLEX ANALYSIS

Water distribution

The East Verde River from Highway 87 to the headwaters and the Green Valley lakes were discussed in this document previously. The following discussion will cover the East Verde downstream.

The East Verde Watershed begins below the Mogollon Rim and flows into the lower Verde River (Figure 86and Figure 87). The East Verde River is interrupted-perennial for most of its length downstream of Highway 87, and is mostly dry near the confluence with the Verde River, based on USGS gage data. Major intermittent tributaries downstream of Highway 87 include Sycamore Creek, Ash Creek, Pine Creek (intermittent/perennial interspersed), and Rock Creek.

Green Valley Lake drains into the ephemeral drainage of American Gulch, which in turn empties into the East Verde River approximately 4 miles west of Payson, Arizona and 12 miles downstream from Webber Creek and 7 miles downstream of Ash Creek. City Creek, after merging with Hail Creek, intermittently enter the East Verde 7 miles downstream of American Gulch.

Pine Creek enters the East Verde River 9 miles farther downstream. Pine Creek flows off the Mogollon Rim on the Tonto National Forest north of the town of Pine, Arizona. It flows south to its confluence with the East Verde River approximately 18 miles downstream of the nearest rainbow trout stocking site. Perennial reaches (in the upper reaches below HWY 87) are interspersed with sections of intermittent flow down to the confluence with the East Verde. The section at the confluence of the East Verde was dry in late September of 2008 and then intermittent for two miles upstream. Pine Creek is also typically dry from Camp Lo Mia downstream to the Tonto Natural Bridge.

Rock Creek has intermittent/ephemeral flow into Walnut Canyon that flows intermittent into the East Verde 1.5 miles downstream of the confluence with Pine Creek. Boardinghouse Canyon also has intermittent flow to the East Verde near the confluence with Walnut Canyon.

The Gorge merges with Greenhorn Canyon intermittently to enter the East Verde River 9 miles downstream of the Pine Creek confluence. This is the last tributary to the East Verde River that is known to have perennial flow. The extent of perennial water is unknown, but a 2009 survey documented flow at the confluence to the terminus of the survey over 0.6 miles upstream with fish noted throughout (Burger and Gill 2009). From The Gorge confluence it is roughly 5 miles to the Lower Verde River confluence.

Flows in the lower East Verde River are highest from January through March and lowest in June and July (Figure 92). Burger and Gill (2009) conducted a fish survey of the lower East Verde River, from LF Ranch to the Verde River confluence, in March 2009. The LF Ranch is located approximately 13 miles from the confluence with the Verde. Discharge in the East Verde River at the time of the survey was 15 cfs. Based on historical discharge data, the East Verde River has gone dry at times though this portion of the stream (Table 86). The overall lack of fish observed or sampled in the mainstem East Verde River supports the notion that much of the stream dries. The middle portion of the sampled reach does contain several deep (> 1.5 m) pools that likely contain at least some water during dry periods. These pools may be important for the long term

survival of fish in this section of river, although at the time of sampling, the pools looked to be relatively devoid of fish.

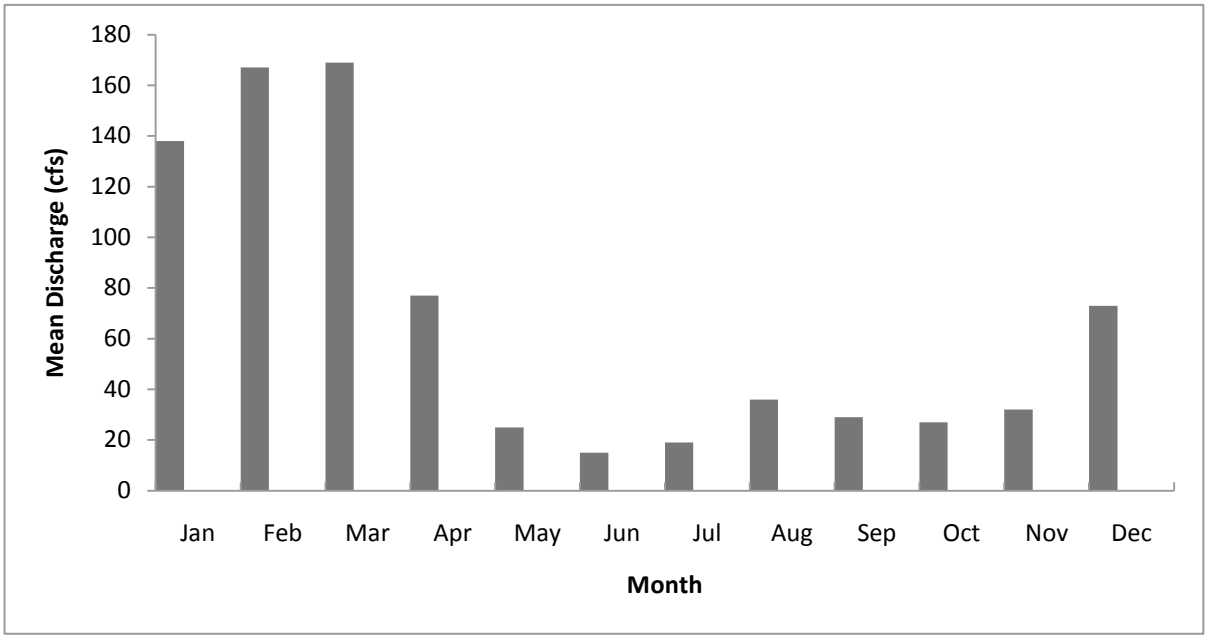

Figure 92. Mean monthly discharge (cfs) for the USGS gage downstream at the Lower East Verde near Childs, AZ for the period from 9-1-61 to 9-30-08.

Table 86. Mean monthly discharge (cfs) for the USGS gage downstream at the Lower East Verde near Childs, AZ for the period from January 2000 to September 2008.

	Year								
Month	2000	2001	2002	2003	2004	2005	2006	2007	2008
Jan	4.8	9.1	5.8	2.7	5.3	414.8		6.6	813.6
Feb	7.0	29.2	5.4	225.3	4.3	759.1		14.8	278.4
Mar	14.9	191.8	4.2	510.2	5.8	131.1		4.5	75.4
Apr	4.8	33.4	2.5	13.5	5.0	37.6		2.8	18.9
May	0.4	7.8	0.5	4.2	0.8	20.2		0.5	9.6
Jun	0.5	5.7	0.0	0.3	0.0	5.1		0.1	2.0
Jul	0.0	25.9	0.0	5.4	4.8	13.4		12.7	14.2
Aug	3.0	27.7	0.0	2.5	2.1	53.3		231.0	3.6
Sep	1.2	11.3	3.4	4.2	43.6	3.2		90.3	5.6
Oct	128.5	13.9	0.4	0.5	16.5		2.4	0.9	
Nov	53.0	5.0	1.0	1.9	96.9		2.9	1.6	

Dec	7.1	7.1	2.0	3.7	200.6		4.1	802.9	

Fish Movement
Stocked fish also have the ability to move freely downstream all the way to the confluence with the Verde River. This is most likely to occur during high winter flows from rain events. A gauging station on the lower East Verde River shows that the highest flows occur during this period (Figure 92) and stream temperatures would be more amenable to trout survival at this time. The East Verde River dries in the lower portions at base flow and temperatures become too warm for trout at this time. Burger and Gill (2009) did not document any trout or channel catfish on a survey that began just upstream of LF Ranch and extended downstream to the Verde River confluence in March 2009.

Channel catfish and rainbow trout would have the ability to move out of Green Valley Lake only during high flow events because the lake typically does not spill except during these periods. If fish were flushed out of Green Valley Lake they would have the ability to move down American Gulch to the East Verde River. Once in the East Verde River they would have the ability to move upstream to the natural waterfall between the Ellison Creek confluence and Waterwheel. Downstream movement would be unrestricted. Once in the Lower Verde River channel catfish would be able to move upstream into the Middle Verde River or downstream to Horseshoe Lake and beyond.

Community Description
LCRB Aquatic GAP data indentifies longfin dace, yellow bullhead, goldfish, desert sucker, Sonoran sucker, red shiner, headwater chub, green sunfish, smallmouth bass, rainbow trout, speckled dace, and Gila trout have been collected from the East Verde River.

Surveys noted the presence of nonnative rainbow trout, green sunfish, yellow bullhead, smallmouth bass, fathead minnow, and red shiner, as well as native Sonora sucker, desert sucker, longfin dace, and roundtail chub, which was likely headwater chub, in the East Verde River (Clark 1997; Burger 2008a; Burger and Gill 2009; Gill 2009c). Green Valley Lake contains rainbow trout (seasonally), channel catfish, flathead catfish, largemouth bass, bluegill, black crappie, and red shiners (Swanson and Hill 2006; Rogers 2009b).

A survey in 1997 (Clark 1997) of an approximately 1 mile stretch of the East Verde River approximately 2 miles below the East Verde River and American Gulch confluence, approximately 25 miles above the confluence with the Verde, found green sunfish, Sonora sucker, roundtail chub, yellow bullhead, smallmouth bass, and fathead minnow. Crayfish were also numerous.

A spot check survey of the East Verde River in late September 2008, upstream and in the vicinity of the Doll Baby Ranch, approximately 18 miles above the confluence with the Verde, found desert sucker, fathead minnow, red shiner, yellow bullhead, and green sunfish, as well as crayfish (Burger 2008a). The East Verde River was dry for at least ¼ mi above the Pine Creek confluence.

A more recent spot check survey of the East Verde River was conducted from LF Ranch to the confluence with the Verde River between March 22 and 24, 2009 (Burger and Gill 2009). The survey used visual observations, dip net surveys, minnow trap surveys, and some hook-and-line sampling. The survey documented the presence of non-native green sunfish, fathead minnow, smallmouth bass, and largemouth bass. Green sunfish were noted to be common in most slack-water habitats. The only native fish species documented in the East Verde River proper was longfin dace. No chub species were collected or observed in the mainstem East Verde River. Additionally, no rainbow trout or channel catfish were observed or collected throughout the survey.

Records from the Native Fish Database show roundtail chub observations in the late 1990s, from above the Webber Creek confluence to downstream near the Pine Creek Confluence.

A number of recent surveys have been conducted on tributaries to the East Verde River (Table 84). These surveys are discussed below beginning in the headwaters of the East Verde River and moving downstream.

A visual survey was conducted in 2008 on lower Pine Creek from the confluence to approximately 2 miles upstream (Burger 2008a). Desert sucker, chub spp. (likely headwater), longfin dace, red shiner, yellow bullhead, and green sunfish were observed. No trout were observed in this stretch nor did the habitat appear suitable for trout. Rainbow trout were collected above Camp Lo Mia on upper Pine Creek in 2007 and the population was noted to be entirely of wild origin (Gill 2007b). This is much better trout habitat than the lower portion. It is higher elevation, with cooler water temperatures and stretches with run, pools, and riffles. The lower portion was mostly comprised of warm pools of water.

A visual survey was also conducted in 2008 on lower Rock Creek (Burger 2008b). That survey noted the presence of native desert sucker and longfin dace. The only nonnative fish species noted in Rock Creek was red shiner (Table 87).

Burger and Gill (2009) surveyed approximately 200 – 300 m of The Gorge, located approximately 6 miles from the Verde River confluence, in March 2009. Multiple age classes of green sunfish and headwater chub were collected from pools in the lower portion of The Gorge. Native longfin dace and a native sucker (likely desert sucker) were also observed.

Narrow-headed gartersnakes are found in the East Verde River (see complex analysis).

Table 87. Summary of the most recent fish surveys in East Verde River Tributaries downstream of highway 87

2008	Jamie Evans Holly Hicks William Lemon	North Sycamore	Visual	Evans 2008. Highline trail trip report.	No fish seen
2008	Bill Burger Natalie Robb	Pine Creek	Visual Dipnet	Burger 2008a. Fish and Herp survey of East Verde, Rock, and Pine Creek.	Desert Sucker Longfin Dace UnID Chub Red Shiner Yellow bullhead Green sunfsh Crayfish
2008	Curt Gill Bill Burger	Pine Creek	Backpack Shocker	Gill 2007. Pine Creek Fish Survey.	Rainbow trout N = 101 (60-205mm)
2008	Bill Burger Natalie Robb	Rock Creek	Visual Dipnet	Burger 2008a. Fish and Herp survey of East Verde, Rock and Pine Creek.	Desert Sucker Longfin Dace Red Shiner Crayfish
2009	Bill Burger Curt Gill	The Gorge	Minnow Trap Hook-and-Line Dipnet	Burger and Gill 2009.	Green sunfish UnID chub desert sucker

Consultation Species or Critical Habitat

Potential impacts to headwater chub, Gila trout, northern Mexican and narrow-headed gartersnakes are discussed below. Potential downstream impacts to northern Mexican and narrow-headed gartersnakes, headwater and roundtail chub, spikedace and critical habitat, razorback sucker and critical habitat, loach minnow, desert pupfish, Gila topminnow and Colorado pikeminnow are discussed in the Lower Verde River analysis. Chiricahua and northern leopard frogs were discussed previously in the site analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican and narrow-headed gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Chiricahua Leopard Frog
See Local and Broad Scale analyses under each stocking location.

Northern Leopard Frog
See Local and Broad Scale analyses under each stocking location.

Northern Mexican Gartersnake
Stocking complex analysis: The East Verde River stocking complex is considered unoccupied by northern Mexican gartersnakes. There are no records of the species within the East Verde River complex (HDMS). The closest locality to the complex is at Tonto Creek (HDMS; Holycross et al. 2006), which drains to the Salt River and is about 10.6 air mi from Green Valley Lake and 15.5 air mi from the East Verde stocking reach. The intervening landscape is rugged and generally unsuitable for northern Mexican gartersnakes and dispersal from those sites to the East Verde River complex is highly unlikely. There is a questionable historical (1933) record for a northern Mexican gartersnake from Hart Canyon, a tributary of Willow Creek (approx. 18.6 air mi from the East Verde stocking reach and about 25 air mi from Green Valley Lake), for which Holycross et al. (2006) provide this analysis: "Wright and Wright (1957) discuss a *T. eques* from Hart Canyon....and provide both a physical description and photographs (p. 802). Unfortunately, it is difficult to tell from the photographs or description whether or not this specimen is a *T. eques*, so the specimen is not mapped…Whether [this record is valid] is a question that needs to be resolved, if possible." Regardless of the credibility of this record, it is unlikely that northern Mexican gartersnakes would disperse across the Mogollon Rim to the East Verde River complex from this site. Also, Green Valley Lake does not provide suitable habitat for the species.

Previous fish surveys in the East Verde River have documented smallmouth bass, green sunfish, crayfish, and bullfrogs (Clark 1997, Burger 2008a, Burger and Gill 2009), making the system less suitable habitat for northern Mexican gartersnakes. Without historical records from the stocking complex and the lack of suitable habitat, there is no likelihood of exposure to fish stocked within the East Verde River complex.

Downstream analysis: Downstream of the East Verde River complex, there are two unvouchered sightings of northern Mexican gartersnakes, and the status of the northern Mexican gartersnakes along that part of the Verde River is unknown. A northern Mexican gartersnake was observed in 1986 at Houston Creek just below the confluence of the East Verde and Verde rivers (approx. 33.5 river mi downstream of the East Verde stocking reach) (Rosen and Schwalbe 1988). There is an additional record from Horse Creek from 1986, a tributary to the Verde River approx. 22 river miles downstream of the East Verde confluence (Rosen and Schwalbe 1988). If fish stocked in the East Verde River complex dispersed into the East Verde and Verde Rivers, there is likelihood that northern Mexican gartersnakes could be exposed to rainbow trout and channel catfish.

Narrow-Headed Gartersnake

Stocking complex analysis: The current status of narrow-headed gartersnakes in the East Verde River is unknown. The East Verde River supported a population of narrow-headed gartersnakes possibly as late as 1992 (Holycross et al. 2006). There are multiple observations of narrow-headed gartersnakes (1981-1986) from 0-3 river miles downstream of the East Verde River stocking reach (HDMS; Rosen and Schwalbe 1988). There is an unsubstantiated observation of an individual from Pine Creek, which flows into the East Verde, but there is no date associated with this record (Holycross et al. 2006). The species was not found during surveys in the East Verde in 2004 and 2005; however the physical habitat appeared suitable despite the presence of crayfish and non-native fish (Holycross et al. 2006). The abundance of non-native and predatory fishes, especially spiny-rayed sunfishes and catfishes may negatively affect their foraging and movement potential and may preclude their persistence in this area. It is possible narrow-headed gartersnakes still exist in the East Verde in low numbers, or that the species could disperse into the East Verde River from populations on the Verde River upstream. Therefore, there is likelihood narrow-headed gartersnakes could be exposed to stocked rainbow trout or channel catfish in the East Verde River.

Downstream analysis: Narrow-headed gartersnakes likely persist in low densities in the Verde River (Holycross et al. 2006). There is a 2005 record of a narrow-headed gartersnake from Ikes Backbone in the Verde River, approx. 34 river mi downstream of the East Verde River complex (HDMS; Holycross et al. 2006). If stocked sportfish disperse from the complex into the East Verde and Verde Rivers, there is likelihood of exposure to narrow-headed gartersnakes.

Headwater Chub

Headwater chub have been documented to historically occupy the East Verde Drainage (Minckley 1973). Records from the Native Fish Database show roundtail chub observations in the late 1990s, from above the Webber Creek confluence to downstream near the Pine Creek Confluence. In 1997 headwater chub were documented in East Verde River downstream of American Gulch (AGFD unpublished). During the first status assessment of headwater chub,

chub were documented near the confluence of Webber Creek in both Webber Creek and the East Verde River (Voeltz 2002). This population was identified as an Unstable and Threatened population, due to the low numbers detected and the presence of green sunfish along with other identified threats. In 2007 and 2008, AGFD documented headwater chub in two tributaries of the East Verde River. These tributaries were Pine Creek and the Gorge. More recently, the reach proposed for stocking rainbow trout is occupied by headwater chub. According to recent discussions with angler groups that frequently fish within the stocking area of the East Verde, headwater chub are abundant and often caught with a hook and line (C. Cantrell pers. comm.).

Recent fires in the drainage area may have impacted the population occupying the stocking area. No recent surveys have been implemented to document the abundance of headwater chub pre and post these fires.

Potential Impacts

Potential impacts to chub from rainbow trout are primarily insectivorous, but may consume small fish, eggs and larvae. However, the main impact would likely be competition for food and space before the trout perished in the summer.

Potential impacts to chub from channel catfish would likely be competition for food and space but more likely from the predation on headwater chub and their eggs and larvae.

Channel catfish leaving the Green Valley Lakes would have to be transported or swim over 5 miles r in one season to access the East Verde River, where headwater chub are located. Channel catfish could survive the summer if water existed in the intervening reaches. To date, no records have been documented of channel catfish in American Gulch or the East Verde River.

The area proposed for stocking is occupied by several other competing and predatory non-native species that occur independent of stocking actions (smallmouth bass, green sunfish, crayfish, bullfrogs, etc.), which would be expected to outcompete and predate on trout. In addition, rainbow trout would not be expected to persist in the East Verde, except above the Mail Creek confluence (Gill 2009c) because of summer temperatures.

Gila Trout

Gila trout have been stocked previously into Dude Creek, a tributary to the East Verde River but are not being considered for future stockings. The last stocking occurred in Dude Creek in 2000 and recent surveys suggest that these fish no longer exist in the stream (Meka 2006). No surveys from the East Verde River have documented Gila Trout within the stocking action area.

Potential Impacts

Behnke (2002) reports the maximum known age of Gila trout to be six years. The last stocking of Gila trout into Dude Creek occurred in 2000, suggesting that these fish have all died. The only

way that stocked rainbow trout could have an effect on previously stocked Gila trout is if the Gila trout stocked successfully reproduced, which is not expected because they have not been found in surveys (Meka 2006).

LOWER VERDE RIVER SUB-WATERSHED ANALYSIS

The Lower Verde River is not proposed for sport fish stocking. The proposed stocking that may impact this area are in the Upper Verde watershed and the Middle Verde River Complex. The proposed stockings on the East Verde River are at a minimum approximately 33 miles upstream of the confluence with the lower Verde. The Lower Verde River has historically been a self-sustaining warm-water fishery with recent regulatory changes allowing unlimited harvest of non-native fishes (AGFD 2009a).

Water Distribution / Connectivity

Water distribution and connectivity, fish movement, and aquatic community descriptions were discussed for the upper and middle Verde River, upper and lower East Verde River, and Green Valley Lake, and will not be repeated here. Impacts to sensitive species in the Lower Verde River sub-watershed attributable to stocking actions in the East Verde River Complex are discussed below. Potential impacts from fishes stocked further upstream in the Middle Verde complex and coming through the Upper Verde River from other upstream complexes are also comprehensively included.

For the purposes of this consultation, the Lower Verde River begins at Childs and continues downstream to Horseshoe Lake, a distance of 36 miles. There are number of intermittent perennial tributaries to the Lower Verde River: Fossil Creek, East Verde River, Red Creek, Wet Bottom Creek, and Tangle Creek.

Fossil Creek is a perennial warm-water stream that flows for 14 miles and empties into the Verde River from the east. Fossil Creek flows into the Lower Verde River 3.8 miles downstream of Childs. The stream was recently renovated and upstream of a constructed barrier the stream is composed of entirely native fish.

The East Verde River empties into the Verde River 3.3 miles downstream from Fossil Creek. There are a number of interrupted perennial tributaries to the East Verde River from the headwaters to the confluence with the Verde River, including; Mail Creek, Dude Creek, Chase Creek, North Sycamore Creek, Ellison Creek, Webber Creek, Pine Creek, and The Gorge.

Red Creek empties into the Lower Verde River 16.2 miles downstream of the East Verde River. From there it is 0.8 miles to Wet Bottom Creek. Tangle Creek converges with the Lower Verde River 8 miles downstream from Wet Bottom Creek. Sycamore Creek enters from the east just under 0.6 miles farther downstream. From Sycamore Creek it is 8.3 miles to Horseshoe Dam.

Typically, the Lower Verde River experiences high flow in the winter and much reduced flows in the summer. Mean monthly flows at the USGS gauge at Tangle Creek range from 120 cfs in June to 1,470 cfs in February (Figure 93).

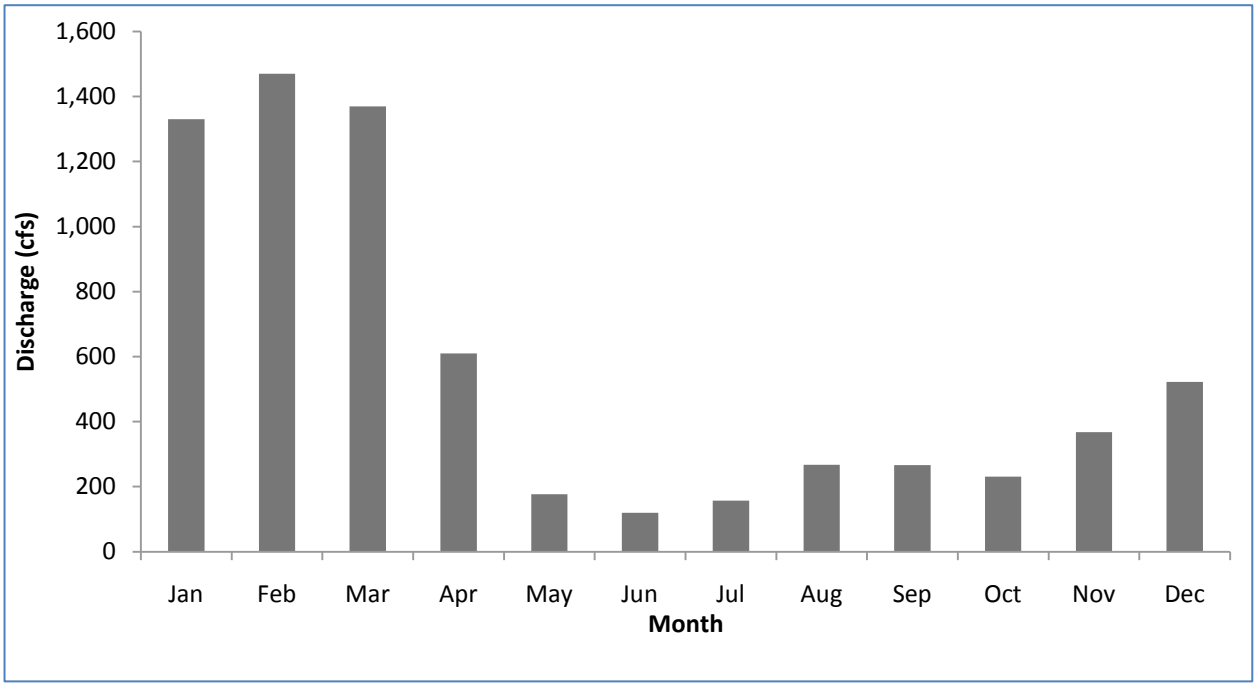

Figure 93. Mean monthly discharge (cfs) for the USGS gage on the Lower Verde River below Tangle Creek for the period from 10-1-85 to 9-30-08.

Fish Movement

Movement of stocked fish out of the proposed stocking locations upstream of Childs and in the East Verde River was previously discussed. Once in the mainstem Verde River below Beasley Flats, fish can move throughout the river system. Most of the tributaries to the Verde River are intermittent at their confluences, minimizing the chance for upstream movement into them. It is possible that fish could move upstream into tributaries during periods of high flow or after run-off events.

Once in the Verde River it would be possible for trout to move upstream to the next partial barrier (Verde Falls located between Beasley Flats and Childs) or downstream to Horseshoe Lake, but only during cooler seasons or when water temperatures allow. Survival of stocked rainbow trout in the Verde River would be limited to less than a year and they could not establish populations because temperatures become too warm for trout survival by summer.

In addition, even when water temperatures would be suitable for the different types of fish proposed for stocking, as indicated above most of the tributaries streams are ephemeral near the confluence with the Verde River making fish movement into those streams only opportunistic during a high flow event.

Community Description
The aquatic assemblage for the East Verde River, its tributaries, and Green Valley Lake were discussed in the previous sections. The aquatic community for the Lower Verde River and its tributaries is discussed below.

LCRB Aquatic GAP data identified 19 species of fish have been collected in the lower Verde River from 1974 to 2003. These are longfin dace, yellow bullhead, desert sucker, Sonoran sucker, common carp, red shiner, threadfin shad, mosquitofish, roundtail chub, channel catfish, green sunfish, redear sunfish, sunfish hybrid, largemouth bass, smallmouth bass, Colorado pikeminnow, flathead catfish, white crappie, and razorback sucker.

The Lower Verde River has been stocked in the past with smallmouth bass and more recently with Colorado pikeminnow and razorback sucker (Table 7). The Department has stocked both the upper and lower Verde River with Colorado pikeminnow and razorback sucker. On the lower Verde River, stockings occur at Beasley Flats and at Childs. From 1981 to 1991 stockings were conducted with fry and fingerling sized fish (Hendrickson 1993). Since 1991, reintroduction efforts in the Verde River have focused on stocking large razorback suckers and Colorado pikeminnow. The minimum size currently being stocked for both species is ten inches.

Table 7. Stocking History for the Lower Verde River

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Smallmouth Bass	1960	1960	1	74
Colorado Pikeminnow	1993	2006	20	14,940
Razorback sucker	1993	2005	30	26,373
Total			51	41,387

From 1994-1998 AGFD placed coded wire tags on each pikeminnow and razorback suckers stocked to assess survival and movement; of the 24,915 razorback suckers stocked in the past 14 years, only one has been recaptured. Hyatt (2004) summarized the capture of razorback sucker (Table) and Colorado Pikeminnow (Table) for surveys conducted between 1990 and 2003. In May 2002, one razorback sucker with a pit tag was captured near Childs. The fish was tagged in 1999 and released in the same pool. A pit tagged Colorado pikeminnow has never been recaptured. Additional research is needed to determine if these fishes can successfully spawn and

recruit offspring into the adult population. There is no evidence of successful reproduction of Colorado pikeminnow or razorback sucker in the Verde River (Hyatt 2004; Jahrke and Clark 1999).

Narrow-headed and northern Mexican gartersnakes are found in the Lower Verde River Watershed (see watershed analysis).

Table 8. Captures of Razorback Suckers by AGFD electrofishing, seines, and trammel nets (Hyatt 2004).

Species	**Year**	**Total # Captured**
Razorback Sucker	1990	46
Razorback Sucker	1991	3
Razorback Sucker	1992	2
Razorback Sucker	1993	34
Razorback Sucker	1994	104
Razorback Sucker	1996	3
Razorback Sucker	1997	28
Razorback Sucker	1998	20
Razorback Sucker	1999	17
Razorback Sucker	2000	12
Razorback Sucker	2001	2
Razorback Sucker	2002	9
Razorback Sucker	2003	3

Table 9. Captures of Colorado Pikeminnow by AGFD electrofishing, seines, and trammel nets (Hyatt 2004).

Species	**Year**	**Total # Captured**
Colorado Pikeminnow	1992	3
Colorado Pikeminnow	1996	26*
Colorado Pikeminnow	1997	24
Colorado Pikeminnow	1998	30
Colorado Pikeminnow	1999	3
Colorado Pikeminnow	2003	1

*23 captured in Horseshoe Reservoir

Surveys were conducted annually on the Lower Verde River by AGFD fisheries personnel between 2001 and 2007. These surveys were conducted from Childs to Sheeps Bridge. Twelve species, including four native species, were documented in these surveys and Gill (2007c)

provided a summary of the surveys conducted between 2002 and 2007 (Table 10). Mosquito fish, yellow bullhead, goldfish, and bluegill have also been documented in portions of the Lower Verde River and/or in Horseshoe Reservoir (Burger 2001; Robinson 2007).

Surveys have also been conducted in the past on many of the tributaries to the mainstem Lower Verde River (Table 11). Burger (2009) documented the aquatic species composition for the lower portions of Squaw Creek and Sycamore Creek; they contained only native species. The only non-native species collected in Red Creek was green sunfish. Wet Bottom Creek contained a mix of natives and non-natives.

Table 10. Summarized comparison of Verde River fisheries survey electrofishing data from 2002 to 2007, excluding carp and red shiner (Gill 2007c).

	Relative Abundance (%)					
Year→ Species↓	**2002 (N)**	**2003 (N)**	**2004 (N)**	**2005 (N)**	**2006 (N)**	**2007 (N)**
CACL	4.9	6.7	5.7	1.1	6.6	18.3
	(19)	(18)	(5)	(10)	(10)	(33)
CAIN	8.6	12.2	21.6	1.4	12.5	32.2
	(33)	(33)	(19)	(12)	(19)	(58)
ICPU	4.4	3.0	0	1.1	2.6	3.3
	(17)	(8)	(0)	(9)	(4)	(6)
LECY	3.9	8.1	2.2	0.1	2.6	2.2
	(15)	(22)	(2)	(1)	(4)	(4)
LEMA	2.3	0.4	2.2	0	0.0	0.6
	(9)	(1)	(2)	(0)	(0)	(1)
MIDO	18.2	20.7	25.0	4.5	52.6	11.7
	(70)	(56)	(22)	(38)	(80)	(21)
MISA	15.9	24.4	17.0	0.6	6.6	3.3
	(61)	(66)	(15)	(5)	(10)	(6)
PYOL	39.3	23.0	21.6	1.3	15.1	28.3
	(151)	(62)	(19)	(11)	(23)	(51)
PTLU	0	0.4	0	0	0.0	0.0
	(0)	(1)	(0)	(0)	(0)	(0)
XYTE	2.3	1.1	4.5	0.2	1.3	0.0
	(9)	(3)	(4)	(2)	(2)	(0)
Overall	(384)	(270)	(88)	(79)	(152)	(180)

Table 11. Summary of the most recent fish surveys on the Lower Verde River Tributaries. Tributaries are listed in the order that they flow into the East Verde River, starting in the headwaters.

Year	Collector(s)	Stream	Survey Type	Source	Species
2008	Jesse Bahm and Codey Carter	Fossil Creek	Visual Dipnet	Carter 2008. Fossil Creek Gila Topminnow Survey	longfin dace, speckled dace, dessert sucker, Gila topminnow, desert pupfish, razorback sucker, roundtail chub
2009	Bill Burger, Curt Gill, and Jon Hanna	Red creek	Visual dipnet	Burger 2009. Verde River and Tributaries, Childs to Horseshoe Dam	longfin dace, dessert sucker, green sunfish
2009	Bill Burger, Curt Gill and Jon Hanna	Wet Bottom Creek	Visual dipnet	Burger 2009. Verde River and Tributaries, Childs to Horseshoe Dam	unid Chub, longfin dace, dessert sucker, green sunfish, smallmouth bass, red shiner
1979	Clarkson, Young	Tangle Creek		Clarkson and Young 1979	longfin dace
2009	Bill Burger, Curt Gill and Jon Hanna	Sycamore Creek	Visual dipnet	Burger 2009. Verde River and Tributaries, Childs to Horseshoe Dam	longfin dace, possible dessert sucker

Consultation Species or Critical Habitat

Potential impacts to northern Mexican and narrow-headed gartersnakes, headwater and roundtail chub, spikedace and critical habitat, razorback sucker and critical habitat, loach minnow, desert pupfish, Gila topminnow and Colorado pikeminnow are discussed below. Chiricahua and northern leopard frogs were discussed previously in the site analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in

Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican and narrow-headed gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Northern Mexican Gartersnake

Watershed analysis: Northern Mexican gartersnakes occupy the Lower Verde River, which lies within the current and historical range of the species, although likely in low numbers (Holycross et al. 2006, HDMS 2009). There are two unvouchered, though reliable, northern Mexican gartersnake observations in the Lower Verde. In 1986, a northern Mexican gartersnake was observed at the confluence of the East Verde and Verde Rivers and another at Horse Creek, north of Horseshoe Reservoir (Rosen and Schwalbe 1988, HDMS 2009). Given the likely presence of the species downstream of the Middle Verde River buffered stocking complex, there is likelihood of exposure to northern Mexican gartersnakes if stocked sport fish disperse from the Upper, Middle or East Verde River stocking sites.

Downstream analysis: There are no records of northern Mexican gartersnakes from the Verde River downstream of the Lower Verde watershed, thus no exposure is anticipated. Although there are historical records of northern Mexican gartersnakes from the Salt River downstream of the confluence with the Verde, northern Mexican gartersnakes are considered extirpated (USFWS 2008a).

Narrow-Headed Gartersnake

Watershed analysis: Narrow-headed gartersnakes occupy the Lower Verde River, which lies within the current and historical range of the species, although likely in low numbers. There is a 1987 gartersnake record from the Verde River at The Falls, approx. 18 river mi upstream of the confluence of Fossil Creek (HDMS 2009). Another was observed in 2005 along the Verde River approx. 1 river mile downstream from the confluence of Fossil Creek (Holycross et al. 2006, HDMS 2009). Therefore, there is likelihood that narrow-headed gartersnakes in the Lower Verde River will be exposed if stocked sport fish disperse from the Middle, Upper, or East Verde River stocking sites.

Downstream analyses: There are no records of narrow-headed gartersnakes below the Lower Verde watershed, thus no downstream exposure is expected (HDMS 2009).

Colorado Pikeminnow

Colorado pikeminnow were extirpated from central Arizona before about 1950. Prior to their disappearance, they were only known from the Verde River at an archaeological site in the Verde Valley and from one record in 1963 near Camp Verde (Sonfishes data). Since the early 1980's,

reintroductions of pikeminnow have occurred throughout the Verde River from the headwaters down to Childs. Colorado pikeminnow in the Verde River and Salt River are designated experimental non-essential under the Endangered Species Act (10j). The species only occurs in Arizona as a result of stocking action by the Arizona Game and Fish Department. No attempts at reproduction have been documented (lack of collection of ripe fish or spawning evidence) and no young have been detected within the Verde River. The USFWS has drafted recovery guidelines for Colorado pikeminnow throughout their range (USFWS 2008). No recovery potential or requirement is provided in those guidelines for a population of pikeminnow in Arizona.

Potential Impacts
Potential impacts could result from the movement of fish out of the stocked reaches. Movement over a minimum of 20 miles from the East Verde Drainage would need to occur in one season for trout or catfish to access the Verde River where Colorado pikeminnow are located.

Channel catfish would survive over the summer if water existed in the intervening reaches. Channel catfish are already well-established in the Verde River. Any trout migrating out of the East Verde River will die in the lower reaches during the summer. Biological response to an exposure between the two species could be competition for food or space if either is limited for Colorado pikeminnow, or predation by rainbow trout and channel catfish on young of year Colorado pikeminnow if they successfully reproduce (which has not been documented) or predation on trout and catfish by pikeminnow (beneficial response). No data exists to indicate that Colorado pikeminnow will migrate into the tributaries from the Verde River.

Desert Pupfish
Desert pupfish were stocked and have established a successful population within Lime Creek, a tributary of the Verde River that flows into Horseshoe Reservoir. In addition Desert pupfish are planned for stockings into Fossil Creek. It is unknown whether they will persist or if movement out of Fossil Creek will occur, but the potential does exist.

Potential Impacts
If pupfish were to wash downstream of both tributary and rainbow trout were able to successfully migrate downstream from the stocking area they could meet in the Verde River. While it is possible that individuals could be washed to downstream areas during flood events, existing literature indicates this will be rare. For example, Minckley and Meffe (1987) determined that, while non-natives are unable to resist flooding events and are washed downstream, native desert fishes show little if any response to flooding events. If individual fish were to be washed downstream it would be anticipated that it would be in low numbers and would likely be preyed upon by the numerous predatory fishes in the Verde River further reducing the opportunity for potential interactions with desert pupfish.

Gila Topminnow

Gila topminnow were stocked in and successfully populating Lime Creek. In addition, topminnows were recently stocked into Fossil Creek as a recovery action. Their persistence has not yet been determined, and movement out of Fossil Creek has also not been documented, but is possible.

Potential Impacts
If topminnows were to wash downstream and rainbow trout were able to successfully migrate downstream from the stocking area they could meet in the Verde River. While it is possible that individuals could be washed to downstream areas during flood events, existing literature indicates this will be rare. For example, Minckley and Meffe (1987) determined that, while non-natives are unable to resist flooding events and are washed downstream, native desert fishes show little if any response to flooding events. If individual fish were to be washed downstream it would be anticipated that it would be in low numbers and would be likely preyed upon by the numerous predatory fishes in the Verde River further reducing the opportunity for potential interactions with Gila topminnow.

Loach Minnow
Loach minnow are determined to be extirpated from the Verde River mainstem. No documented occurrences have been found since 1967. Loach minnow were recently stocked into Fossil Creek as a recovery action. Their persistence has not yet been determined, and potential for movement out of Fossil Creek has also not been documented.

Potential Impacts
If loach minnow were to wash downstream and rainbow trout were able to successfully migrate downstream from the stocking area they could meet in the Verde River. While it is possible that individuals could be washed to downstream areas during flood events, existing literature indicates this would be rare. For example, Minckley and Meffe (1987) determined that, while non-natives are unable to resist flooding events and are washed downstream, native desert fishes show little if any response to flooding events. If individual fish were to be washed downstream it would be anticipated that it would be in low numbers and would be likely preyed upon by the numerous predatory fishes in the Verde River further reducing the opportunity for potential interactions with loach minnow.

Razorback Sucker with Critical Habitat
Razorback suckers have been stocked throughout the Verde River since about 1981. Beginning in 1993, they have only been stocked at or below Beasley Flats. Reproduction has never been documented in the Verde River, but reproductively mature males have been encountered. Reproductive females have not been encountered, nor have larval or young razorbacks, although it should be noted that larval razorback sucker surveys have yet to be conducted.

Critical habitat for the razorback sucker on the Verde River was designated in 1995 and extends from the western boundary of the Prescott National Forest west of Perkinsville to Horseshoe Dam. The Verde River critical habitat unit was described in the biological support document for the designation as contributing to delisting of the species, therefore important for recovery (Maddux et al. 1993). The Middle Verde River reach was described as being altered by diversions, sand and gravel operations, and agricultural and residential development adjacent to the channel that may have affected channel morphology, especially in restricting the river from meandering. Backwaters and riparian areas are degraded. The Middle Verde River also was noted to support a diverse non-native fish community.

At the time of designation, the Verde River supported several constituent elements of critical habitat as described below:

> Water: The Verde River base flow is affected by the diversions that at times, can take all the flow from the river and leave it dry in spots (Kubacki 1998). Inflows from perennial tributaries and irrigation return flows provide some relief, especially in the Verde River beginning at Beasley Flats. There is sufficient flow through this reach to support fish populations.
>
> Physical habitat: The Verde River contained mainstem and backwater habitats, with shallow waters available at the lower ends of perennial tributaries.
>
> Biological environment: At the time of designation, non-native fish species were common in the Verde River with native fishes such as Sonora and desert sucker, roundtail chub, and longfin dace also present. Most of these native species are still present (Gill 2007c); however, the lack of consistent surveys in the reach is unable to document population trends for either native or non-native species.

Additional selection criteria besides the primary constituent elements were developed to assist in selecting critical habitat areas for the razorback sucker:

> Presence of spawning population: There was no spawning population in the Verde River at the time of designation. The Verde River may have supported a spawning population of razorback suckers later than did the Gila or Salt Rivers, as the last razorback sucker from the Verde River was documented in 1954, several years after the species was gone from the other central Arizona rivers.
>
> Nursery habitat: Nursery habitat is available in all reaches of the Verde River.

Historic or present distribution: The reintroduction of razorback sucker into the Verde River began in the 1980s, and the river was considered occupied at the time of designation of critical habitat.

Maintenance of range wide distribution: Potentially the last of the central Arizona rivers to support razorback suckers, the Verde River shares some physical characteristics with the Gila River in terms of elevational changes and the mixture of canyon and open alluvial floodplain areas. The Gila River is also free-flowing in that critical habitat reach, upstream of San Carlos Reservoir. The Gila River supported a large and dominant non-native fish community at the time of designation, similar to the Verde River.

Special management: Maintenance of a natural flow regime that would encourage native fish and discourage non-native fish was also identified as an important management need.

Potential Impacts

Razorback sucker

Potential impacts to the razorback sucker in the lower Verde River may result from the stocking of rainbow trout into the mainstem Verde River, Oak Creek, Wet Beaver Creek, West Clear Creek, East Verde River or from stocking rainbow trout and channel catfish into Green Valley Lake. Effects from stockings in tributaries could occur if the stocked fish moved down into the mainstem or if razorback suckers move into the stocking reaches of Oak Creek, Wet Beaver Creek, West Clear Creek or East Verde River, particularly during the razorback sucker spawning period.

Rainbow trout are documented to prey on razorback sucker larvae in the wild (Mueller 1993) and in a laboratory setting (Carpenter and Mueller 2008). While rainbow trout are not considered particularly piscivorous, they do prey on small fish (Bonar et al. 2004, Propst et al. 1998) and once stocked, may feed on natural foods (Propst et al. 1998). Bonar et al. (2004) also noted that stocked rainbow trout were primarily feeding on insects.

Catchable sized rainbow trout are proposed for stocking in the mainstem from November to March and in the tributaries from March to May and October to November. All fisheries are intended for high intensity use with repeated stockings during the period to maintain sufficient fish for anglers. Kubacki (1998) estimated a return to the creel of stocked trout of 50% in 1997 and 61% in 1998. He also notes that the 78% return from 1996 was done under a different census and should not be compared with the later results. Later creel results from 2000 indicated a return of 40%.

Rainbow trout are stocked before, during and after the probable spawning period for razorback suckers in the Verde River. Robinson (2007) caught seven tuberculate, ripe males in one gill net set in Horseshoe Reservoir in April 2005 where the water had a surface temperature of 19°C. The cluster of males is indicative of staging behavior during the spawning period. No ripe females have been found. No surveys for larval razorback suckers have been initiated, so it is unknown if spawning occurs. Persistence of rainbow trout in the river until May is documented and temperatures in the area currently known to be occupied by razorback suckers (Beasley Flat to Horseshoe Reservoir) remain suitable for rainbow trout until at least April (Robinson 2007).

The distribution of rainbow trout below West Clear Creek to Horseshoe Reservoir is unclear. Bonar et al. (2004) had a survey site at West Clear Creek and the Verde River, and likely that is the source of the rainbow trout they captured in their Reach III, although the specific record is not included in their report. The series of surveys in the Childs to Sheep Bridge and in Horseshoe Reservoir have not documented rainbow trout in that area (Table), even with some surveys done at the times of the year that rainbow trout could be expected to be in the system.

Table 12. Surveys in the Lower Verde River (Childs to Horseshoe Reservoir) that did not document rainbow trout in occupied razorback sucker habitat.

Date of Survey	Location	Source
1995	Childs to Sheep Bridge	Jahrke and Clark 1999
1996	Childs to Sheep Bridge	Jahrke and Clark 1999
1997	Childs to Sheep Bridge	Jahrke and Clark 1999
1998	Childs to Sheep Bridge	Jahrke and Clark 1999
1999	Childs to Sheep Bridge	Jahrke and Clark 1999
10/2001	Childs to Sheep Bridge	Weedman 2001
5/2002	Childs to Sheep Bridge	Weedman 2002
5/2003	Childs to Sheep Bridge	Weedman 2003
6/2004	Childs to Sheep Bridge	Weedman 2004a
2/2004	Horseshoe Reservoir	Weedman 2004b
10/2005	Childs to Sheep Bridge	Robinson 2007
3 and 10/2006	Childs to Sheep Bridge	Robinson 2007
4 and 10/2005	Horseshoe Reservoir	Robinson 2007
3 and 10/2006	Horseshoe Reservoir	Robinson 2007
5/2007	Childs to Sheep Bridge	Gill 2007c

For the Lower Verde, there are no records in the dataset (LCRB Aquatic GAP database) examined for stocked rainbow trout in the current razorback sucker stocking area. The Lower

Verde River is also occupied by many centrarchids, ictalurids and cyprinids (esp. carp and red shiner, known predators on razorback eggs and larvae).

Biological interactions between razorback sucker and trout have not been well studied. However, trout are known to be piscivorous at larger sizes and at younger sizes there may be dietary overlap with razorback suckers. Potential impacts may involve predation and competition in the area stocked with razorback suckers, but only if the trout move out of the East Verde River or other upstream tributaries. Potential interactions increase if the razorback suckers successfully reproduce and recruit (which has not been documented to date) because of the presence of young of year fish.

The draft Razorback Sucker Recovery Goals 2008 revision provides extensive discussion of the effects of non-native fishes on razorback sucker and attempts to control specific species in the upper basin (USFWS 2008). Many nonnative species are identified as concerns for razorback suckers in that document, including carp, channel catfish, flathead catfish, smallmouth bass, largemouth bass, bluegill, green sunfish, red shiner, sand shiner, fathead minnow, walleye and northern pike. Rainbow trout is not included in the list of species of concern.

Control efforts in the Upper Basin are targeted at pike, smallmouth bass and channel catfish specifically, within habitats also occupied by species of trout, where trout are not targeted for removal. It does not appear that trout are a recognized concern for razorback sucker. The Fish and Wildlife Service continues to stock rainbow trout into critical habitat and with a reproducing population of razorback sucker in Lake Mohave and below Davis Dam in the Colorado River.

Channel catfish stocked in Green Valley Lake have the potential to move downstream to the Lower Verde River and interact with razorback suckers in the main channel. Channel catfish could also survive over the summer in the intervening reaches between Green Valley Lake and the Verde River, if pools or water are present. Occurrence of channel catfish in this intervening habitat has not been documented, although recent surveys are limited (Burger and Gill 2009). Channel catfish are already well-established in the Verde River.

Critical habitat

The primary constituent elements of razorback sucker critical habitat include one for the biological environment. This element includes food supply, predation and competition components of the habitat. When critical habitat was established the Service recognized that non-native fish species were common in the Verde River. The Lower Verde River hosts at least 19 species according to the LCRB Aquatic GAP Data 1974 to 2003. These are longfin dace, yellow bullhead, desert sucker, Sonoran sucker, common carp, red shiner, threadfin shad, mosquitofish, roundtail chub, channel catfish, green sunfish, redear sunfish, sunfish hybrids, largemouth bass, smallmouth bass, Colorado pikeminnow, flathead catfish, white crappie, and razorback sucker.

Any stocked rainbow trout or catfish that joined this assemblage would contribute an incremental effect to this constituent element. However, the rainbow trout would not persist in critical habitat through the summer because of the high water temperatures.

Spikedace

Spikedace were recently stocked into Fossil Creek as a recovery action. Their persistence has not yet been determined, and potential for movement out of Fossil Creek has also not been documented. They are also assumed to be present in the upper Verde River above the Peck's Lake diversion dam, where critical habitat is designated, and is addressed in the Middle Verde River Complex discussion.

Potential Impacts

If spikedace were to wash downstream and rainbow trout were able to successfully migrate downstream from the stocking area they could meet in the Verde River. While it is possible that individuals could be washed to downstream areas during flood events, existing literature indicates this will be rare. For example, Minckley and Meffe (1987) determined that, while non-natives are unable to resist flooding events and are washed downstream, native desert fishes show distinctive behavioral responses that make them less susceptible to floods. If individual fish were to be washed downstream it would be anticipated that it would be in low numbers and would be likely preyed upon by the numerous predatory fishes in the Verde River that would further reduce the opportunity for potential interactions with spikedace.

Headwater Chub and Roundtail chub

Headwater chub and roundtail chub genetics and morphology are extremely complicated with similarities that make it difficult to distinguish the two apart. The two species were historically identified as separate sub-species, *Gila robusta robusta and G.r. grahmi*, and now based on those identifications; biologists determine the chub species based upon geography. During high flows many of the populations of these two species occupying the Verde River Drainage have the ability to move and coexist within the same habitat. Due to this inability to separately identify individuals to species, we will discuss them together.

Headwater chub have been documented to historically occupy the East Verde Drainage, Wet Bottom Creek, Deadman Creek, and Fossil Creek within the lower Verde River Drainage (Minckley 1973). Headwater chub were identified to be the species of chub occupying these streams in 1976 (Rinne 1976).

Within the East Verde Drainage, the upper mainstem East Verde, Webber Creek, Pine Creek, and the Gorge have all documented the presence of chub. In 1997, AGFD documented headwater chub near the confluence of American Gulch in the East Verde River. During the first status assessment of headwater chub, chub were documented near the confluence of Webber creek in

both Webber Creek and the East Verde River (Voeltz 2002). This population was identified as an Unstable and Threatened population, due to the low numbers detected and the presence of green sunfish along with other identified threats. In 2007 and 2008, chub were documented in Pine Creek and the Gorge. According to recent discussions with angler groups that frequently fish within the stocking area of the East Verde, headwater chub are abundant and often caught with a hook and line (C. Cantrell pers. comm.). Recent fires in the drainage area may have impacted the population occupying the stocking area. No recent surveys have been implemented to document the abundance of headwater chub pre and post these fires.

Headwater chub were also documented in the status assessment as occupying both Deadman Creek and Wet bottom Creek. Their statuses were stable, threatened and unknown respectively. More recently the presence of chub was confirmed again in Wet bottom Creek (Burger 2009). Roundtail chub have been documented to historically occupy the Verde River mainstream, fossil creek, and have recently been stocked into Roundtree Canyon; a tributary to Red Creek.

As stated above, Fossil Creek contains both headwater and roundtail chub. Fossil Creek was recently renovated to remove non-native fish from the creek in 2005. Since that time the chub populations in Fossil Creek have exploded. Currently the chub is thought to be the most abundant fish within Fossil Creek.

Roundtail chub were considered unstable and threatened in 2002 during the first status assessment for the species. In 2005, the Department has embarked on an aggressive propagation program for roundtail chub within the Verde River Drainage. The objective of this propagation program is to stock the roundtail into the Verde River and its tributaries that currently do not contain a chub species. To date, over 4,000 chub have been stocked into the drainage. Specifically, approximately 2000 were stocked into the lower Verde River, just below Childs power plant, 1000 into Roundtree Canyon and 2000 into ponds in the drainage.

Potential Impacts

Potential impacts to chub could result from the predation and competitive exclusion food and space by stocked rainbow trout or channel catfish. Please refer to the species interactions appendix.

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Chapter 10 SANTA CRUZ RIVER WATERSHED

Physical Geographic Description

Drainage area

The Santa Cruz River Watershed is located in south-central Arizona and Northern Sonora, Mexico. Within the U.S. the watershed encompasses > 8,000 square miles. The river flows in a north direction. There are very few perennial reaches remaining in the drainage: portions of the mainstem Santa Cruz River in the San Rafael Valley, an 11 mi reach downstream of the Nogales Sewage Treatment Plant (effluent dominant segment), and portions of Cienega, Sabino, and Sonoita Creeks. All other reaches in the watershed are either intermittent (flowing seasonally) or ephemeral (flowing in response to precipitation events) and are characterized by broad, flat bottoms with deep sand substrate.

The Santa Cruz River watershed stocking sites for the proposed action are discussed based on location of stocking sites and drainage patterns to the Santa Cruz River. There are six proposed stocking sites and five urban waters in the Santa Cruz basin (Figure 1) The watershed is divided into the Upper Santa Cruz River sub-watershed, Middle Santa Cruz River sub-watershed (including Pantano Wash-Rillito Creek complex) and the Brawley Wash-Los Robles complex.

The channel continues north, paralleling I-19 for 17.5 miles to Amado, where Sopori Wash joins. The Santa Cruz continues north 44 miles to Tucson where the Rillito River (which is formed at the junction of Tanque Verde and Pantano washes) joins. From this point it continues north and west paralleling Interstate 10 where Brawley Wash enters, upstream of where it historically connected to the Gila River. However, the Santa Cruz now rarely flows past the Santa Cruz Flats, just south of Eloy before reaching the Gila River. Santa Cruz Flats is now a large active agricultural area (Figure 2). Cienega Creek, Sabino Creek, Sonoita Creek, Tanque Verde Wash, Canyon del Oro Wash, and Pantano Wash are the primary tributaries of the Santa Cruz. Of these, only Cienega, Sabino, and Sonoita, contain perennial reaches, none of which reach the Santa Cruz under normal flow conditions (Figure 3). The USGS gauge from the Santa Cruz River near Tucson shows the lack of flow, except during the monsoon, over the past 10 years (Figure 4).

Range of Elevations

The watershed ranges from over 9,400 feet in the Santa Rita Mountains to 1,100 feet near the terminus at Santa Cruz Flats.

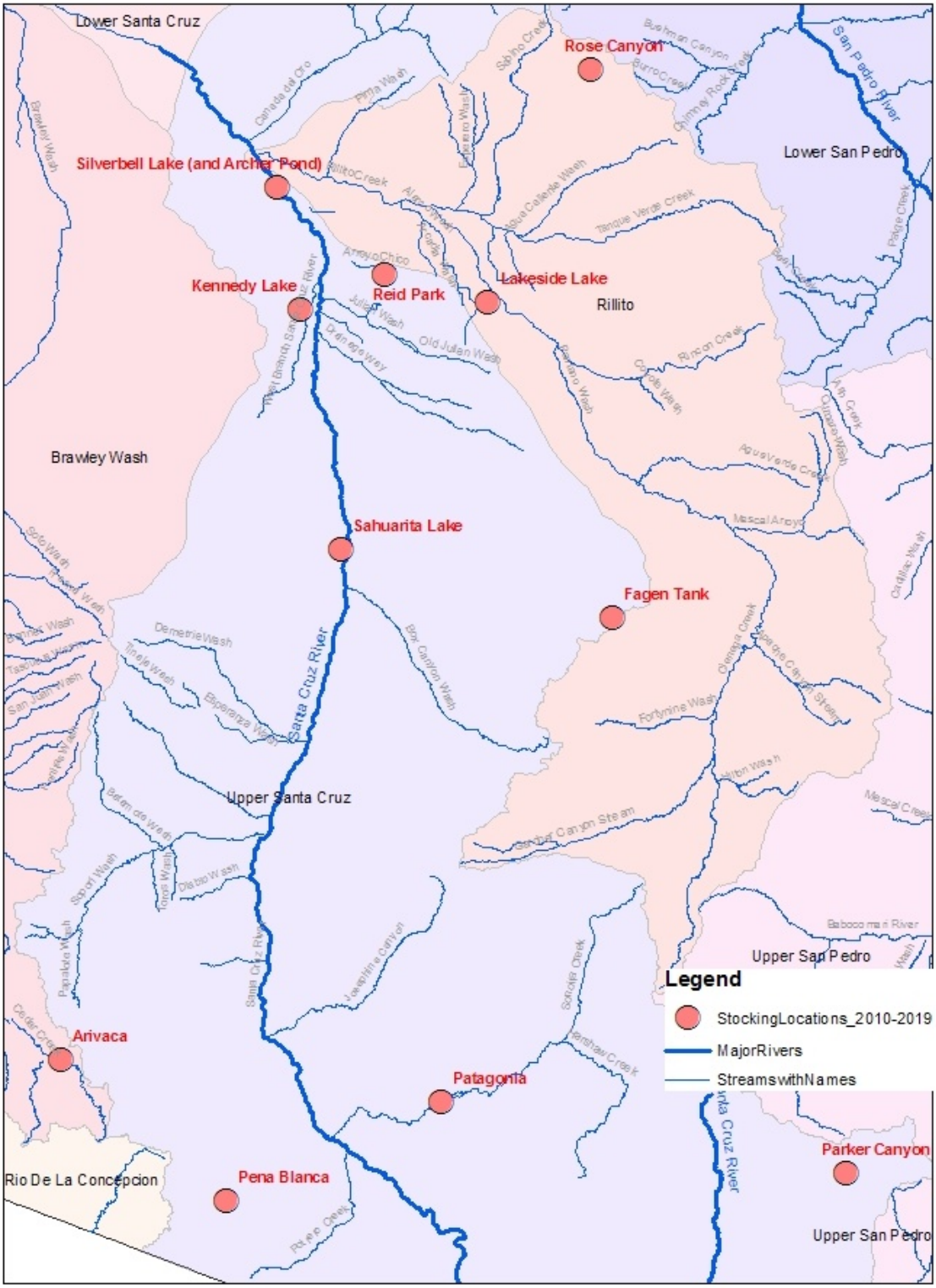

Figure 1. Santa Cruz River sub-watersheds.

Figure 2. Satellite photo showing terminus of Santa Cruz into agricultural fields.

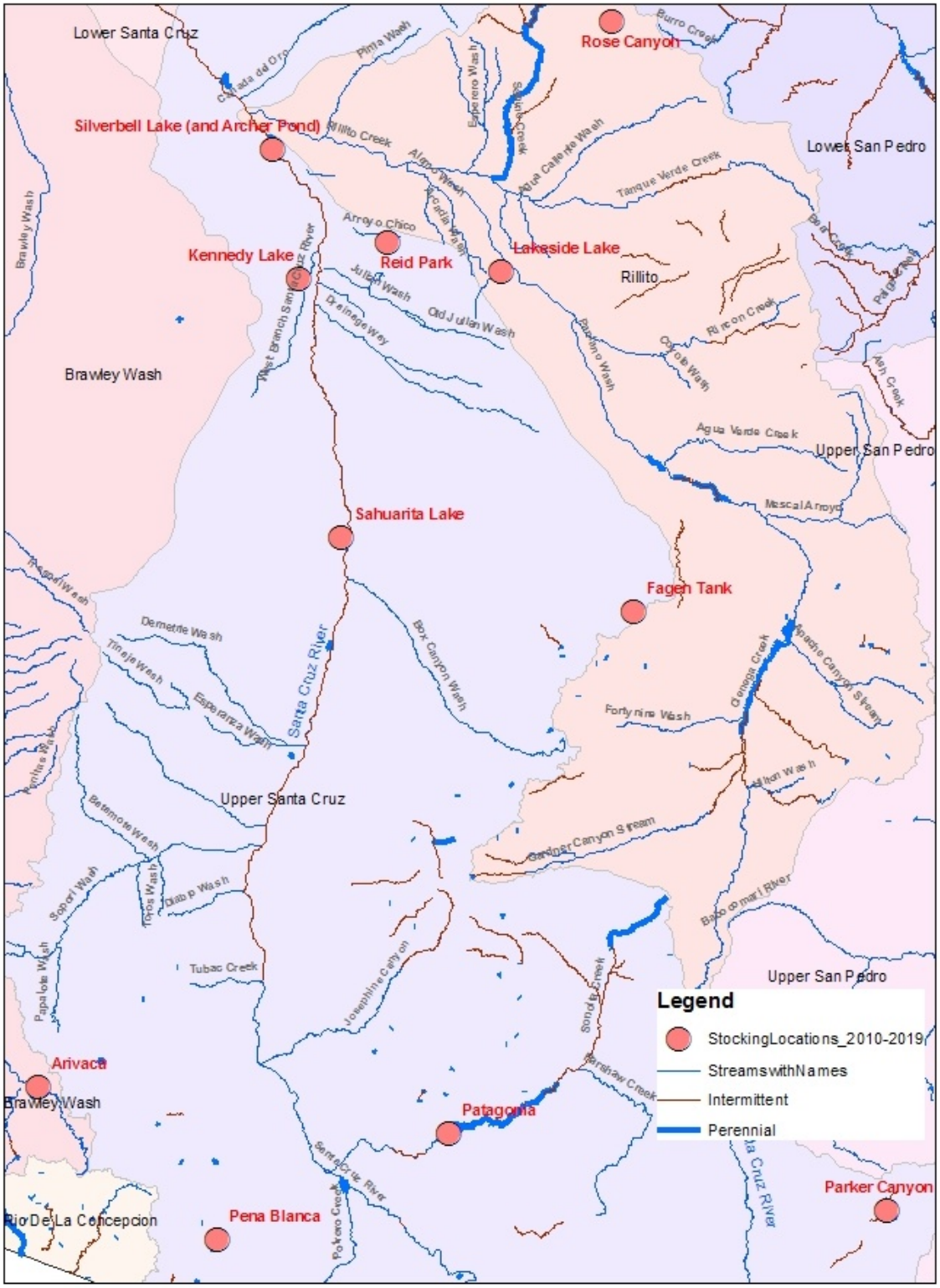

Figure 3. Santa Cruz Watershed tributaries.

UPPER SANTA CRUZ RIVER SUB-WATERSHED

The upper Santa Cruz River includes Parker Canyon, Patagonia and Pena Blanca Lakes.

Physical Geographic Description

The upper watershed contains the mainstem Santa Cruz River from its headwaters in the United States, south through Mexico, then north back into the United States up through the Tucson area. The drainage area is 2,227 square miles. The upper watershed begins in the San Rafael Valley and flows south into Mexico, where Parker Canyon (Parker Canyon Lake drainage) empties into the Santa Cruz, then it enters active agricultural fields for 10 miles, then it flows south and west around Sierra de San Antonio, where it turns north and re-enters the U.S east of Nogales, Arizona. Twelve miles downstream, at Rio Rico, Arizona, Sonoita Creek in the Patagonia Lake drainage enters the Santa Cruz River. Just north of this confluence, Agua Fria Canyon in the Peña Blanca Lake drainage joins the Santa Cruz.

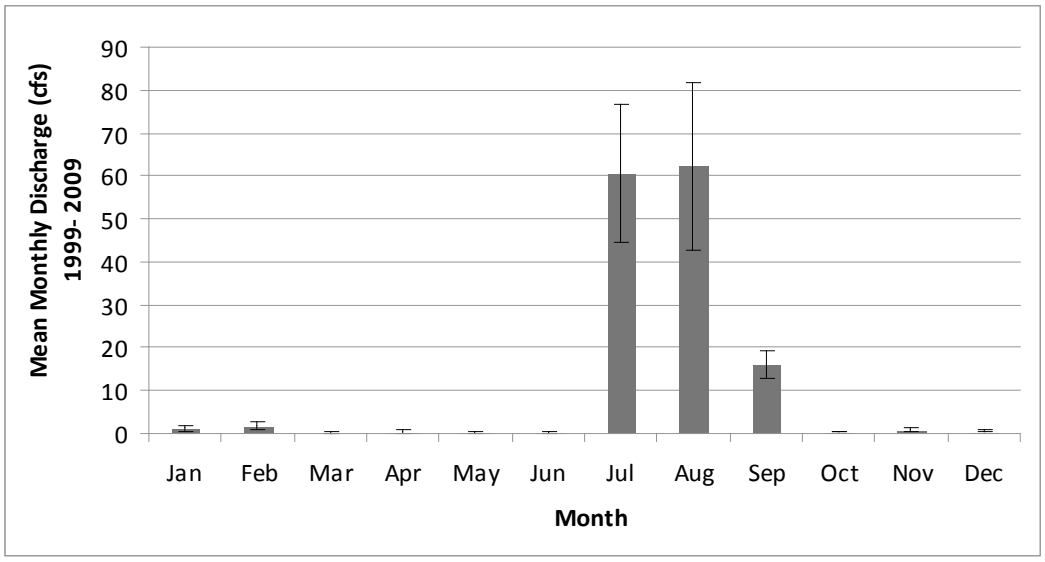

Figure 4. USGS Gauge discharge data from Santa Cruz River in Tucson, AZ.

Drainage Area and Elevations

Sonoita Creek and Sopori Wash are the two major tributaries in this portion of the drainage. Both drainages contain ephemeral/intermittent reaches of flow during periods of rainfall. Only Sonoita Creek contains perennial reaches scattered throughout is length. Perennial portions of Sonoita Creek do not connect with the Santa Cruz River and typically ceases to be perennial approximately 3 miles upstream of the confluence with the Santa Cruz River. Additionally there are several perennial tributaries located in the upper reaches of Sonoita Creek. These include Redrock Canyon, Harshaw Canyon, Temporal Canyon, Fresno Canyon, Coal Mine Springs Canyon, Flux Canyon and Alum Canyon. None of these locations contain perennial waters at their confluences with Sonoita Creek and many if not all of them are separated by at least several

miles of dry reach between the end of perennial water and their confluences with Sonoita Creek before their confluence.. Additionally there are several springs and small cienegas in numerous tributary drainages, particularly in the San Rafael Valley. Elevations range from 9,452 to 2,156 feet at the headwaters near Tucson.

Parker Canyon Lake

Site Description

Parker Canyon Lake is located 18 miles southeast of Sonoita. It is a 124 acre reservoir constructed in 1964. Parker Canyon is a tributary of the upper Santa Cruz River with its confluence located in Mexico. The lake is on the Coronado National Forest, which maintains campgrounds supporting a variety of recreational opportunities, including a store, boat ramp, fishing pier and hiking trails (Figure 5).

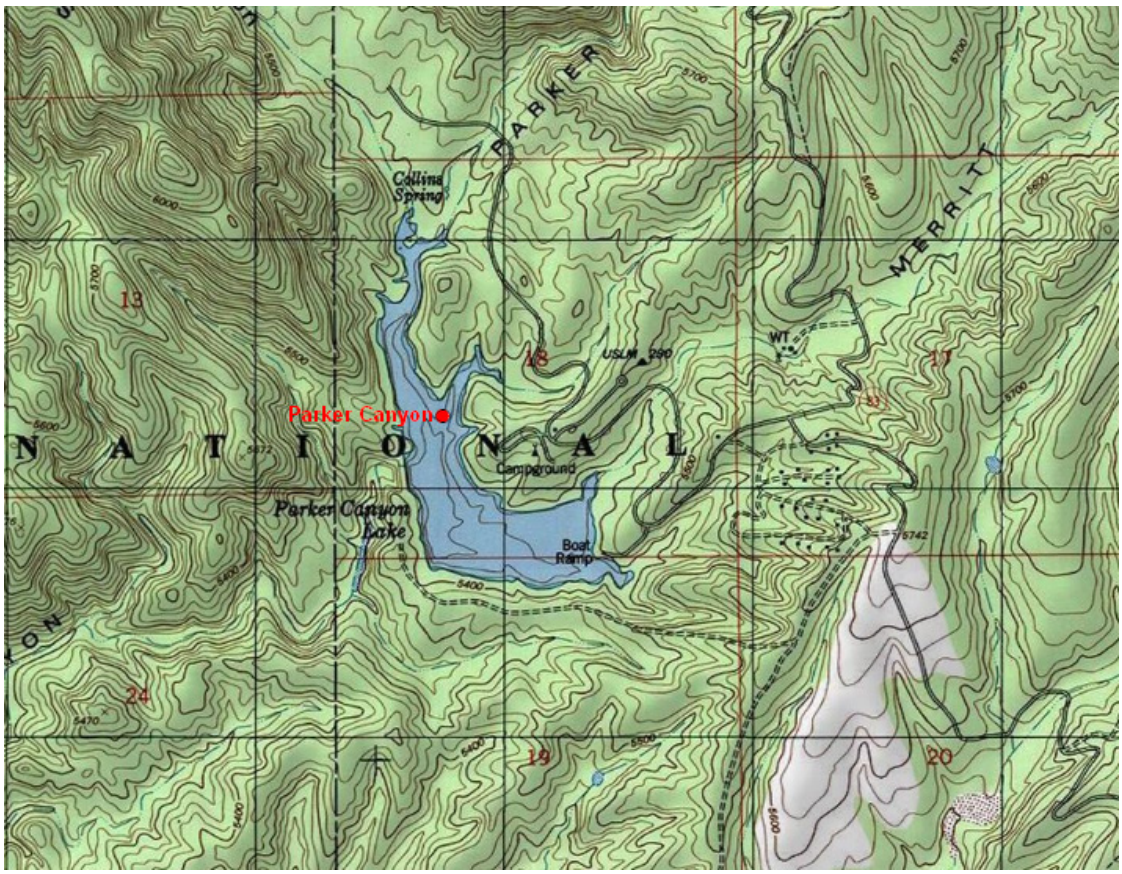

Figure 5. Parker Canyon Lake overview map.

Management of Water Body

Parker Canyon Lake has historically been managed as a three tier fishery: primary cold water put-and-take winter fishery of rainbow trout; secondarily a naturally reproducing warm water fishery of largemouth bass, bluegill, and redear sunfish; and tertiary a put-and-take fishery of

channel catfish. Catchable rainbow trout are stocked from October to April, and channel catfish are stocked as needed. The winter stocking of rainbow trout has continued, however, channel catfish stockings ceased in 1995, due to budget constraints (Table 1). While the warm water species are self sustaining, the stocked trout do not reproduce due to the lack of required habitat. The lake was also historically stocked by the Department with a number of bait species in an effort to improve the quality of the warm water fishery, but none of these species persisted in the lake and they were never documented in subsequent surveys. The only legally stocked species of fish currently found in the lake are channel catfish and rainbow trout; all other species are the results of illegal introductions by the public. Angler surveys completed in 2001 estimated that anglers expended 28,584 angler days at Parker Canyon Lake (Pringle 2004).

Table 1. Historic Department fish stockings at Parker Canyon Lake.

Species	First-Last year	Stockings	Num. stocked
Channel catfish	1965 - 1995	16	133,819
Coho salmon*	1971 - 1972	2	10,525
Fathead minnow*	1971 - 1971	1	8,000
Freshwater shrimp*	1971 - 1971	1	900,000
Plains red shiner*	1967 - 1967	1	11,250
Rainbow trout	1963 - 2008	275	1,238,619
Threadfin shad*	1971 - 1971	2	1,506
Total			2,303,719

* No longer found in the system.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, redear sunfish, and bluegill are proposed for the period covered by this consultation.

Catchable rainbow trout would be stocked from multiple times each year during the months of October through April; numbers of trout stocked would range from 0 to 45,000 fish annually.

Channel catfish (sub-catchables, catchables), bluegill (fry/fingerling, sub-catchables, catchables), and redear sunfish (fry/fingerling, sub-catchables, catchables) may be stocked as needed at any time during the period covered by this consultation, to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Parker Canyon Lake's water source is rain run-off from the ephemeral Parker, Merritt, and Collins Canyons (Figure 6). These inflows are ephemeral, only holding water for short periods of time following summer and winter rainfall events. Parker Canyon drains off the west side of Peterson Peak in the Huachuca Mountains and enters Parker Canyon on the northern end of the

lake. Collins Canyon, the second major tributary, is about 0.5 miles in length and drains rain runoff from a small portion of the watershed northwest of the lake. Merritt Canyon, the third major ephemeral tributary, enters from the east, and is about 4 miles in length.

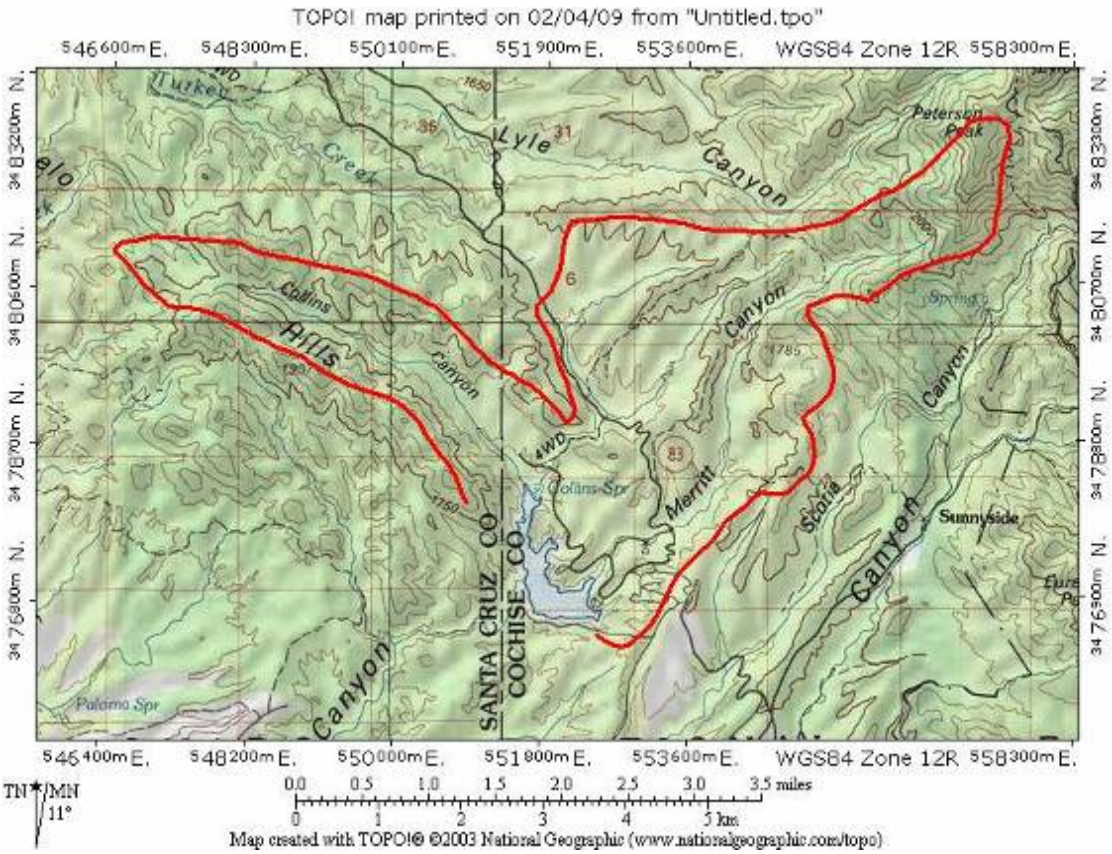

Figure 6. Approximate location of Watershed above Parker Canyon Lake.

Parker Canyon Dam has an incorporated spillway for water overflow in periods of sustained heavy rainfall. Arizona Game and Fish Department engineers estimate that the lake will fill only 3 out of 10 years. There are no data for spill history. The drainage heads southwest for 10 miles to the Mexican border. Directly below the spillway, Parker Canyon is perennial for 1 mile. This perennial water is in pools supported by a spring that began producing surface flow during the construction of the dam in the 1960's. The next 4.5 miles below the end of the perennial reach is ephemeral until it reaches another 0.25 mile stretch of perennial water (Figure 7). Past this point the reach is ephemeral for 6 miles, to the confluence with the Santa Cruz River in Mexico. At the confluence in Mexico the flows are intercepted by active agricultural fields (Figure 8).

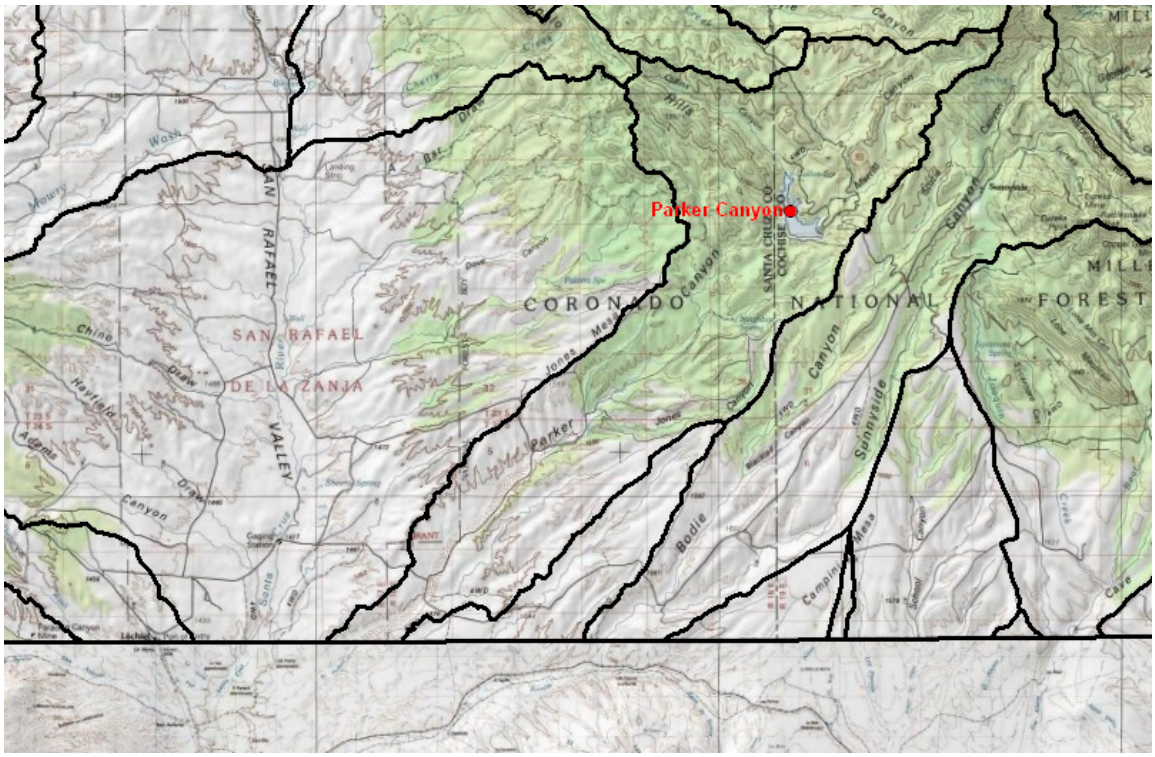

Figure 7. Watershed below Parker Canyon Lake, showing neighboring and downstream watersheds.

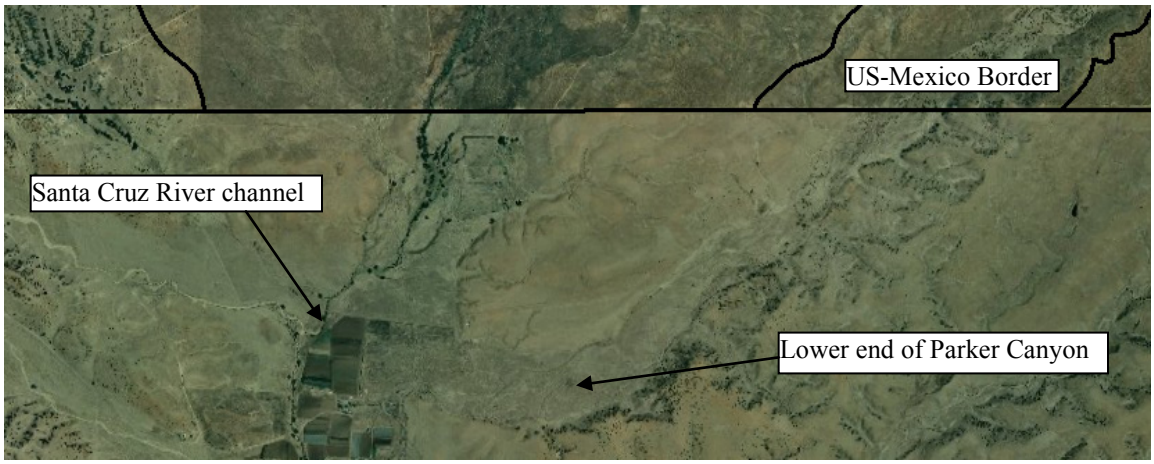

Figure 8. Aerial photo of the confluence of Parker Canyon and the Santa Cruz River in Mexico.

Fish Movement

Parker Canyon contains a series of fish barriers, 0.25 miles upstream of the confluence with the lake (Figure 9), in addition to the absence of perennial water; therefore fish cannot move up or

persist. The other inflows, while not containing fish barriers, are ephemeral and have broad sandy bottoms that do not hold water long enough to sustain fish.

Figure 9. Natural barriers in Parker Canyon ¼ mile above Parker Canyon Lake.

There is potential for fish to spill from Parker Canyon Lake. The perennial reach below the dam maintains water, mostly in two large pools. Beyond these pools, all but 0.25 miles of the 12 mile drainage is ephemeral, to its confluence with the Santa Cruz River in Mexico, and contains no suitable habitat for stocked fish. Shortly before the confluence with the Santa Cruz, the drainage gets very broad and there are several small channels that could allow fish to reach the Santa Cruz River directly during periods of low sustained flows. However, during heavy flows typically associated with monsoonal events, because the channel is poorly defined it is more likely fish and water could become spread on the numerous active agricultural fields located directly in the confluence of Parker Canyon and the Santa Cruz River (Figure 8). Above the confluence of Parker Canyon and the Santa Cruz, flows are minimal except during the monsoon season, as shown by the USGS gauge (Figure 10).

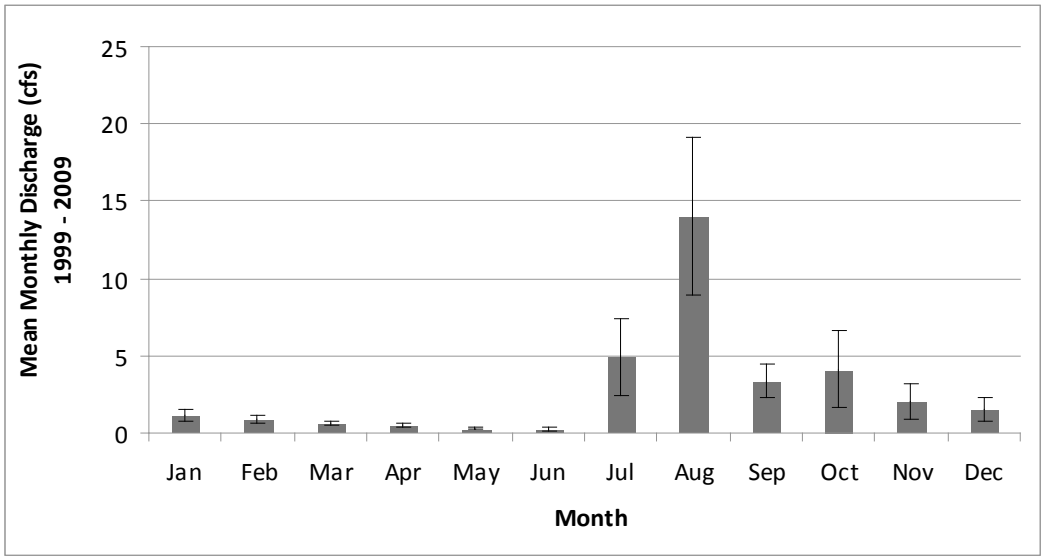

Figure 10. USGS Gauge data from Santa Cruz near Lochiel, AZ, just north of international border, before Parker Canyon enters watershed.

Community Description

The lake and pools below Parker Canyon support a healthy population of bullfrogs (Stefferud and Stefferud 2004), which are known to prey on native reptiles and amphibians. Due to the large number of bullfrogs and crayfish present (adults present in large numbers), it is unlikely that any native aquatic herpetofauna persist at or below the lake in this perennial area. There is one record of Chiricahua leopard frog at the lake reported in 1979, but none have been surveyed at or near the lake since (HDMS). Chiricahua leopard frogs were known from Scotia Canyon, about 3.4 air mi NE of the stocking site, but were last reported in 1981 and 1986 (Holm and Lowe 1995, USFWS 2009). In October 2009, the Department repatriated Chiricahua leopard frogs into upper Scotia Canyon from stock in Miller Canyon on the east side of the Huachuca Mountains (AGFD 2009). Arizona treefrogs are also present in Scotia Canyon and in stock tanks near the headwaters of Parker Canyon.

Sonoran tiger salamanders are found in stock tanks in the vicinity of the lake and drainage. Within a 5 mile radius of Parker Canyon Lake, Sonoran tiger salamanders have been documented at 18 sites one or more times (AGFD Sonoran tiger salamander database, T. Jones pers. comm.). Northern Mexican gartersnakes historically occurred in the vicinity of Parker Canyon, and they occupy the 20 km buffer surrounding Parker Canyon Lake (see site analysis below).

Parker Canyon Lake was built as a cold water fishery; however illegal stockings resulted in the presence of the warm water species now found in the lake along with northern pike. The fish population currently consists of largemouth bass, bluegill, redear sunfish, green sunfish, channel

catfish, black bullhead, mosquitofish, and northern pike. Coho salmon, red shiner, threadfin shad, and fathead minnows have all been stocked at the lake, but none of these species have been documented in biannual surveys. Catchable sized rainbow trout are stocked in the winter months from October through April. Rainbow trout do carry over in the cool deep waters of the hypolimnion, but they cannot spawn due to lack of appropriate habitat. Northern pike were illegally introduced in the late 1990's. Reproduction of this species has only been documented in 1999, even though electrofishing and gill net surveys are done each year.

Surveys of Parker Canyon downstream of the dam were completed in 1997 and 2004. In 1997, the fish population consisted of green sunfish, largemouth bass, and bluegill, within the 1 mile perennial section of Parker Canyon directly below the lake (D. Mitchell, pers. comm.). A 2004 survey of the drainage below the lake to Mexico showed the fish community consisted of green sunfish, largemouth bass, mosquitofish, and longfin dace in the two perennial reaches (Stefferud and Stefferud 2004).

Catfish species have never been documented within the perennial section of Parker Canyon (Stefferud and Stefferud 2004; D. Mitchell pers. comm.). In 20 plus years of annual sampling by the Department Gila chub and topminnow have never been found at Parker Canyon Lake or in Parker Canyon. The closest population of both species is 18 drainage miles from the stocking location, in a couple of springs in the San Rafael Valley, upstream of the confluence with the Santa Cruz and agricultural fields. No stocked species have ever been documented in these springs (Simons 1987; Bagley et al 1991; Weedman and Young 1997; Voeltz and Bettaso 2003; Table 3).

The Department monitors about 200 stock tanks for Sonoran tiger salamanders in the Santa Cruz drainage of the San Rafael Valley and surrounding foothills on a variable and rotating basis. Most of these tanks are actively managed for Sonoran tiger salamanders by the Department and cooperators. Although managed for Sonoran tiger salamanders, a few of these tanks still harbor sport fish species and could be contributing fish to the Santa Cruz River (Figure 11). Of those tanks, Ridge Tank has been known to support bass and bluegill sunfish species continuously since at least 1997; 3 tanks have supported both bluegill and green sunfish and bullhead catfish at least until 2002 or 2003, but each of those has been fishless since then and has supported Sonoran tiger salamanders in the last five years; 6 tanks had fish in the 1990's but have not supported fishes in the last 5 years and at least 2 have had Sonoran tiger salamanders in the last 10 years; 2 others supported unidentified centrarchids and catfish (probably bullheads) in 1999 and 2001, respectively, but have not been sampled since (AGFD Sonoran tiger salamander database, T. Jones pers. comm.).

Table 2. Fish collected during Parker Canyon electrofishing surveys 2008.

Species	Num. Sampled
Largemouth Bass	177
Bluegill	69
Redear Sunfish	14
Green Sunfish	29

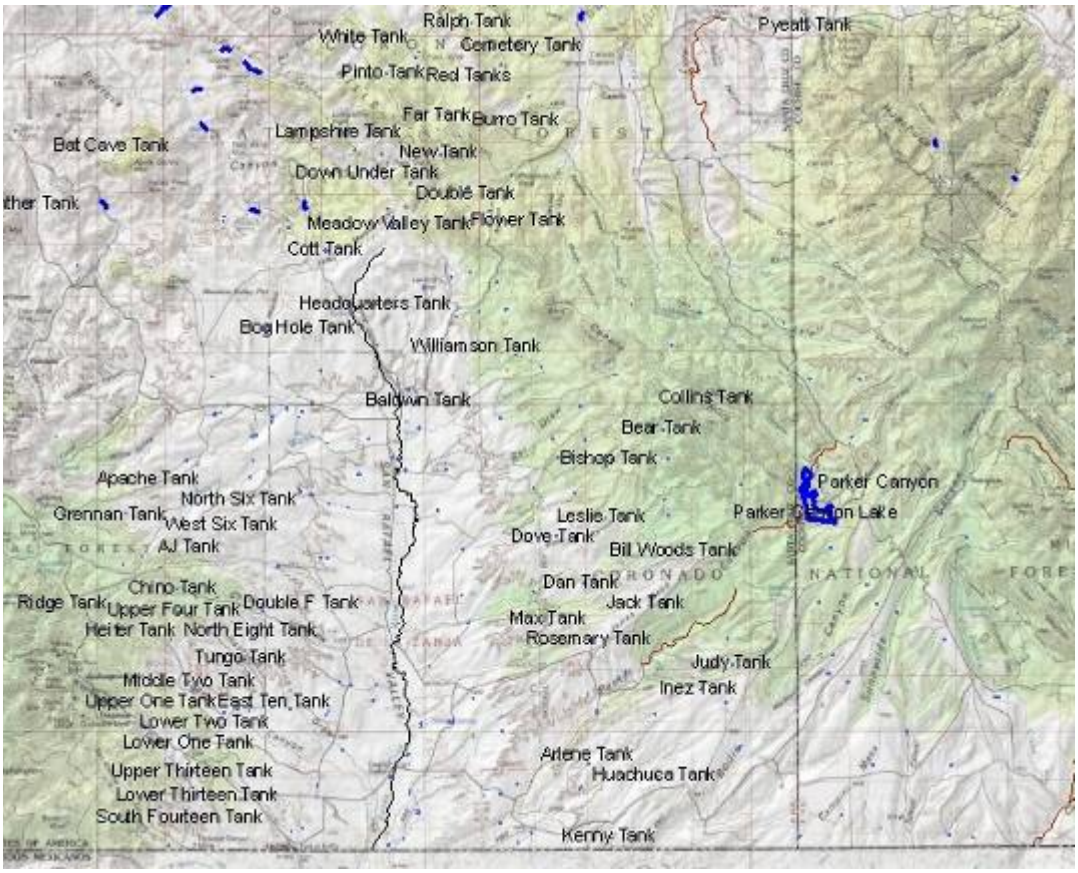

Figure 11. Named stock tanks in the headwaters of the Santa Cruz drainage that are known to support fish populations. More stock tanks exist, but are not named or mapped.

Table 3. Aquatic fauna captured 2009 from the upper Santa Cruz Basin above the Mexico border (Ehret 2009).

Location	Methods	Green Sunfish	Mosquitofish	Gila Chub	bullfrog	Sonoran mud turtle
Santa Cruz at Corral	5 hoop nets 4 minnow traps	33	64	0	6	3
Santa Cruz at Corral	2 seine hauls	3	155	0	8	0
Santa Cruz	2 seine hauls	77	10	0	6	0

Location	Methods	Green Sunfish	Mosquitofish	Gila Chub	bullfrog	Sonoran mud turtle
at Duquesne Bridge						
Santa Cruz at Border	3 minnow traps	4	4	0	0	0
Santa Cruz at Border	1 seine haul	1	63	0	24	0
Heron Spring	2 minnow traps	0	0	0	0	0
Sheehy Spring	4 minnow traps 3 hoop nets	0	0	385	11	0
Total		118	296	385	55	3

Consultation Species and Critical Habitat

Potential impacts to the Arizona treefrog distinct population segment, Chiricahua leopard frog, Gila chub, Gila topminnow, northern Mexican gartersnake and Sonoran tiger salamander are addressed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

The lake and pools below Parker Canyon support a healthy population of bullfrogs (Stefferud and Stefferud, 2004), which are known to prey on native reptiles and amphibians. Due to the large number of bullfrogs and crayfish present (adults present in large numbers), it is unlikely that any native aquatic herpetofauna persist at or below the lake in this perennial area.

Chiricahua leopard frogs are analyzed at a site, complex and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Arizona Treefrog

Site-Specific Analysis: The distribution of Arizona treefrogs in and around the Huachuca Mountains is incompletely understood (USFWS 2008h). Arizona treefrogs occur within 1.2 miles of Parker Canyon Lake, and most of the known extant localities are within about 5 miles, all of which are east, northeast or north of the lake in the headwaters of Turkey Creek and in the Scotia Canyon drainage (USFWS 2008h). Nearest known breeding sites include Hannah Tank (1.05 mi [1.7 km] E of Parker Canyon Lake) and Whiner Tank (1.8 mi [2.9 km] N of Parker Canyon Lake); other nearby sites include those in Scotia Canyon northeast of the lake (> 1.9 mi [> 3 km]) (USFWS 2008h). There have been no systematic surveys specifically for Arizona treefrogs at or around Parker Canyon Lake. Stock tanks within a 5 mile radius of Parker Canyon Lake (n = 29), many of which could provide breeding habitat for Arizona treefrogs, were sampled over 200 times from 1999 – 2008, and most were surveyed multiple times (range 1 – 22) (AGFD Sonoran tiger salamander database, T. Jones pers. comm.). However, many of those surveys were conducted in months during which Arizona treefrogs would not have been active, so it is unclear how effective the surveys might have been. In 2008 – 2009, there were numerous surveys in upper Scotia Canyon during efforts to eliminate bullfrogs from its perennial waters (T. Jones pers. comm.), and reproductively active Arizona treefrogs were documented in 2008 (Jones and Timmons in review). Stefferud and Stefferud and Stefferud (2004), conducted fish surveys of pools in Parker Canyon below the lake, and although those surveys were conducted in May before treefrogs would be reproductively active, bullfrogs were abundant at all sites making the habitat unsuitable for treefrogs.

There are no movement data to evaluate the extent to which Arizona treefrogs disperse away from breeding ponds, so the extent to which they are likely to move to sites with stocked fish is unknown. Studies of other, ecologically similar and similarly-sized species of hylid frogs provide a conservative basis for comparison. Maximum movement distances have been reported for pine barrens treefrogs (102 m), gray treefrogs (about 300 m) and western chorus frogs (about 200 m) (Freda and Gonzalez 1986, Johnson et al. 2007, Kramer 1973), all of which breed in ephemeral waters and spend most of the non-breeding season feeding in adjacent forests. Importantly, all of those species occur in more mesic habitats in the eastern U.S., which would presumably facilitate more lengthy terrestrial movements. Thus, we conservatively suggest that Arizona treefrogs might move up to 300 m from breeding sites. Although the known sites listed above are farther than 300 m from Parker Canyon Lake, we do not know if there are populations of Arizona treefrogs closer to the lake. Thus, it is possible that Arizona treefrogs could enter Parker Canyon Lake and be preyed upon by stocked fish or their progeny.

Broad Scale Analysis: Parker Canyon Lake discharges into Parker Canyon. There are no records of Arizona treefrogs downstream from Parker Canyon Lake (HDMS, USFWS 2008), and therefore no downstream exposure to dispersing fish is anticipated.

Chiricahua Leopard Frog

Local Analysis: The Parker Canyon Lake buffered stocking site is within the historical range of the Chiricahua leopard frog, and the buffered stocking site is currently occupied by Chiricahua leopard frogs (Figure 12; AGFD Riparian Herpetofauna Database, V. Boyarski pers. comm.). Parker Canyon Lake is located within the Upper San Pedro-Santa Cruz Recovery Unit. Within the buffered stocking complex there are historical records for Chiricahua leopard frogs from Parker Canyon Lake (no date) (reported in Platz and Mecham 1979). Chiricahua leopard frogs occurred in upper Scotia Canyon, about 3.4 air mi NE of the stocking site, and were last reported in 1981 and 1986 (Holm and Lowe 1995, USFWS 2009). AGFD, with partners in USFWS and USFS repatriated Chiricahua leopard frogs into the upper reaches of Scotia Canyon in October 2009 (AGFD 2009).

There have been no systematic surveys for Chiricahua leopard frogs at Parker Canyon Lake. Surveys of Parker Canyon below the lake have only documented bullfrogs (Stefferud and Stefferud 2004), and bullfrogs occupy the lake. Stock tanks within the buffered stocking site (n = 29) have been sampled over 200 times from 1999 – 2008, and most were surveyed multiple times (range 1 – 22) (AGFD Sonoran tiger salamander database, T. Jones pers. comm.). No Chiricahua leopard frogs were reported during those surveys. In 2008 – 2009 there were numerous surveys in upper Scotia Canyon during efforts to eliminate bullfrogs from its perennial waters (T. Jones pers. comm.), but no Chiricahua leopard frogs were seen.

Scotia Canyon is a tributary to Bodie Canyon which lies approximately parallel to Parker Canyon to the southeast. Bodie Canyon is an ephemeral drainage that flows into the Santa Cruz River south of the Parker Canyon – Santa Cruz confluence. The upper part of Scotia Canyon includes an approximately 1.5 mi permanent reach, below which the canyon is intermittent (Stefferud and Stefferud 2004). It is logical to assume that once leopard frogs are established, they will occupy much or all of the perennial reach of Scotia Canyon.

There are two logical routes by which Chiricahua leopard frogs might access Parker Canyon Lake from the lower end of the perennial Scotia Canyon reach. Dispersing frogs could either travel about 0.7 miles overland into Merritt Canyon and then about 2.3 mi down that ephemeral canyon to the lake, or travel about 3.8 mi through seasonally dry Scotia Canyon to a point closest to and about 1.0 mi overland from Parker Canyon Lake. The topography surrounding Scotia Canyon is relatively rugged, and would likely impede movement of leopard frogs. Therefore, the likelihood of exposure of dispersing Chiricahua leopard frogs to stocked fish in Parker Canyon Lake is moderate.

Broad Scale Analysis: Below Parker Canyon Lake there are Chiricahua leopard frog records from seven sites in the upper Santa Cruz River drainage in the San Rafael Valley. Five sites include no records more recent than 1985, and all of them have supported bullfrogs at some time in the last 20 years (AGFD Riparian Herpetofauna Database, AGFD Sonoran Tiger Salamander

Database, T. Jones pers. comm.). In 1995, Chiricahua leopard frogs were recorded at three stock tanks west of the Santa Cruz River, in the southern part of the Valley. Each of those tanks empties into ephemeral washes, and are over four "wash" miles from the river. The latter two tanks drain into washes that enter the Santa Cruz River 0.86 and 1.39 miles south of the international boundary, respectively. There have been no reports of Chiricahua leopard frogs in the Santa Cruz River mainstem or its perennial tributaries in 25 years. AGFD has systematically surveyed for Sonoran tiger salamanders for most of the last 10 years, which since 2004 has included a randomized sampling design that covers nearly 200 sites in the San Rafael Valley and surrounding foothills (including the three tanks referenced above) (AGFD Sonoran Tiger Salamander Database, T. Jones pers. comm.). No Chiricahua leopard frogs have been found since 1995. AGFD, with partners in USFWS and USFS repatriated Chiricahua leopard frogs into a frog-fenced stock tank on private land in the San Rafael Valley in October 2009 (AGFD 2009). In all cases in which Chiricahua leopard frogs have been reported from stock tanks, those tanks drain into ephemeral washes through which fish would not be able to travel. Therefore, stocked fish that might escape from Parker Canyon Lake would not encounter frogs at those tanks, nor are they likely to encounter Chiricahua leopard frogs in the San Rafael Valley. Because there are no known free-living Chiricahua leopard frogs in the San Rafael Valley, it is not likely that dispersing leopard frogs would encounter stocked fish that might escape into the upper Santa Cruz River.

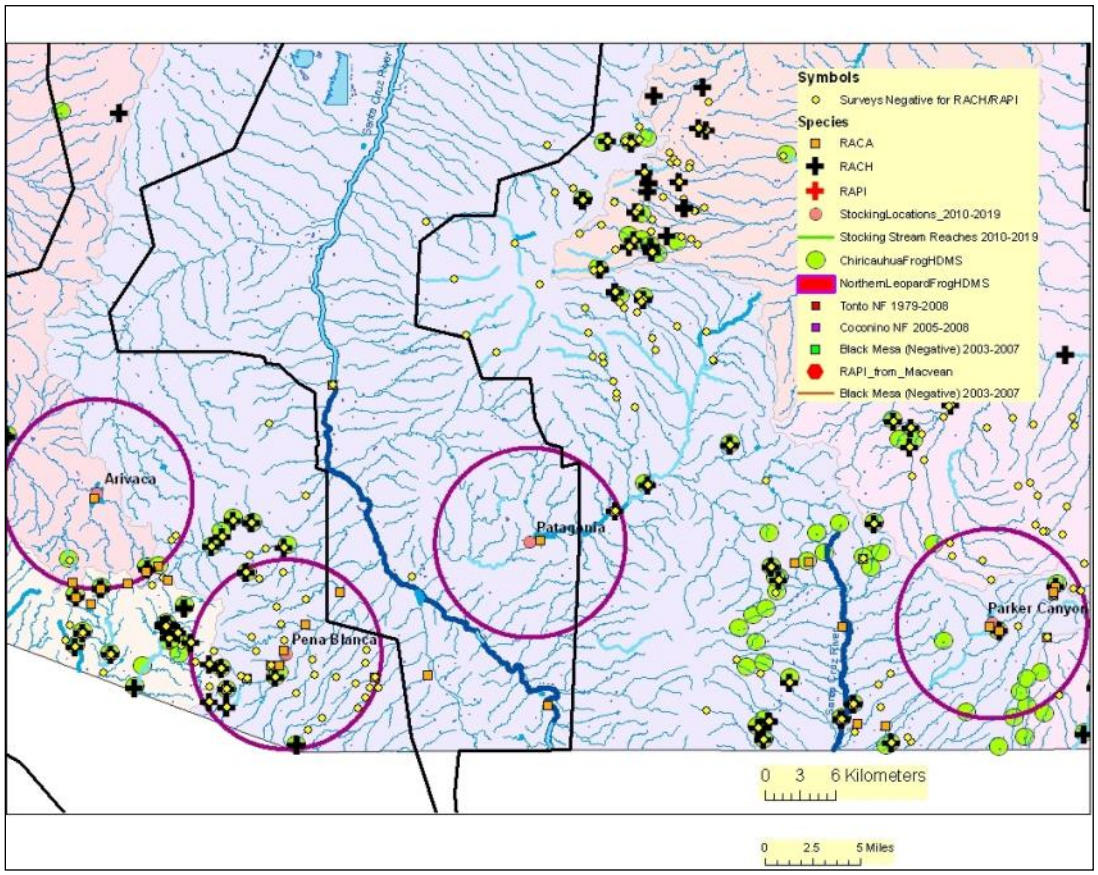

Figure 12. Map of Upper and Lower Sub-Complex of the Santa Cruz River Watershed buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Gila Chub

The closest population of Gila chub is located at Sheehy Spring in the San Rafael Valley, approximately 18 drainage miles from the lake.

Potential Impacts

The proposed activity is not anticipated to impact the Gila chub, as the nearest population occurs over 18 drainage miles from the lake within in a somewhat isolated spring. Impacts are extremely unlikely to occur because the stocked species would have to escape into Parker Canyon, persist through the 12 miles of ephemeral reaches, and end up in the mainstem of the

Santa Cruz River in Mexico. Once in Mexico, during periods of heavy flow water would likely inundate active agricultural fields located at the confluence causing fish to be washed into these fields as well. During periods of slower flow, it is likely fish and water could stay contained in the small ephemeral channel and end up in the Santa Cruz River. From this point, fish would then have to swim upstream in the main channel of the river and eventually find their way into the small side channel that would allow access to the small side drainage in which Sheehy spring is located.

The potential for Gila chub to be washed out of Sheehy Spring in the Santa Cruz River where they could come in contact with escaped stocked species is extremely unlikely. The small drainage that Sheehy Spring is located in has a diversion located upstream of the spring that collects rain runoff and likely prevents large amounts of water form flushing through the small channel down where the spring is located. However if severe flood conditions lasted long enough for chub to wash from Sheehy Spring and stocked fish from Parker Canyon, and both fish survive, the two could coexist in the Santa Cruz, where impacts due to predation and/or competition for resources may occur. This would be very unlikely based on the low potential for connectivity and ephemeral barriers within the system, as well as the sediment load and debris associated with such a flood precluding fish survival. Furthermore, it would be extremely difficult to determine the source of sport fish in such an event due to the presence of stock tanks that harbor non native fish species (Figure 11) as well as the presence of many of the same non native fish species within the Santa Cruz River in Mexico. There are no known angling opportunities in the Santa Cruz or the lower end of the Parker Canyon drainage due to the ephemeral nature of the drainages and the lack of habitat for sport fish to persist. Some angling does occur in the Parker Canyon drainage directly below the lake however. No impacts due to angling in these areas outside of the lake are anticipated.

Gila Topminnow

The closest known population of Gila topminnow was located in Sharp Spring and Heron Spring in the San Rafael Valley; approximately 18 miles downstream of the lake (see previous Gila chub discussion). Topminnows have also been documented downstream in the Santa Cruz River in Mexico. Suitable habitat is present for the Gila topminnow in the Santa Cruz River in the U.S. but has not been detected in the river since 1993 (Weedman and Young 1997; Voeltz and Bettaso 2003). The last known occurrences in the San Rafael Valley were in 1999 in Sharp Spring and 2003 in Heron Spring (Voeltz and Bettaso 2003).

Potential Impacts

Impacts could potentially occur over time only if the stocked species were able to escape into the mainstem of the Santa Cruz and persist, moving down into Mexico (see Gila Chub above). It is unlikely that connectivity would persist long enough for exposure would occur. For potential impacts in the Santa Cruz River, refer to the Upper Santa Cruz River complex analysis.

Northern Mexican Gartersnake

Stocking Site Analysis: Northern Mexican gartersnakes occupy the 20 km buffer surrounding Parker Canyon Lake. There are recent (1986), verified observations of northern Mexican gartersnakes from Parker Canyon Lake (HDMS, Rosen and Schwalbe 1988). There also is an unsubstantiated observation of an individual from the lake in 2006 (V. Boyarski, pers.comm.). The presence of crayfish and bullfrogs at the lake make the habitat less suitable for northern Mexican garternakes, but the snakes may persist there in low numbers. There also are recent (2008, 2009) records of the species from nearby upper Scotia Canyon (about 3.4 air mi NE of the stocking site), Turkey Creek (approx. 8.7 air mi away; 1985, 2008, 2009), and Canelo Hills (approx. 7.5 air mi away; 1992) (HDMS, V. Boyarski pers. comm.). There also are recent northern Mexican gartersnake observations from the San Rafael Valley (1986, 2007), the Santa Cruz River (1986, 2000, 2005), northern (1994) and eastern (1987) Huachuca Mountains (HDMS), which represent surrounding drainages but are within the buffer and therefore within possible dispersal distance. It is likely that northern Mexican gartersnakes will be exposed to sportfish stocked into Parker Canyon Lake because the snakes might occupy the lake, and because northern Mexican gartersnakes might disperse to the lake from surrounding populations.

Downstream Analysis: Northern Mexican gartersnakes could be exposed to stocked sport fish that escape from Parker Canyon Lake and disperse downstream along Parker Canyon to the Santa Cruz River because northern Mexican gartersnakes occupy the Santa Cruz River above the international border in the San Rafael Valley (HDMS, V. Boyarski). Because there are recent (1986, 2000, 2005) records of northern Mexican gartersnakes from the Santa Cruz River upstream of the International Border, it is likely that northern Mexican gartersnakes also occupy the river in Mexico and snakes could be exposed to dispersing stocked sport fish (HDMS). However, no known recent surveys have been conducted in Mexico.

Sonoran Tiger Salamander

Site-specific Analysis: Sonoran tiger salamanders occur in and around stock tanks near Parker Canyon Lake within the upper Santa Cruz River watershed. Breeding populations of Sonoran tiger salamanders are found in stock tanks throughout the San Rafael Valley and in much of the Canelo Hills. Sonoran tiger salamander sites have been surveyed since the 1980s, although earlier sampling was directed at selected sites (Collins et al. 1988, Jones et al. 1988, AGFD Sonoran Tiger Salamander Database). AGFD has systematically surveyed for Sonoran tiger salamanders for most of the last 10 years (AGFD Sonoran Tiger Salamander Database). Stock tanks within an approximately 5 mile radius of Parker Canyon Lake (n = 30) have been sampled over 200 times from 1999 – 2008, and most were surveyed multiple times (range 1 – 22). Sonoran tiger salamanders have been documented at 18 of those sites one or more times (AGFD Sonoran tiger salamander database, T. Jones pers. comm.). Salamanders have never been documented at Parker Canyon Lake (HDMS), and in the San Rafael Valley they have never been documented in perennial waters other than stock tanks.

There are few data to evaluate the extent to which metamorphosed Sonoran tiger salamanders move away from breeding ponds. But, marked Sonora tiger salamanders have been found 0.9 and 1.2 miles from tanks where they had been found the previous spring, and others have been found 1.9 – 2.5 miles from the nearest potential source population (Maret et al. 2006). The sites nearest to Parker Canyon Lake that have been known to support Sonoran tiger salamanders and their straight-line distances from the lake include: Hannah Tank (1.1 mi), Heidi Tank (1.75 mi), High Berm Tank (1.7 mi), Dinner Tank (2.1 mi) and Bill Woods Tank (2.6 mi), all of which are presumably close enough for salamanders to disperse to Parker Canyon Lake. Consequently, it is possible that Sonoran tiger salamanders could enter Parker Canyon Lake, but we do not know how likely that would be.

Broad Scale Analysis: Below Parker Canyon Lake there are extant Sonoran tiger salamander populations throughout the upper Santa Cruz River drainage in the San Rafael Valley (USFWS 2007, AGFD Sonoran Tiger Salamander Database). Except for one site in Scotia Canyon, in all cases in which Sonoran tiger salamanders have been reported from stock tanks, those tanks drain into ephemeral washes through which fish would not be able to travel even at exceptionally high water levels. Therefore, stocked fish that might escape from Parker Canyon Lake would not encounter salamanders at the tanks. Nonetheless, because tiger salamanders have been known to travel at least 2.5 miles from the nearest potential source population (Maret et al. 2006), it is possible that metamorphosed individuals might enter the Santa Cruz River, and there they might encounter non native fishes that are either resident in the Santa Cruz River, or have escaped from one of several stock tanks currently occupied by non natives or from Parker Canyon Lake.

Peña Blanca Lake

Site Description

Peña Blanca Lake, a 50 acre lake created in 1957, is located approximately 12 miles northwest of Nogales in Peña Blanca Wash (Figure 13). The lake is on the Coronado National Forest, which maintains campgrounds and supports recreational opportunities. There is a boat ramp and fishing pier along with hiking trails. United States Forest Service drained the lake in 2008 to remove mercury contaminated sediment from the lake bottom. The project was completed in September 2009 and the lake refilled following significant winter rainfall in January 2010. The Service completed a consultation that allowed the Department to stock rainbow trout in the lake in the winter and spring 2010. The Forest Service is completing a consultation for the reestablishment of the warm water species that were present in the lake prior to their dredging project.

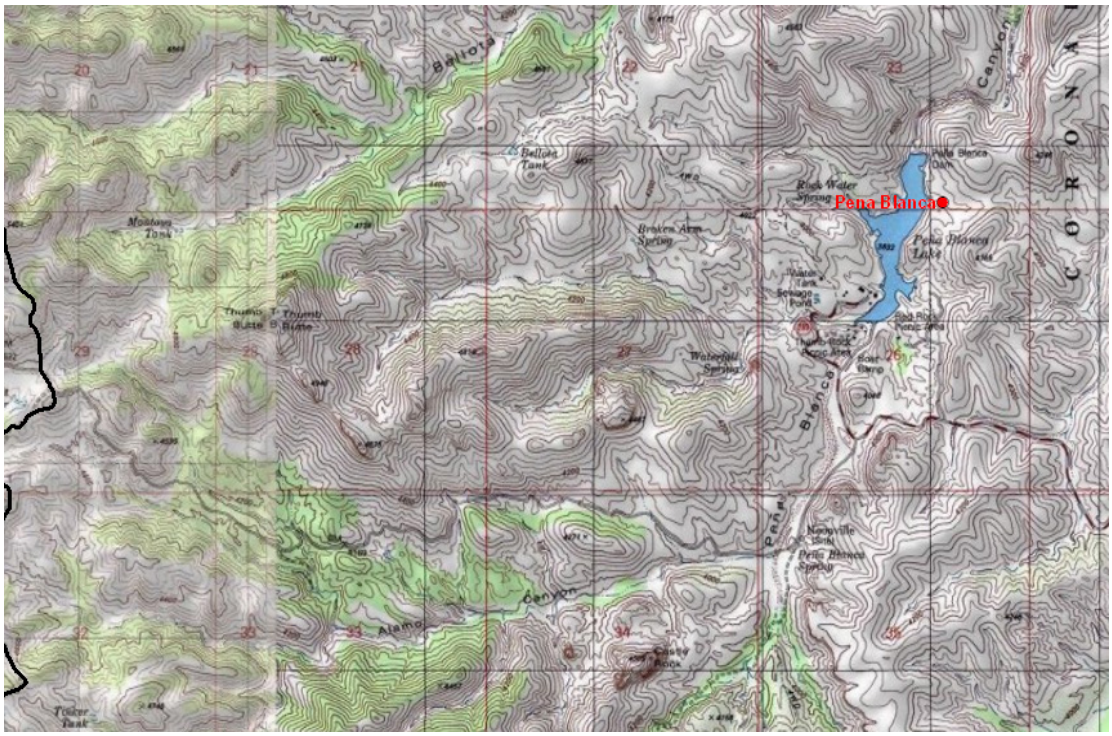

Figure 13. Peña Blanca Lake drainage.

Management of Water Body

Peña Blanca was historically managed as a two tiered fishery. The primary fishery was a naturally reproducing warm water fishery, and a secondary winter put-and-take trout fishery that was sustained with multiple stockings annually of catchable sized rainbow trout. While the warm water species are self sustaining, the stocked trout do not carry over due to warm water temperatures and do not reproduce due to lack of required habitat. Stocking history at the lake consists of sporadic warm water species stockings with regular winter trout stockings (Table 4). Fathead minnow and threadfin shad were stocked to increase the forage base, but these species did not persist. Angler surveys completed in 2001 estimated angler use days at 21,298 (Pringle 2004).

Table 4. Historic Department fish stockings at Peña Blanca Lake.

Species	First Year	Last Year	Stockings	Num. Stocked
Black crappie	1958	1958	2	64
Channel catfish	1958	1993	42	340,106
Crayfish	1991	1993	4	1,800

Fathead minnow*	1991	1994	4	117,268
Largemouth bass	1958	1964	6	20,326
Rainbow trout	1959	2010	550	1,407,194
Threadfin shad*	1957	1958	4	16,000
Bullfrog Tadpole	1968	1971	4	7,800
Total				1,906,558

*Never documented as persisting in the lake.

Proposed Action

The Department proposes to stock rainbow trout for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times each year; the numbers of trout stocked would range from 0 to 45,000 fish annually.

Water Distribution / Connectivity

Peña Blanca Lake is a run-off fed reservoir with Peña Blanca Wash at its main tributary. The wash starts in Mexico and flows north for 4.5 miles before reaching Peña Blanca Lake. The canyon is ephemeral and only has water in it following rainfall events. Alamo Canyon, an ephemeral tributary to Peña Blanca Canyon, also starts in Mexico and is a major tributary; it often flows continuously throughout the summer monsoon season. These canyons join approximately 0.75 miles above Peña Blanca Lake.

Peña Blanca Dam has an incorporated spillway and does spill in high seasonal rains. The first mile downstream is a canyon that contains scattered pools of water that can persist throughout much of the year, except during the driest summer months. The next two miles downstream, the wash is ephemeral with a wide sandy bottom. Three miles downstream of the lake, the wash joins with Agua Fria Canyon, also an ephemeral drainage with a wide sandy bottom. The drainage continues another 4 miles before being intercepted by a large sand and gravel operation located within Agua Fria Canyon, where flow would spread over a thin sheet (Figure 14). The drainage leaving the sand and gravel operation continues 1.5 miles to the confluence with the Santa Cruz River. The Santa Cruz River is perennial at the confluence with Agua Fria Canyon due to sewage effluent releases from the City of Nogales.

Figure 14. Aerial photo of sand and gravel operation that intercepts flow in Agua Fria Canyon downstream of Peña Blanca Lake.

Fish Movement

During periods of flooding, it is unlikely fish could move upstream due the presence of a small fish barrier created by Arizona Hwy 289, also known as Ruby Road that crosses Peña Blanca Canyon just above the lake and creates a fish barrier with a three to four foot drop (Figure 15).

Figure 15. Road Crossing above Peña Blanca Lake looking downstream.

Fish can spill from the reservoir during flood events. The first mile downstream contains pool habitat that is suitable for trout, except in summer months. These pools below the lake were surveyed in 1996 and 1997, and although fish had escaped from the lake, they did not reproduce or persist for more than a couple of months because the pools either dried up during the summer months or dissolved oxygen dropped to lethal levels for trout. Table 5 shows species occurrence documented below the lake during this survey (D. Mitchell, pers. comm.). Although rainbow trout have not been documented below the lake in these pools it is likely they do wash out of the lake however conditions are not adequate to support their survival as summer temperatures cause water temperatures to reach lethal limits for trout survival (D. Mitchell, pers. comm.). Beyond the few pools immediately below the lake there is no perennial water in Peña Blanca Canyon, Agua Fria Canyon, or any of their tributaries. The ephemeral nature of the extensive sandy washes provides no habitat for fish. The gravel and sand operation in the drainage forces flows to a thin sheet that would not support fish movement, and any water would quickly be absorbed by the sand bottom. The lake was pumped dry during fall 2008 and winter 2009, and water flowed continuously over the spillway for 34 days. Even then, flows were only a trickle when they finally reached the bridge at I-19, and they were not enough to transport stocked species (J. Kline, pers. comm.). Furthermore, there are no records of stocked species occurring in the Santa Cruz River in the vicinity of the confluence of Agua Fria Canyon (HDMS).

Table 5. Species composition and distribution below Peña Blanca Lake 1996 and 1997.

Date	Station 1	Station 2	Station 3	Station 4	Station 5
12/1996	No fish	Dry	Dry	Dry	Dry
01/1997	No fish	Dry	Dry	Dry	Dry
02/1997	Green sunfish, bluegill, yellow bullhead, mosquitofish	No Fish	Dry	Dry	Dry
03/1997	mosquitofish	mosquitofish	mosquitofish	Dry	Dry
04/1997	No Fish	No fish	No Fish	Dry	Dry
05/1997	Largemouth bass, yellow bullhead, mosquitofish, bluegill	No fish	Dry	Dry	Dry
09/1997	mosquitofish	Dry	Dry	Dry	Dry

Community Description

Peña Blanca was filled by heavy winter rains in January 2010. Rainbow trout were stocked into the lake. Prior to draining and dredging, Peña Blanca's fish population consisted of largemouth bass, bluegill, redear sunfish, green sunfish, black crappie, channel catfish, and black bullhead, but only four of these species were documented in 2008 surveys (Table 6). All of these species

except bullhead catfish and green sunfish are proposed for restocking as part of the consultation being completed by the Forest Service. Prior to the populations being removed all of these species were reproducing in the lake. During the winter months of November through early March, the Department stocks catchable rainbow trout. These fish do not persist or reproduce in Peña Blanca, due to warm water temperatures and lack of habitat. Historically, the lake was stocked with a number of bait species in an effort to improve the quality of the warm water fishery; however, none of these species persisted in the lake and were never documented in subsequent surveys. Since 1993, the lake has only been stocked annually with rainbow trout in support of the trout fishery (Table 4).

Table 6. Fish Species collected in Peña Blanca Lake electrofishing surveys 2008.

Species	**Num. Sampled**
Largemouth Bass	182
Bluegill	103
Redear Sunfish	38
Black Crappie	14

Peña Blanca harbored a population of bullfrogs; however, during the dredging project steps were taken to attempt to remove them from the area to protect native ranid frog populations. At present it appears that the project has been successful and careful monitoring of aquatic habitats in the area should prevent them from recolonizing. Lowland leopard frogs are found in Peña Blanca Canyon about 1 mile above the lake at Peña Blanca Spring, and populations of Chiricahua leopard frogs have been known to occupy stock tanks near the headwaters of Alamo Canyon. In summer 2009 prior to the lake refilling, both species of leopard frog dispersed into the lake basin and occupied a pool that was fed by an apparently temporary spring that erupted in the lake bottom during the removal of sediment from the lake bottom. At present, it is not known if they continue to persist in the lake now that it has refilled completely.

Peña Blanca Lake lies within the potential historical range for Northern Mexican Gartersnakes, though they likely do not occupy the 20 km buffer surrounding the lake (see site analysis below), and there are no historical records near the lake.

Consultation Species or Critical Habitat
Potential impacts to Chiricahua leopard frogs, Gila topminnow, Mexican spotted owl and northern Mexican gartersnake are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and northern leopard frogs are analyzed at a local and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Chiricahua Leopard Frog

Local Analysis: Peña Blanca Lake is within the historical range of the Chiricahua leopard frog, and there is a high likelihood that Chiricahua leopard frogs will come into contact with fish stocked in the lake. There are historical and recent records (2010) for Chiricahua leopard frogs from the vicinity of Peña Blanca Lake and within the buffered stocking complex (Figure 12, AGFD Riparian Herpetofauna Database, HDMS, M. Sredl pers. comm., T. Jones pers. comm.). Peña Blanca Lake was completely drained and dried in 2008 – 2009, and sediments were removed. The lake refilled with heavy winter rains in January 2010.

A total of 73 sites have each been surveyed once within the buffered stocking site. Prior to 2006, 14 of 73 sites had each been surveyed one or more times (n = 57 surveys), and in 2008 – 2009 each of those 73 sites was surveyed from 1 – 13+ times, (n = 106+ surveys) (AGFD Riparian Herpetofauna Database, T. Jones pers. comm.). Chiricahua leopard frogs were documented at 9 sites, including five sites from 1993 through 2004, and four other sites in 2008-09. Each of those 9 currently or formerly occupied sites is upstream from Peña Blanca Lake. In 2008 – 2009, bullfrogs were systematically removed from within the buffered stocking site, thus making new and historical habitat available for colonization by Chiricahua leopard frogs. Subsequently in 2009, a Chiricahua leopard frog was found on Forest Rd. 39 where it crosses Peña Blanca Canyon, *about* 0.9 air mi upstream from the lake (C. Akins, A. Owens pers. comm.), and seven individuals were observed in a spring pool in the dried lake basin (T. Jones pers. comm.). The lake has not been surveyed for Chiricahua leopard frogs since it refilled.

Broad Scale Analysis: There are no historical records for Chiricahua leopard frogs below Peña Blanca Lake in or around Agua Fria Canyon. Agua Fria Canyon is ephemeral throughout its entire length from the mouth of Peña Blanca Canyon to the confluence with the Santa Cruz River. However, there were pools in Peña Blanca Canyon immediately below the lake, many of

which supported non native fishes (presumably centrarchids) through June 2009 (T. Jones, C. Akins pers. comm.). Failure to identify these fish resulted in an inability to determine if they were stocked species or other wild centrarchids (i.e. green sunfish). The pools are unsuitable for Chiricahua leopard frogs to persist because of these nonnatives. Chiricahua leopard frogs immediately above the lake have the potential to occupy pools below the lake and additional sites around the lake that were previously occupied by bullfrogs. Thus, if fish were to disperse from Peña Blanca Lake, the likelihood that they would encounter Chiricahua leopard frogs would be high immediately below Peña Blanca Lake dam with a decreasing likelihood the further downstream from the dam you go because the habitats are not perennial and spilled fish would always eventually die from desiccation. Similarly, if fish escaped and occupied those pools below the lake, there would be a high likelihood that dispersing Chiricahua leopard frogs would encounter those fish.

Gila Topminnow

The closest suitable habitat and documented occurrences for Gila topminnow occur in the Santa Cruz River approximately 7 miles downstream from the lake (refer to the Upper Santa Cruz River complex analysis). Upstream in the Santa Cruz from the confluence with the Agua Fria Canyon in Nogales Wash, topminnows were documented in 2002 (HDMS). Downstream near the confluence of the Santa Cruz and Negro Canyon, topminnows were documented in 2002 (HDMS).

Potential Impacts

The proposed activity is not anticipated to have impacts to topminnow due to the distance and conditions in the drainage (refer to fish movement discussion). In the unlikely event trout were able to access the Santa Cruz River mainstem and move into occupied topminnow habitat, potential impacts may include predation and competition for space. Trout would not be anticipated to have long-term persistence due to the elevated water temperatures in the late spring and early fall causing mortality. Refer to the Upper Santa Cruz River complex analysis for further information.

Mexican Spotted Owl Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH).

Potential Impacts

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring

restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Northern Mexican Gartersnake

Site-Specific Analysis: Although Peña Blanca Lake lies within the potential historical range of northern Mexican gartersnakes, there are no known records of the species from the lake (HDMS, AGFD Riparian Herpetofauna Database). Within the 20 km buffer surrounding Peña Blanca Lake, there are historical records of northern Mexican gartersnakes along the Santa Cruz River at Portrero Canyon (1956), near Tumacacori National Monument (1970), and just outside the 20 km buffer at Tubac (1942) (HDMS). There is also a historical (1941) record along Forest Service Road 39, west of Ruby (AGFD Riparian Herpetofauna Database). There are no recent records of northern Mexican gartersnakes within the 20 km buffer surrounding Peña Blanca Lake, and it is unlikely that they occupy the buffered stocking complex, though no systematic surveys for gartersnakes have been conducted in this area. Therefore, it is unlikely that northern Mexican gartersnakes will be exposed to sport fish stocked into Peña Blanca Lake.

Downstream Analysis: As mentioned in the Fish Movement section, downstream dispersal of stocked sport fish would occur when heavy rains caused the lake to overflow, and fish survival would be limited to pools immediately below the dam. The Agua Fria Canyon below Peña Blanca Lake is ephemeral and there are no records of stocked species occurring in the Santa Cruz River in the vicinity of the confluence of Agua Fria Canyon (HDMS). Additionally, northern Mexican gartersnakes are likely extirpated from the Santa Cruz River downstream of the buffered stocking complex (HDMS). Therefore, it is unlikely that northern Mexican gartersnakes would be exposed to dispersing stocked sport fish that escape from Peña Blanca Lake.

Patagonia Lake

Site Description

Patagonia Lake is a 265 surface acre reservoir with a storage right and water right for 11,420 acre-feet for recreation and wildlife uses. The lake is located 10 miles east of Nogales in Santa Cruz County. Patagonia Lake and the associated recreation facilities were constructed in the late 1960's by the Lake Patagonia Recreation Association, Inc. The lake and its facilities became an Arizona State Parks property in the mid 1970's. Since that time, the lake has been managed cooperatively between Arizona State Parks and the Department.

Patagonia Lake is located within Patagonia Lake State Park and is a recreational destination in that includes trails, campgrounds, boat ramps, store, marina, and a swim beach.

Management of Water Body
The primary fishery at Patagonia Lake is a naturally reproducing warm water fishery, and as secondary fishery an intensive winter put-and-take rainbow trout fishery with stockings occurring multiple times annually. While the warm water species are self-sustaining, the stocked trout do not persist due to warm water temperatures, nor reproduce due the lack of required spawning habitat. Stocking history at the lake consists of sporadic warm water species stockings with regular winter trout stockings (Table 7).

Table 7. Historic Department fish stocking at Patagonia Lake.

Species	First Year	Last Year	Stockings	Num. Stocked
Brook trout*	1977	1977	1	8,500
Channel catfish	1977	1984	3	47,000
Largemouth bass	1977	1977	3	8,464
Rainbow trout	1976	2007	227	645,494
Redear sunfish	1977	1978	4	20,388
Threadfin shad	1979	1979	2	3,400
Total				733,246

*No longer found in this location.

Angler surveys conducted at the lake in 2002, show that the lake provides approximately 21,298 angler days per year (Pringle 2004).

Proposed Action
The Department proposes to stock rainbow trout, are proposed for the period covered by this consultation.

Catchable rainbow trout would be stocked from November to March multiple times each year; the numbers of trout stocked would range from 0 to 30,000 fish annually.

Water Distribution / Connectivity
The lake's water source is precipitation runoff from Sonoita Creek and Ash Canyon, and treated effluent flowing down Sonoita Creek from the town of Patagonia. Sonoita Creek is perennial

from the Town of Patagonia, approximately seven miles upstream, where the town releases treated effluent into Sonoita Creek, to near the inlet at the lake. This water from the town's water treatment plant keeps this portion of the creek perennial for all but the driest parts of the driest years. There are several tributaries to Sonoita Creek: Redrock Canyon, Temporal Gulch, Big Casa Blanca Canyon, Harshaw Canyon, and Cottonwood Spring, which contain perennial water and native fish populations. However, these perennial waters are all separated from Sonoita Creek by several-mile stretches of dry creek bed in their lower ends, except during periods following significant rainfall events when they could be temporarily connected. Ash Creek is ephemeral and only flows into Patagonia Lake after significant rainfall.

Water can leave Patagonia Lake at two locations: the water right maintained through the dam, which is perennial, or the spillway in flood events (Figure 16). Sonoita Creek is perennial below the lake because water is released to satisfy a downstream water right held by the City of Nogales (Figure 16). The perennial portion of Sonoita Creek is approximately 5 miles long from the dam, and then flows go underground 3 miles upstream of the confluence with the Santa Cruz River near the town of Rio Rico. Fresno Canyon is the only tributary downstream of the lake that holds perennial water. Fresno Canyon is protected by a natural barrier (Figure 18) just above its confluence with Sonoita Creek. The lowest 0.25 - 0.5 miles of Fresno Canyon are also dry except during periods of run-off as a result of rainfall events.

Figure 16. Sonoita Creek and Patagonia Lake overview map.

Fish Movement

There are no barriers to prevent fish from moving upstream into Sonoita Creek; however, the reach immediately upstream of Patagonia Lake dries nearly every summer, and the perennial reach farther upstream contains no suitable habitat for rainbow trout (see Community

Description below). Ash Creek is ephemeral and lacks habitat for stocked species or other fishes to persist

Patagonia Lake has a spillway, separate from the dam, which will allow for fish to spill from the lake during flood events into a short tributary that re-joins Sonoita Creek just downstream of the dam (Figure 17). The reach below the spillway is ephemeral. Below the dam, Sonoita Creek is perennial as discussed above. The water quality in this reach is poor due to the depth at which water is released from the dam through a bottom release structure, and generally only supports crayfish the first 0.87 mile. Beyond this 0.87 reach the creek will, and has, supported fish. Fresno Canyon, the only perennial tributary below the lake, is protected by a natural barrier as was shown in Figure 18. Streams and tributaries downstream of Patagonia Lake were shown in Figure 16.

Figure 17. Spillway and low flow releaase channels below Patagonia Lake.

Community Description

The current fish population within the lake consists of largemouth bass, bluegill, redear sunfish, green sunfish, channel catfish, flathead catfish, black crappie, and threadfin shad (Table 8). During the winter months of November through early March, catchable size rainbow trout have been stocked at this lake, but they do not persist when summer water temperatures exceed upper thermal limits for survival. Black bullhead, red shiner, mosquitofish and crayfish have been documented both above and below the lake within Sonoita Creek but have never been documented during bi-annual sportfish surveys in Patagonia Lake. Numerous surveys show that while sport fish can move upstream, native fish dominate the population (Foster and Mitchell 2005; Killeen 2005; Rodgeveller unpublished manuscript). One rainbow trout was documented above the lake in the early 1990's but the information is not available in any report or database

(D. Mitchell pers. comm.) Native species that occupy Sonoita Creek above the lake include topminnows, speckled dace, Longfin dace, sonoran suckers and desert suckers (HDMS Database). In 2005, only native species (speckled dace, longfin dace, and desert sucker) were found in two surveys above the lake (Foster and Mitchell 2005).

Figure 18. Natural barrier in Fresno Canyon that prevents upstream movement of fish from Sonoita Creek below Patagonia Lake.

Table 8. Species sampled at Patagonia Lake in electrofishing surveys 2008.

Species	**Number Sampled**
Largemouth Bass	223
Bluegill	96
Redear Sunfish	177
Green Sunfish	2

Channel Catfish	6
Flathead Catfish	18

Historically, mosquitofish, topminnow, longfin dace, black bullhead, green sunfish, red shiner, fathead minnows, flathead catfish, channel catfish, bluegill sunfish, desert suckers, Sonoran suckers and speckled dace have been documented below the lake (AGFD data). In 2005, the Department surveyed lower Sonoita Creek. Crayfish and mosquito fish dominated the fisheries biomass, with low concentrations of largemouth bass, black bullhead, and green sunfish (Foster and Mitchell 2004; Figure 19).

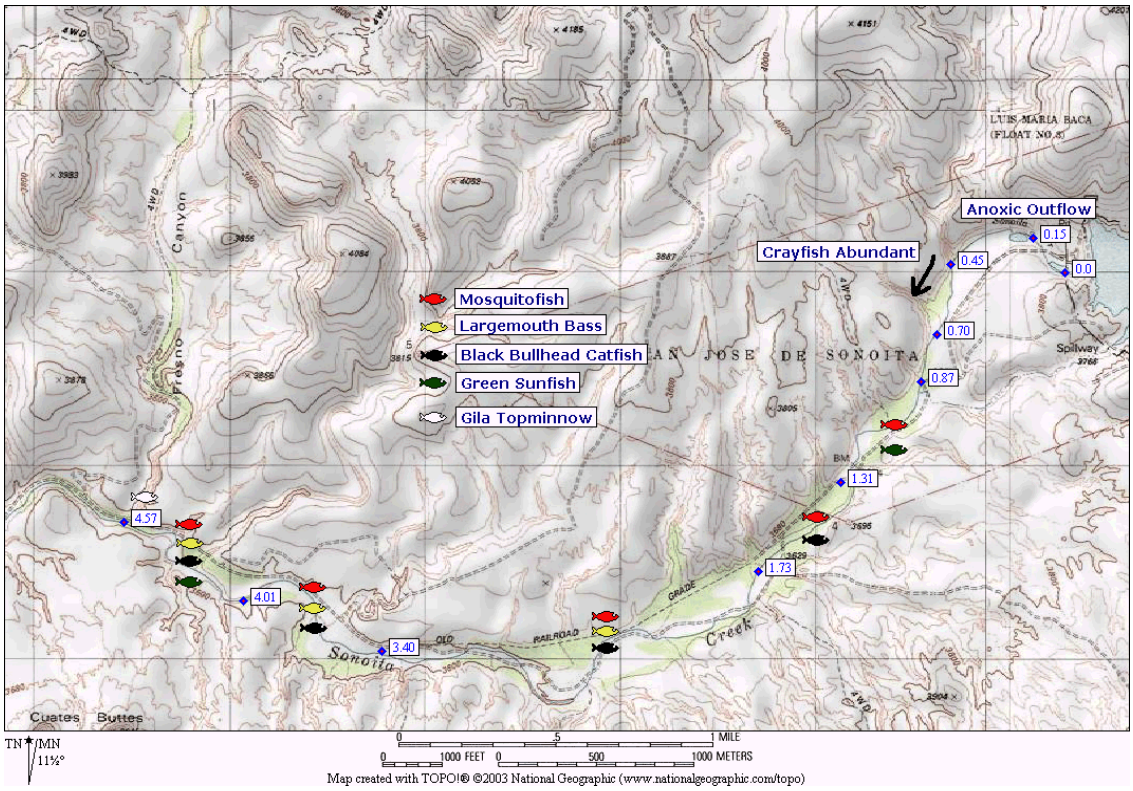

Figure 19. Distribution of fish species in lower Sonoita Creek in 2005. Distance units are miles.

Bullfrogs are common in Patagonia Lake and along Sonoita Creek (Turner 2006), and they, along with crayfish, likely contribute to the absence of some native reptiles and amphibians, including northern Mexican gartersnakes and lowland leopard frogs. Northern Mexican gartersnakes might still occupy the 20 km buffer surrounding Patagonia Lake (see analysis below).

Consultation Species or Critical Habitat
Potential impacts to Chiricahua leopard frogs, Gila topminnow, northern Mexican gartersnakes and Western yellow-billed cuckoo are addressed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and Northern leopard frogs are analyzed at a site, complex and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Chiricahua Leopard Frog
Local Analysis: Although the Patagonia Lake stocking site is not in the historical range of the Chiricahua leopard frog, a portion of the 5 mile buffer falls within the frog's former range. There are no records for Chiricahua leopard frogs from Patagonia Lake, however, there is one historical record of Chiricahua leopard frogs from one site within the buffered stocking site: Sonoita Creek (= Circle Z Ranch) (1928), however, subsequent surveys in 2006 (n = 9) (Turner 2006) have not reported Chiricahua leopard frogs in the area (Figure 12, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The likelihood that Chiricahua leopard frogs would be exposed to stocked fish at Patagonia Lake is low because the stocking site is not within the historical range of the frog and data suggest that frogs no longer occupy sites within the buffered complex that falls into former Chiricahua leopard frog range. In addition, crayfish, non-native fish and bullfrogs make the habitat less suitable for Chiricahua leopard frogs (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from the Patagonia Lake buffered stocking complex is low. There are historical records for Chiricahua leopard frogs outside the buffered stocking complex; however, subsequent data suggest that it is unlikely that Chiricahua leopard frogs still occupy sites outside

the buffer to which stocked fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm. and HDMS).

Gila Topminnow

Suitable habitat and documented occurrences for topminnow occur in Sonoita Creek and tributaries to Sonoita Creek both up and downstream of Patagonia Lake. Upstream includes: Sonoita Creek proper, Cottonwood Spring, Monkey Spring (protected by a natural barrier), Redrock Canyon. Downstream includes: Sonoita Creek proper, Fresno Canyon (protected by a barrier) and Coal Mine Canyon (protected by a barrier). Refer to the Upper Santa Cruz River complex analysis for information downstream to the confluence with the Santa Cruz River mainstem.

Potential Impacts

Winter stocking of rainbow trout may result in the potential for them to escape from the lake to move either upstream or downstream in Sonoita Creek during the cooler season when water temperatures allow for their persistence and flows for movement. Trout would not persist or establish in the stream due to the elevated water temperatures in the late spring and through early fall. Upstream movement could occur during low winter flows with downstream movement occurring due to spill. Department survey data have not found trout downstream of the reservoir but one trout has been found upstream within Sonoita Creek (D. Mitchell pers. comm.).

Northern Mexican Gartersnake

Local Analysis: It is unknown whether northern Mexican gartersnakes occupy the 20 km buffer surrounding Patagonia Lake, though it lies within the historical range of the species. No northern Mexican gartersnakes were detected during recent surveys of Patagonia Lake State Park or the Sonoita Creek State Natural Area, and none have been detected within the 20 km buffer since 1974 (Turner 2006, HDMS). Additionally, the USFWS (2008a) determined in the 12-month finding that northern Mexican gartersnakes are likely extirpated along the Santa Cruz River downstream of the Nogales area in Arizona and at Portrero Canyon/Springs. Within the 20 km buffer for Patagonia Lake, there are historical records of northern Mexican gartersnakes upstream of the lake along Sonoita Creek at the confluence with Adobe Canyon (1928, 1965), Patagonia (1954), and Circle K Ranch (1974) (HDMS). Downstream of Patagonia Lake and along the Santa Cruz River, there are also historical northern Mexican gartersnake records at Portrero Canyon (1956), near Tumacacori National Monument (1970), and just outside the 20 km buffer at Tubac (1942) (HDMS). The likelihood that northern Mexican gartersnakes will be exposed to stocked rainbow trout in Patagonia Lake or those that emigrate from the lake during flooding of the main channel of Sonoita Creek is low because trout will not persist during warm water temperatures (probably between mid-April through mid-September when the snakes would be active). Additionally, it is unknown whether northern Mexican gartersnakes currently occupy the buffered stocking complex. The existing community of warm water sport fish, bullfrogs and

crayfish in the lake and surrounding general area, coupled with the lack of native ranid frogs considerably diminish the amount of suitable habitat for northern Mexican gartersnakes.

Downstream Analysis: It is unlikely that northern Mexican gartersnakes would be exposed to dispersing rainbow trout that escape from Patagonia Lake and move downstream through Sonoita Creek to the Santa Cruz River the species may be extirpated from the area or only persist in low numbers (USFWS 2008a). Additionally, stocked rainbow trout would not persist in warm water temperatures.

Western Yellow-Billed Cuckoo

Suitable breeding and/or foraging habitat exists at or adjacent to the lake for the cuckoo. In 1998 and 2003, documented occurrences for migrating birds were located on the outskirts of the lake. Sonoita Creek above the lake also contains occurrences of cuckoos.

Potential impacts are identified below and described in greater detail in the methodology and criteria contained in Chapter 3.

Potential Impacts

There may be some limited amount of habitat degradation and some amount of disturbance to nesting cuckoos from anglers using or creating new trails to access the stocking site.

Potential impacts to migrant cuckoos can occur statewide and are most frequently found in the riparian zones along aquatic habitats (rivers, creeks, etc.), it is difficult to identify areas where they could not occur during migration. Additionally, the habitat requirements for migrant cuckoos are not as specific as nesting birds and specific stopover locations used are unpredictable in timing, duration, location, and abundance.

UPPER SANTA CRUZ RIVER COMPLEX ANALYSIS

Water Distribution / Connectivity

Parker Canyon drains off the west side of Peterson Peak in the Huachuca Mountains and enters Parker Canyon on the northern end of the lake. Collins Canyon, the second major tributary, is about 0.5 miles in length and drains rain runoff from a small portion of the watershed northwest of the lake. Merritt Canyon, the third major ephemeral tributary, enters from the east, and is about 4 miles in length.

Peña Blanca Lake is a run-off fed reservoir with Peña Blanca Wash at its main tributary. The wash starts in Mexico and flows north for 4.5 miles before reaching Peña Blanca Lake. The canyon is ephemeral and only has water in it following rainfall events. Alamo Canyon, an ephemeral tributary to Peña Blanca Canyon, also starts in Mexico and is a major tributary; it often flows continuously throughout the summer monsoon season. These canyons join approximately 0.75 miles above Peña Blanca Lake.

Water can leave Patagonia Lake at two locations: the water right maintained through the dam, which is perennial, or the spillway in flood events (Figure 16). Sonoita Creek is perennial below the lake because water is released to satisfy a downstream water right held by the City of Nogales (Figure 16). The perennial portion of Sonoita Creek is approximately 5 miles long from the dam, and then flows go underground 3 miles upstream of the confluence with the Santa Cruz River near the town of Rio Rico. Fresno Canyon is the only tributary downstream of the lake that holds perennial water. Fresno Canyon is protected by a natural barrier (Figure 18) just above its confluence with Sonoita Creek.

Fish Movement

Parker Canyon contains a series of fish barriers, 0.25 miles upstream of the confluence with the lake (Figure 9), in addition to the absence of perennial water; therefore fish cannot move up or persist. The other inflows, while not containing fish barriers, are ephemeral and have broad sandy bottoms that do not hold water long enough to sustain fish. There is potential for fish to spill from Parker Canyon Lake. The perennial reach below the dam maintains water, mostly in two large pools. Beyond these pools, all but 0.25 miles of the 12 mile drainage is ephemeral, to its confluence with the Santa Cruz River in Mexico, and contains no suitable habitat for stocked fish.

During periods of flooding at Pena Blanca, it is unlikely fish could move upstream due the presence of a small fish barrier created by Arizona Hwy 289, also known as Ruby Road that crosses Peña Blanca Canyon just above the lake and creates a fish barrier with a three to four foot drop (Figure 15). Fish can spill from the reservoir during flood events. The first mile downstream contains pool habitat that is suitable for fish, except in summer months. These pools below the lake were surveyed in 1996 and 1997, and although fish had escaped from the lake, they did not reproduce or persist for more than a couple of months, since the pools either dried up during the summer months or dissolved oxygen dropped to lethal levels for fish (refer to Table 5). Beyond the few pools immediately below the lake there is no perennial water in Peña Blanca Canyon, Agua Fria Canyon, or any of their tributaries. The ephemeral nature of the extensive sandy washes provides no habitat for fish.

There are no barriers to prevent fish from moving upstream into Sonoita Creek from Patagonia Lake; however, the reach immediately upstream of Patagonia Lake dries nearly every summer, and the perennial reach farther upstream contains no suitable habitat for stocked species. Patagonia Lake has a spillway, separate from the dam, which will allow for fish to spill from the lake during flood events into a short tributary that re-joins Sonoita Creek just downstream of the dam (Figure 17). The reach below the spillway is ephemeral.

Community Description

Sensitive fish and amphibian species are seasonally isolated by ephemeral stream reaches both up and downstream of the perennial waters. This is also true of tributary canyons, where frogs

are located, that are seasonally isolated by long stretches of ephemeral channel. Fish sampling (Native Fish Database) has documented mosquitofish, green sunfish, largemouth bass, and fathead minnow in the Santa Cruz River upstream of the confluence with Parker Canyon. The actual origin of these fish and all other non native fish in the watershed should be considered unknown because there are several stock tanks in the area (Figure 11) that maintain non native fish populations along with the, presence of non native fish species in the Santa Cruz River in Mexico. Fish sampling data collected during 1992-1996 (Weedman and Young 1997) and between 1998-2003 (Voeltz and Bettaso 2003) Gila topminnow monitoring show that rainbow trout, redear sunfish, bluegill sunfish and channel catfish were not found in the area on the Santa Cruz River upstream of the confluence with Parker Canyon Creek. These results were supported by subsequent monitoring since Voeltz and Bettaso 2003 (R. Timmons pers. comm.). Thus, the ephemeral reaches appear to have served as an effective barrier to upstream movement of fishes to occupied topminnow populations.

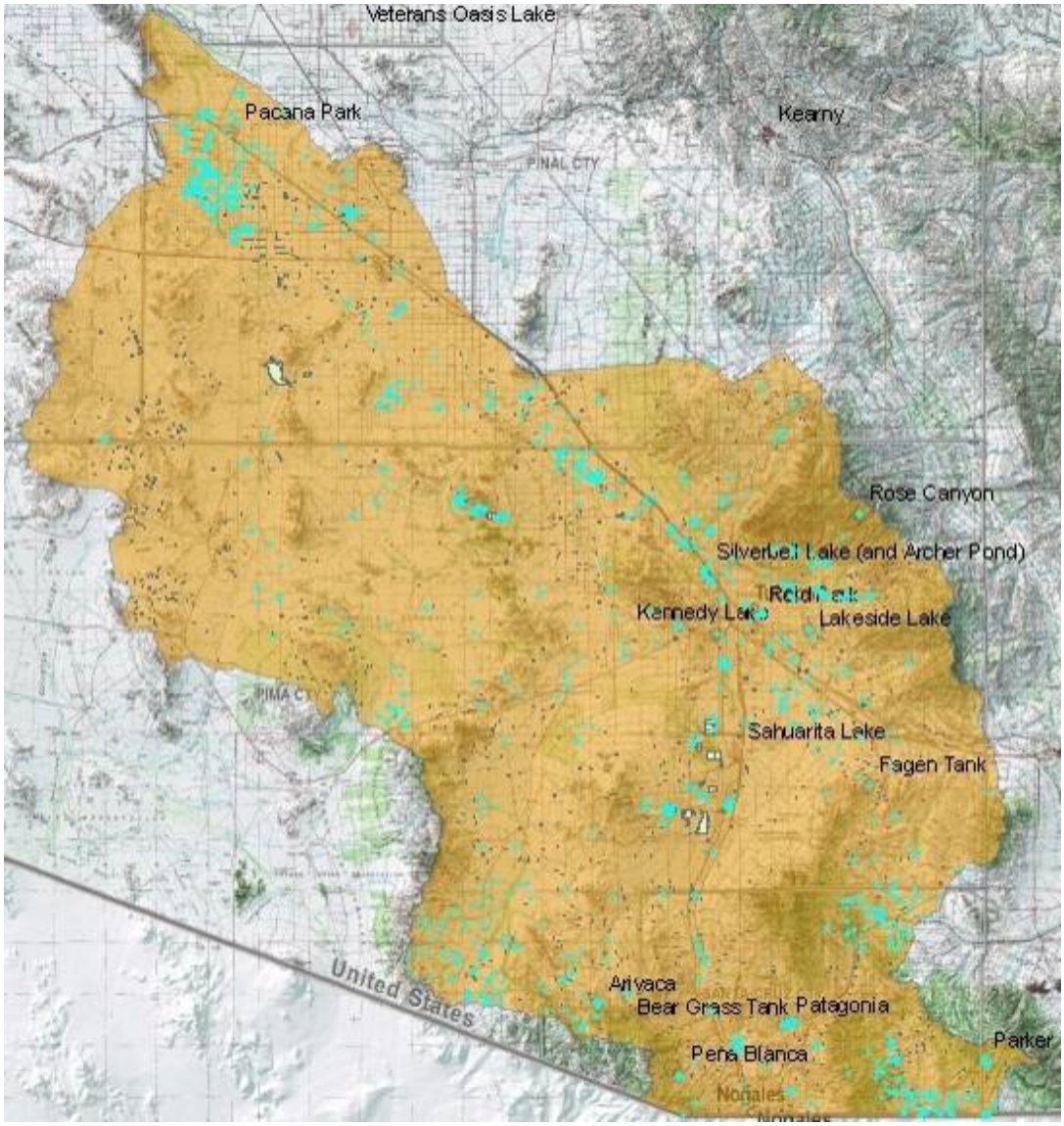

Figure 20. Perennial stock tanks and lakes in the Santa Cruz watershed (n=807).

Consultation Species or Critical Habitat

Potential impacts to Gila topminnow in the mainstem Santa Cruz River are discussed below. Impacts to topminnow directly up or downstream from proposed sites were discussed at the site.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur. The gartersnakes were discussed within the proposed sites.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Gila Topminnow

Populations of Gila topminnows are known in Sharp spring and Heron spring (HDMS 2001) in the San Rafael Valley downstream of Parker Canyon Lake. Suitable habitat and documented occurrences for the Gila topminnow also occurs in Sonoita Creek and tributaries to Sonoita Creek both upstream and downstream of Patagonia Lake. These upstream tributaries include: Sonoita Creek proper, Cottonwood Spring (protected by barrier), Monkey Spring (protected by barrier), Redrock Canyon (protected by natural barrier) Sonoita Creek, Cottonwood, Monkey and Redrock are considered occupied habitats. Downstream tributaries to Sonoita Creek include: Fresno Canyon and Coal Mine Canyon (protected by barriers) and are considered occupied. Downstream in the Santa Cruz from the confluence with Agua Fria Canyon, Gila topminnows were last observed in Nogales Wash a small tributary to the Santa Cruz River in 2002 (HDMS) and Negro Canyon in 2002 (HDMS).Surveys conducted in this portion of the river in 2008 and 2009 did not detect topminnows (Table 9).

Table 9. Catch per unit effort in Santa Cruz River and Nogales Wash.

Location	Date	Longfin Dace (N)	Mosquitofish (N)	Effort (seconds or m^2)	Longfin Dace CPUE (fish/min. or fish/ $m^{2)}$	Mosquitofish CPUE (Fish/min.)	Method
Chavez Siding	11/08	1	0	431 s	0.14	0	e-shock
	11/09	26	47	908 s	1.72	3.11	Dipnet,e-shock
Tubac Bridge	11/08	1	0	436s	0.14	0	e-shock
	11/09	36	103	485 s	4.46	12.75	e-shock & block
Santa	11/08	0	0	468s	0	0	e-shock

Gertrudis							& block
	11/09	10	6	500 m^2	0.02	0.01	seine
Palo Parado	11/08	0	0	433	0	0	e-shock
	11/09	24	0	484s	2.97	0.0	e-shock & block
Rio Rico	11/08	0	0	426s	0	0	Dip-net, e-shock & block
	11/09	46	0	663s	4.17	0	e-shock & block
Johnson's Property	11/08	196 14	14 48	256s 43.5 m^2	45.9 0.32	3.27 1.10	e-shock, seine
Nogales Wash	11/08	0	0	457s	0	0	e-shock & block
	11/09	230 using 2 methods	0	119s 90 m^2	Unknown	0	e-shock seine

While suitable habitat may still be present for the Gila topminnows within this section of the Santa Cruz River, the last known occurrences in the U.S. was in 1994 (HDMS). Upstream from the confluence with Agua Fria Canyon, topminnows were last documented in Portrero Creek in 2002 (HDMS).

Potential Impacts

Impacts could potentially occur to topminnow, if stocked species were able to escape from the lakes into the mainstem of the Santa Cruz or Sonoita Creek and persist moving upstream into Mexico or downstream toward Tucson, or if topminnow were to escape Fresno Canyon and move into Sonoita Creek.

Winter stocking of rainbow trout may result in the potential for them to escape from the lake either upstream or downstream during the cooler seasons when water temperatures allow for their persistence and movement. If this were to occur, the trout would not have long-term persistence, due to elevated water temperatures in the late spring through early fall. Rainbow trout would not persist through the year in the lakes for the same reason.

MIDDLE SANTA CRUZ RIVER SUB-WATERSHED

The middle Santa Cruz River includes Fagan Tank, Sahuarita Lake, Lakeside Lake, Reid Park, Kennedy Lake, Silverbell Lake and Rose Canyon lakes. Fagan Tank, Sahurita Lake and Reid

Park are closed systems with no hydrological connections to the Santa Cruz River. Sahuarita, Lakeside, Kennedy, Reid Park and Siverbell are Urban Fishing Program waters.

This sub-watershed includes several Tucson Area Urban Fishing Lakes that have outflows, or are closed systems, that join the same ephemeral stream channels as other stocked lakes in the Santa Cruz system. Origin of stocked species, if they were to occur in the system, could not be attributed to any specific stocking locality. These urban lakes are included in the for the Santa Cruz River Watershed analysis.

There are currently three Urban Fishing Program (UFP) waters in Tucson and one south of the city in the Town of Sahuarita, near the Santa Cruz River. These artificial lakes are all in municipal public parks and urban recreational areas (Figure 21). Three types of fish stockings occur at UFP lakes:

- Put-and-take stockings of catchable sized fish for the purpose of recreation and harvest;
- Supplemental stockings that either add fish to a fishery, or help augment low natural reproduction, or increase short-term fishing success for a fishing clinic or other similar event, or;
- Restocking of fish communities following catastrophic events or lake draining and maintenance.

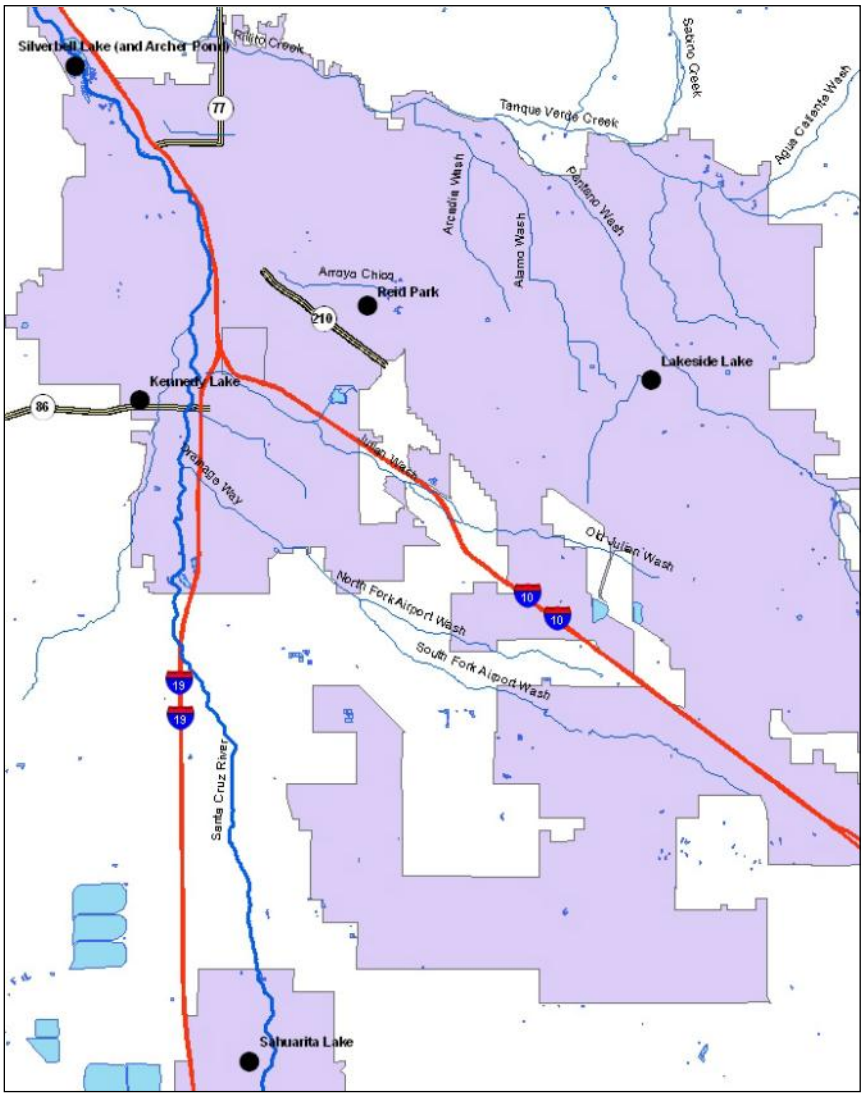

Figure 21. Tucson UFP and Prospective Fishing in the Neighborhood Lake.

Physical Geographic Description

The middle Santa Cruz River contains the mainstem Santa Cruz River.

Drainage area and elevations

Fagan Tank

Site Description

Fagan Tank is located near Mount Fagan on lands owned by the Forest Service. It is also labeled as "The Lake" on the USGS Topo map. The 5 acre tank is located on the eastern side of the upper Santa Cruz watershed. There are no improvements such as campgrounds, restrooms or boat ramps at this location, and there are no known data on the recreational use patterns at this

lake. Road access to this location is by unimproved dirt road off Highway 83, approximately 7.5 miles south of the I-10 interstate and Highway 83 intersection.

Management of Water body
Fagan tank is managed as a naturally reproducing warm water fishery to provide year round low-yield angling opportunities to anglers. Historically, the location has been infrequently stocked with channel catfish, largemouth bass, redear sunfish, and flathead catfish to maintain and augment the existing fish population (Table 10). In years past, fish used for stocking this location have been captured at Patagonia Lake during annual fish population surveys and then transported to Fagan Tank for release.

Table 10. Historic Department fish stocking of Fagan Tank.

Species	**First Year**	**Last Year**	**Num. Stocked**
Channel catfish	1974	1984	5,900
Flathead catfish	1991	1991	1
Largemouth bass	1986	1991	670
Redear sunfish	1989	1991	5,024
Total			11,595

The Department has not completed fish population surveys or creel surveys at the tank, and currently the existing condition is unknown. Based on reports from district officers and the public, the tank has gone dry due to drought conditions several times in the past 5 to 10 years.

Proposed Action
The Department proposes to stock bluegill sunfish, and redear sunfish for the period covered by this consultation.

Bluegill sunfish (sub-catchables, catchables), and redear sunfish (sub-catchables, catchables) may be stocked on an as needed basis at any time during the year to augment or to recover the fishery, following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines as identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Upstream, there are several large unnamed drainages that feed water into Fagan Tank, with rain runoff during the summer and winter rainy season; these are Fagan Tank's only source of water. All of these drainages are ephemeral and only contain water after a heavy rain.

Fagan tank could potentially spill during heavy rainfall events in the late summer and winter. Water leaving the tank flows in a northerly direction in an unnamed wash until it meets a second unnamed wash approximately 5 miles downstream. From there, water flows in a westerly direction for another 6 miles before the wash terminates into a bajada just west of Houghton road, southwest of Tucson. The ephemeral drainage has an extremely low gradient (0.01%), going from an elevation of about 4200 feet at Fagan Tank to an elevation of about 2500 feet where the nondescript unnamed drainage empties into the Santa Cruz River. This drainage then passes several check dams and erosion control structures as it traverses to the lower Sonoran desert. Because flows from this creek would be expected to terminate prior to reaching any tributaries hydrologically connected to the sub-watershed and due to the extensive distance and low gradient of these washes, Fagan Tank is considered a closed system. Fagan Tank is not in the Cienega Creek watershed. Fagan Tank has been reported to have gone dry several times during the past 5 to 10 years by the public and wildlife managers. No flooding or spilling has been reporting however it is likely to occur during periods of significant rainfall and runoff.

Fish Movement
Fish cannot persist upstream of Fagan; none of the drainages that provide water to the tank contain perennial water, nor is there any persistent aquatic habitat within them. Any fish that swam upstream in a flood would quickly die as the water evaporated and absorbed into the sand substrate.

Due to the ephemeral nature and wide sandy bottoms of the drainages, no habitat exists for aquatic species; any fish that wash out of Fagan Tank would be stranded with no water in a few days. Fagan Tank is a closed system that is isolated from the Cienega Creek watershed.

Community Description
Currently, the aquatic species assemblage is unknown; it is possible the tank is currently fishless due to the repeated drying of the tank due to existing drought conditions. Historically, the fish population consisted of largemouth bass, channel catfish, and redear sunfish within the tank.

Consultation Species or Critical Habitat
There are no consultation species in the drainage for Fagan Tank. Stocked fish cannot escape into Cienega Creek drainage because Fagan Tank's drainage does not hydrologically connect with Cienega Creek. Potential impacts to Chiricahua leopard frog and northern Mexican gartersnake are discussed below due to the movement potential of frogs into the drainage area for the tank.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frogs are analyzed at a site, complex and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Chiricahua Leopard Frog

Local Analysis: Although, Fagan Tank is within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to fish stocked in Fagan Tank is low. There are no historical records for Chiricahua leopard frogs from Fagan Tank, however, there is 1 current record for Chiricahua leopard frogs from 1 site within the buffered stocking complex; East Dam (= S of Barrel Canyon) (2008) and there have not been any further surveys (Figure 22, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Although the area has not been adequately surveyed and Chiricahua leopard frogs occupy the buffered complex, Fagan Tank is a closed system and it is unlikely for frogs to disperse to Fagan Tank because the occupied site exceeds the five mile distance a Chiricahua leopard frog would likely disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

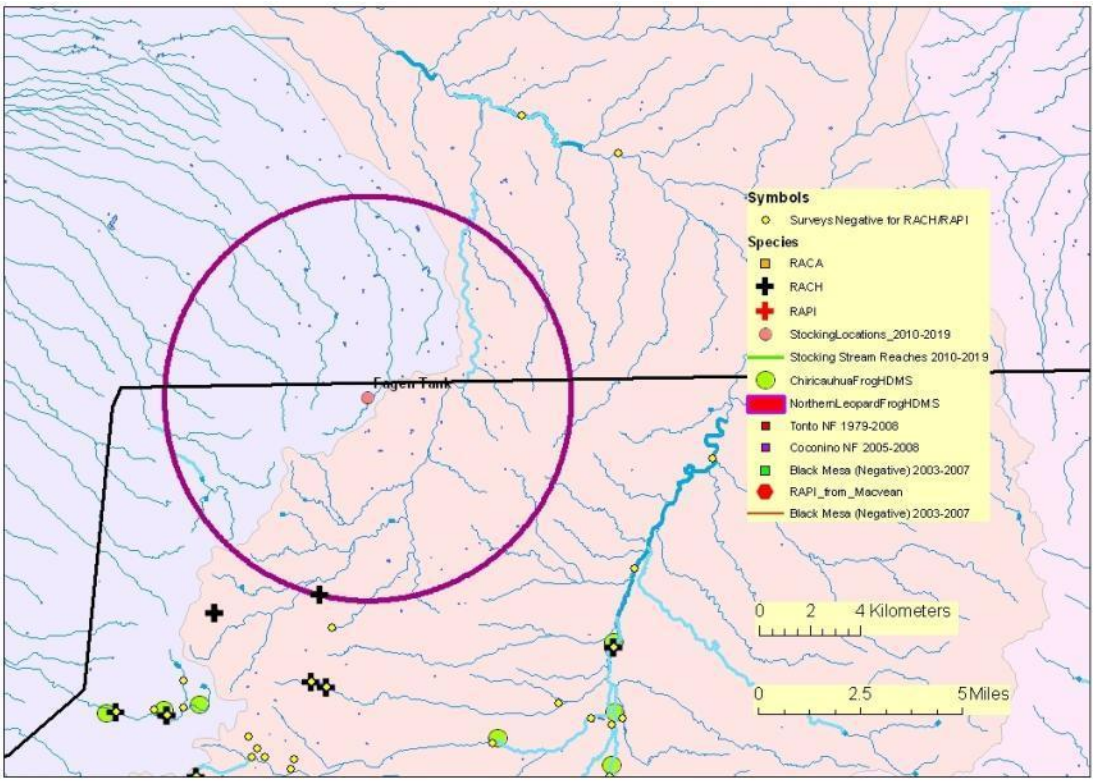

Figure 22. Map of Fagan Tank Sub-Complex of Santa Cruz River Watershed buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from the Fagan Tank buffered stocking complex is low. There are records for Chiricahua leopard frogs outside the buffered stocking complex, however, Fagan Tank is a closed system and it is unlikely for Chiricahua leopard frogs to disperse to Fagan Tank from occupied sites outside the buffered stocking complex because the occupied frog sites exceed the five mile distance a Chiricahua leopard frog would likely disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Mexican Gartersnake

Site-Specific Analysis: There are no historical northern Mexican gartersnake records from Fagan Tank, however, it lies within the historical range of the species and northern Mexican gartersnakes occupy the 20 km buffer surrounding Fagan Tank. There are recent northern

Mexican gartersnake records from the headwaters of Cienega Creek (1994) and along Cienega Creek within the Las Cienegas National Conservation Area (1985-2009) and near Davidson Canyon (1999, 2001) (Rosen et al. 2001; HDMS; AGFD Riparian Herpetofauna Database). Fagan Tank is considered a closed system and isolated from the Cienega Creek watershed where northern Mexican gartersnakes persist, thus it is unlikely that northern Mexican gartersnakes will disperse to Fagan Tank from the Cienega Creek area. Therefore, although northern Mexican gartersnakes occupy the buffered stocking complex, it is unlikely that snakes could be exposed to fish stocked in Fagan Tank.

Downstream Analysis: It is unlikely that northern Mexican gartersnakes could be exposed to dispersing fish from the Fagan Tank buffered stocking complex because Fagan Tank is considered a closed system and isolated from the Cienega Creek watershed where northern Mexican gartersnakes persist. Additionally, stocked sportfish that escape from Fagan Tank will not survive.

Sahuarita Lake

Site Description

Sahuarita Lake is located at Sahuarita Park on La Villita Road and Rancho Sahuarita Boulevard in the Town of Sahuarita, at 2710 foot elevation (Figure 23). This 10-acre lake was constructed in 2002 as part of their urban park system. The lake was built for park aesthetics, recreational fishing, property value, and for use in watering park landscape. This artificial lake has a sealed bottom and a concrete perimeter edge. Lake depths average 7 feet with a maximum of 12 feet. Sahuarita Park has a variety of improvements including restrooms, seating areas, ramadas, lighting, handicap accessibility, and a boat ramp.

Figure 23. Photo of Sahuarita Lake.

Management of Water Body

Since 2002, Sahuarita Park Lake has been managed as an intensively stocked put-and-take fishery (Table 11) to provide year-round high use urban fishing opportunities for anglers of all ages and abilities. Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, and sunfish. No live baitfish use is allowed.

Creel survey results from 2005 found 23,100 angler use days per year, an angler satisfaction rate of 84% and a 36% youth participation rate (Swanson and Hill 2006).

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March, and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 11. Historic UFP fish stocking of Sahuarita Lake.

Species	Years	Num. of Stockings	Num. Stocked
Rainbow trout	2002-2008	54	24,678

Channel catfish	2002-2008	72	37,320
Bluegill/Hybrid sunfish	2002-2008	12	10,320
Largemouth bass	2002-2008	3	3,180
TOTAL		141	75,498

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill sunfish, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 20,000 fish annually.

Largemouth bass (sub-catchables, catchables) would be stocked annually in numbers ranging from 0 to 1,500.

Largemouth bass (fry/fingerlings, sub-catchables, catchables), bluegill sunfish (fry/fingerlings, sub-catchables, catchables), and redear sunfish (fry/fingerlings, sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines indentified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
Sahuarita Lake is considered a closed system water body because there is no drainage inflow or outflow, with no spillway present. The lake is supplied with ground-water fed through a pipeline. Pumps pull lake water from the lake to irrigate surrounding park turf grass. While not connected, the lake is located 0.3 miles from the ephemeral Santa Cruz River.

Fish Movement
There is no opportunity for fish to leave this lake. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Swanson and Hill (2006) report rainbow trout, channel catfish, bluegill/hybrid sunfish, and largemouth bass. All species present are part of the current stocking program.

Consultation Species or Critical Habitat
Sahuarita is considered a closed system with no hydrologic connection to the Santa Cruz River.

Kennedy Park Lake

Site Description
Kennedy Park Lake is located at Mission Road and Ajo Way in southwest Tucson, at 2450 foot elevation (Figure 24). This 10-acre lake is in the UFP. Constructed by the City of Tucson in the 1960's as part of their urban park system, the lake was built for park aesthetics, recreational fishing, and for minor flood retention. This artificial lake with earthen dam has a sealed bottom and a gradually sloping dirt edge around the shoreline perimeter. Lake depths average 7 feet with a maximum of 13 feet. Tucson's popular Kennedy Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, and a boat ramp.

Figure 24. Photo of Kennedy Park Lake.

Management of Water Body
Since 1984, Kennedy Park Lake has been managed as an intensively stocked put-and-take fishery (Table 12) to provide a year round high-use urban fishing opportunity for anglers of all

ages and abilities. Special regulations are in place for this UFP water that governs the harvest of trout, catfish, bass, sunfish, and white amur. No live baitfish use is allowed.

Creel survey results from 2005 found 48,000 angler use days per year, an angler satisfaction rate of 86% and a 28% youth participation rate (Swanson and Hill 2006).

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March, and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 12. Historic UFP fish stocking of Kennedy Park Lake.

Species	**Years**	**Num. of Stockings**	**Num. Stocked**
Rainbow trout	1984-2008	216	104,568
Channel catfish	1984-2008	288	159,600
Bluegill/Hybrid sunfish	1984-2008	48	33,480
Largemouth bass	1984-2008	12	11,400
TOTAL		564	309,048

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill sunfish, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 20,000 fish annually.

Largemouth bass (sub-catchables, catchables) would be stocked annually in numbers ranging from 0 to 1,500.

Largemouth bass (fry/fingerlings, sub-catchables, catchables), bluegill sunfish (fry/fingerlings, sub-catchables, catchables), and redear sunfish (fry/fingerlings, sub-catchables, catchables), may be stocked on an as needed basis at any time during the period covered by this consultation to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for

this purpose would be determined according to stocking guidelines indentified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
Kennedy Park Lake is considered a predominately closed system water body because it has a small desert watershed inflow and a spillway. The lake is supplied with ground-water pumped through a pipeline. There are no pumps to withdraw water from the lake.

The lake is subject to extreme overflow events (winter storms or summer monsoons) every few years on average. Water leaving the lake will flow in a northerly direction in an unnamed ephemeral wash until it connects to Pantano Wash, also an ephemeral wash 0.5 mile north of Kennedy Park Lake. From there, water flows in a northerly direction for another three miles until it connects to the Santa Cruz River. The small drainage above Kennedy Park Lake and the ephemeral washes connecting to the Santa Cruz River do not contain any perennial waters nor is there persistent aquatic habitat within them.

Fish Movement
Precipitation events that fill the lake to overflowing are infrequent, occurring on average at 3-7 year intervals. During an overflow event, the possibility exists for stocked fish or offspring of stocked fish to move over the spillway into the ephemeral washes below. Any fish caught in these episodic flooding events would be subjected to a variety of environmental and physical stressors including: turbulence, high sediment loads, drop structures, physical damage, clogged gills, and disorientation. As flood flows in these ephemeral drainages recede in hours or days, any remaining fish would be subject to rapid temperature changes, loss of oxygen, stranding, and desiccation/mortality. The only persistent aquatic habitat available downstream is located approximately 10 miles away on the Santa Cruz River below the Roger Road wastewater treatment discharge site. To reach this location, fish would need to move downstream in the watercourse described in the Water Distribution/Connectivity section above. No sampling has been done to determine if fish have spilled in the drainage below Kennedy.

Community Description
Swanson and Hill (2006) report seasonal rainbow trout, channel catfish, largemouth bass, bluegill/hybrid sunfish, common carp, white amur, and black crappie.

Consultation Species or Critical Habitat
Refer to the Middle Santa Cruz River Complex Analysis for potential impacts to Gila chub, Gila topminnow and northern Mexican gartersnakes downstream in the Santa Cruz River.

Silverbell Lake
Site Description
Silverbell Lake is located at Christopher Columbus Park on 4600 North Silverbell Road in northwest Tucson, at 2255 foot elevation (Figure 25). This 13-acre lake was constructed by the

City of Tucson in the 1960's as part of their urban park system. The lake was built for park aesthetics and recreational fishing. This artificial lake has a natural, dirt edge around the shoreline perimeter and has a dirt bottom. Lake depths average 5 feet with a maximum of 7 feet. Tucson's popular Christopher Columbus Park has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, a dog park, and boat ramps.

Figure 25. Photo of Silverbell Lake.

Management of Water Body

Since 1984, Silverbell Lake has been managed as an intensively stocked put-and-take fishery (Table 13) to provide year round high-use urban fishing opportunities for anglers of all ages and abilities. Special regulations are in place for this UFP water that manages the harvest of trout, catfish, bass, sunfish, and white amur. No live baitfish use is allowed.

Creel survey results from 2005 found 54,900 angler use days per year, an angler satisfaction rate of 80% and a 19% youth participation rate (Swanson and Hill 2006).

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March, and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 13. Historic UFP fish stocking of Silverbell Lake.

Species	Years	Num. of Stockings	Num. Stocked
Rainbow trout	1984-2008	216	134,016
Channel catfish	1984-2008	288	171,264
Bluegill/Hybrid sunfish	1984-2008	48	43,440
Largemouth bass	1984-2008	12	11,352
TOTAL		564	360,072

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill sunfish, redear sunfish, black crappie and largemouth bass are proposed for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill sunfish, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 25,000 fish annually.

Largemouth bass (sub-catchables, catchables) would be stocked annually in numbers ranging from 0 to 2,000.

Largemouth bass (fry/fingerlings, sub-catchables, catchables), bluegill sunfish (fry/fingerlings, sub-catchables, catchables), redear sunfish (fry/fingerlings, sub-catchables, catchables), and black crappie (sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines indentified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity

Silverbell Lake is considered a predominately closed system water body as it has a small desert watershed inflow and an overflow feature. The lake is supplied with ground-water pumped through a pipeline from a shallow, reclaimed water recharge zone. There are no pumps to withdraw water from the lake.

The park watershed size is too small to cause a lake spillover; however, lake operators have, at times, not turned off the well water pumps and subsequently some lake water has spilled from

the outflow. Water discharged from the lake flows in a northerly direction through a small unnamed drainage, then goes to a small retention or catchment area that allows water to percolate into the ground. Within 200 feet of this site is the Santa Cruz River, a perennial reach that is solely supported by reclaimed water discharge from the City of Tucson Roger Road water treatment facility.

Fish Movement
During an extreme overflow event or a lake operations error, the possibility exists for stocked fish or offspring of stocked fish to move over the spillway into the ephemeral wash below. As flood flows in the ephemeral drainage recede, any remaining fish would be subject to rapid temperature changes, loss of oxygen, stranding, and desiccation/mortality. A persistent aquatic habitat is available downstream at the confluence with the Santa Cruz River. If stocked fish were to escape and make it to the Santa Cruz River, the poor water quality associated with the treated effluent, the irregular flows, and the high water temperatures during the summer would prohibit long term survival of escaped fish. No sampling has been done to determine if fish have spilled in the drainage below Silverbell.

Community Description
Swanson and Hill (2006) report seasonal rainbow trout, channel catfish, largemouth bass, bluegill/hybrid sunfish, common carp, white amur, and black crappie.
Consultation Species or Critical Habitat
Refer to the Middle Santa Cruz River Complex Analysis for potential impacts to Gila chub, Gila topminnow and northern Mexican gartersnakes downstream in the Santa Cruz River.

PANTANO WASH-RILLITO RIVER COMPLEX
Physical Geographic Description

Drainage area

The Pantano Wash–Rillito River sub-watershed begins in the north western most portion of Santa Cruz County and eastern Pima County. The upper end of the watershed contains the headwaters of Cienega Creek in Santa Cruz County, as well as the headwaters of Tanque Verde Wash, the Rillito River, and Pantano Wash to the confluence of the Rillito River with the Santa Cruz River in north Tucson. The drainage area encompasses about 920 square miles.

Tributaries

Major tributaries for this portion of the drainage include Cienega Creek, Tanque Verde Creek, Rillito River, Pantano Wash, and Canada Del Oro Wash. Of the major tributaries, only Cienega Creek maintains perennial water and is protected by a barrier at Del Lago. Portions of these tributaries and other smaller tributaries are ephemeral or intermittent.

The Rillito River is actually an ephemeral wash, only supporting water for short periods after heavy rainfall (Figure 26).

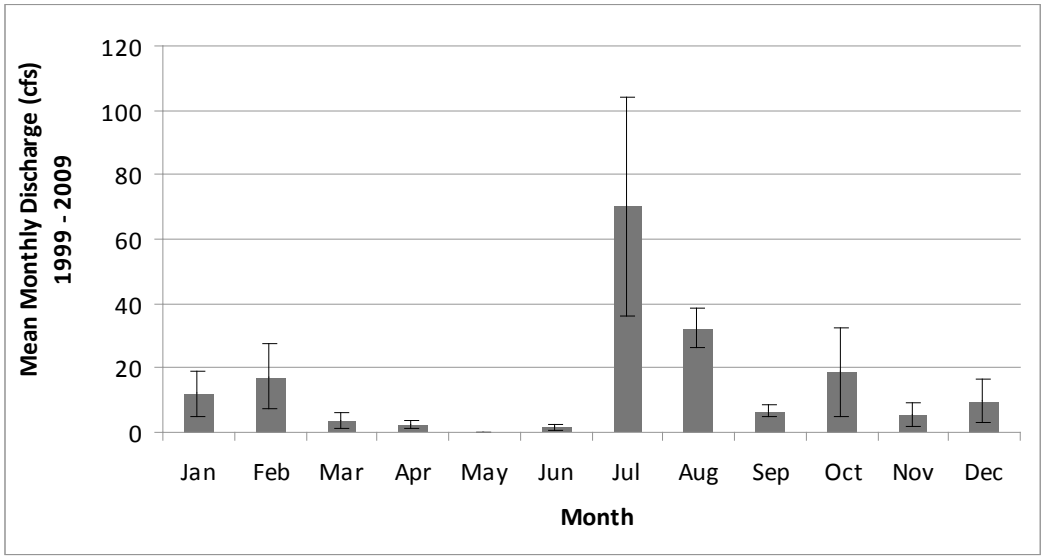

Figure 26. USGS Gauge data from Rillito River near Dodge Blvd, Tucson, AZ (1999-2009).

Rose Canyon Lake

Site Description

Constructed in 1959, Rose Canyon Lake is a 7 acre impoundment located on the Coronado National Forest, located 40 miles northeast of Tucson. Rose Canyon Lake is located within an improved Forest Service campground. In addition, there is a handicapped trail around a portion of the lake that leads to a handicapped accessible fishing pier. The campground and area around the lake is only open from April-October; outside those months anglers must hike into Rose Canyon Lake.

Management of Water Body

Rose Canyon Lake is managed as intensive use cold water put-and-take rainbow trout fishery and a put- grow-and-take brown trout fishery, to provide year-round angling opportunities with multiple stockings of both species annually (Table 14). The lake harbored a population of illegally stocked green sunfish until a dredging project in 2000 drained the entire lake, resulting in their removal. The ability of the Department to stock this location is highly dependent on water quality during the summer months and it is not uncommon to suspend trout stockings due to high temperatures during the months of June through August. Because the lake has always been a put-and-take trout fishery, and other priorities have not made surveying a stocked population possible, the Department has never conducted a fish survey at this lake. Angler survey data collected in 2001 showed anglers spent 6,097 angler use days at Rose Canyon Lake (Pringle 2004).

Table 14. Historic Department fish stocking at Rose Canyon Lake.

Species	First Year	Last Year	Stockings	Num. Stocked
Brook trout	1988	1988	1	5,000
Brown trout	1972	2005	6	38,001
Rainbow trout	1958	2007	337	958,023
Total				1,001,024

Proposed Action

The Department proposes to stock rainbow and brown trout for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times each year during the summer months from April through late September depending on water level and quality; the number of catchable sized rainbow trout stocked would range from 0 to 30,000 annually.

Brown trout would be stocked multiple times each year depending on water level and quality as sub-catchables and catchables; the number of sub-catchable brown trout stocked annually would range from 0 to 10,000 while the number of catchable brown trout stocked annually would range from 0 to 20,000.

Water Distribution / Connectivity

Rain and snow melt run-off are the only sources of water for Rose Canyon Lake. Typically it is anticipated to spill during heavy rainfall events in the late summer and winter. There is also the potential for spill in the spring following winters with sufficient snowfall to produce run-off. Water spilling from this lake flows in a southerly direction into Sycamore Canyon for approximately 4½ miles, where it meets Bear Canyon. At this point, it is approximately 5 miles in Bear Canyon to the confluence with Sabino Canyon. From this point, it is 3 miles to the confluence with Tanque Verde Wash. The Tanque Verde Wash is an ephemeral drainage that drains the northwest slopes of the Rincon Mountains east of Tucson. Water from Rose Canyon Lake, once reaching Tanque Verde Wash, would travel 3 miles until it confluences with Pantano Wash, forming the Rillito River. Pantano Wash is an ephemeral drainage that drains the southern slopes of the Rincon Mountains east of Tucson and the Empire Valley southeast of Tucson. The Rillito River is ephemeral (Figure 27) and drains the south slopes of the Catalina Mountains, traveling in a western direction for approximately 14 miles, where it confluences with the Santa Cruz River near Marana (Figure 28).

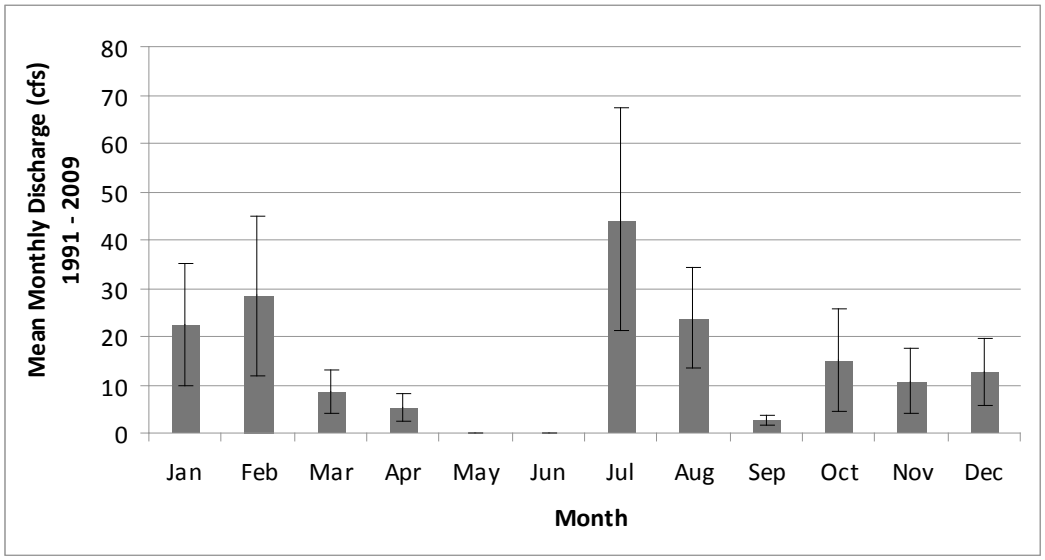

Figure 27. Mean (1 SE) monthly discharge at USGS gauge 09484500 Tanque Verde Creek at Tucson, AZ from 1999 - 2009.

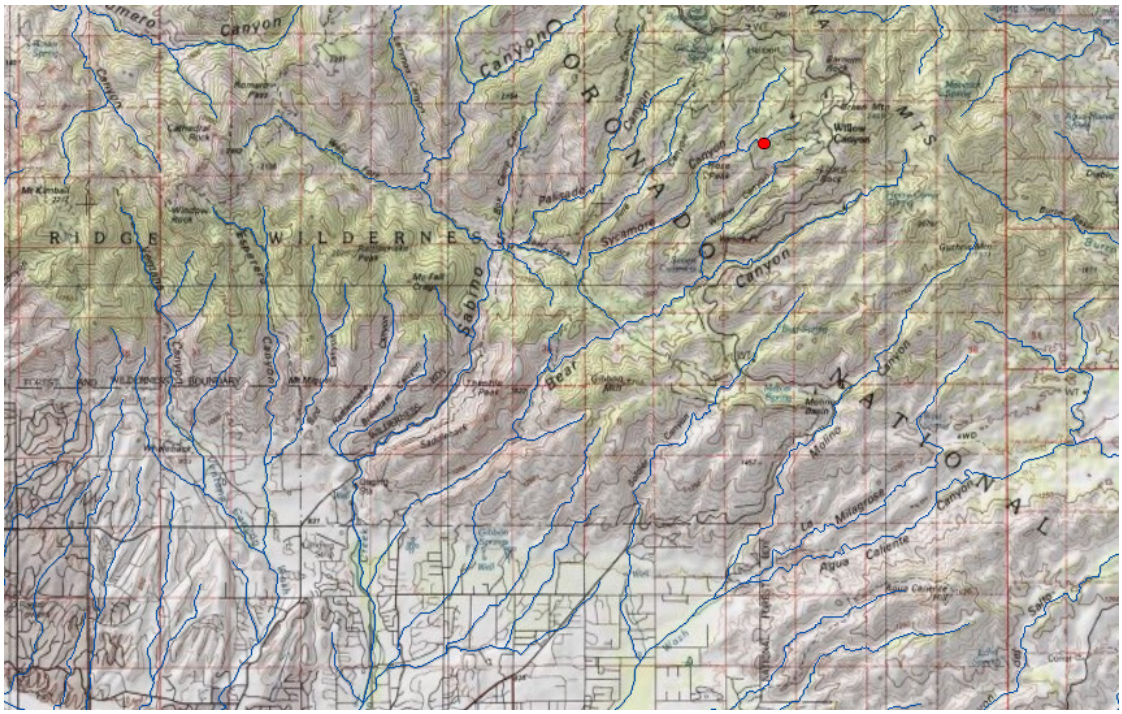

Figure 28. Lower drainage of Rose Canyon Lake showing connection to Bear Canyon and then to Sabino Canyon.

Fish Movement

Stocked trout can escape from Rose Canyon Lake when it overflows. They would leave the lake via a spillway over the dam and drop approximately 50 feet into Rose Canyon. There is a small concrete splash pad located at the bottom of the spillway. Trout that do make it over the spillway and survive landing on the splash pad could then be washed further downstream and would follow the same path as the water connectivity above. Further downstream, Rose Canyon joins Sycamore Canyon, where there is the remnants of an old reservoir known as Sycamore Reservoir. This reservoir is now silted in and any escaped fish will pass through this location over an 18 foot drop from the crest of the dam and onto exposed bedrock at the base of the old dam. Because the reservoir is silted in to the top of the dam there is no aquatic habitat in this location except during flood events. Beyond the old dam at Sycamore Reservoir, Bear Canyon narrows to a bedrock canyon and there is sporadic perennial water located in pools created by depressions in the bedrock. These tinajas are created and destroyed due to the large amount of sediment that continues to move through the drainage as a result of the 2003 Aspen fire. Because these tinajas do come and go so frequently, there is no way to predict where fish will be and will not be from year to year; however, because they do exist there is opportunity for short term survival of escaped fish in Bear Canyon following significant flow events.

Any survival of trout in these locations would be of short duration because water temperatures exceed upper limits for trout survival, and dissolved oxygen is low in these pools (Ehret 2008). Just past these tinajas there is a series of seven waterfalls that total about 400 feet; each has a bedrock base that trout would have to survive passage over in order to travel downstream to the confluence with Sabino Canyon. If a trout survived the falls, it could possibly move upstream in Sabino Canyon; however, 1½ miles upstream of the confluence of Bear Canyon and Sabino Canyon there is an old dam structure at Sabino Lake that is approximately 12 feet high and serves as a barrier to upstream movement of fish (Figure 29). Any trout that might persist in Sabino Canyon below this structure would only do so for a short duration because summer water temperatures exceed upper thermal limits for trout survival. If an extreme flood event occurred, fish could be washed to the normally dry Rillito River, which is very broad and flat with a deep sand bottom. From the Rillito, they could be washed downstream into the Santa Cruz River; however, the water would be loaded with sediment and debris, and trout would likely not survive in the muddy flood waters. In the highly unlikely event of stocked fish escaping and making it all the way to the Santa Cruz River, fish could reach perennial water located at the confluence of Rillito Creek and the Santa Cruz River. Perennial flow is provided by several municipal wastewater treatment plant outflow pipes at Sweetwater and Roger Roads. This portion of the river is perennial due to discharges of treated effluent from several treatment plants located along the river. This treated effluent's water quality is very poor for aquatic species survival due to high levels of ammonia and low levels of dissolved oxygen (Pima County 2002; Walker et al undated).

Figure 29. Sabino Canyon dam located in lower Sabino Canyon which prevents upstream movement of fish escaping from Rose Canyon Lake.

Community Description

The aquatic species assemblage within Rose Canyon Lake currently consists of crayfish, bullfrogs, mosquitofish, rainbow trout, and brown trout. Prior to the dredging project crayfish, bullfrogs and mosquito fish were present. Although the lake was dry for a period of nearly one full year, both bullfrogs and crayfish were observed almost immediately once the lake begin to fill, and mosquitofish were observed several months later once the lake had completely re-filled. It is likely that the mosquitofish were stocked by someone, but it is unlikely that the crayfish and bullfrogs were stocked, given the quickness in which they reappeared once the lake begun to refill. It is unknown how these species were able to find their way back to Rose Canyon Lake. Both rainbow trout and brown trout persist in the lake year round and have been stocked regularly since the completion of the 2002 dredging project. The lack of appropriate spawning habitat required by trout species prevents natural reproduction in the lake. All trout currently resident in the lake are the result of stocking.

Because the Department re-established Gila chub in 2004 following the Aspen fire, they have expanded from the initial stocking locations and are now found throughout the 7 miles of perennial habitat in Sabino Canyon above Sabino Lake. These 7 miles of habitat located from the confluence between Sabino Canyon and the west fork of Sabino Canyon downstream to the Forest Service boundary is designated as critical habitat for the chub (Figure 30). Until about the mid 1980's, within Sabino Canyon, both rainbow and brown trout were stocked in the higher elevations of Sabino Canyon. No surveys have been completed in these higher elevations and it is currently not known if brown trout still persist. Anglers report catching rainbow trout regularly

in the higher elevations of Sabino Canyon and Lemmon Creek, which is a small tributary to Sabino Canyon that was also stocked historically. Although trout species persist in the higher elevations of Sabino Canyon and its tributaries, they have never been documented in the lower elevation habitats that are occupied by the chub (Kline 2006; Ehret 2008, 2009). This is likely due to water temperatures in the summer that exceed lethal limits for trout survival and low dissolved oxygen in the pools.

In addition to the efforts in Sabino Canyon, the Department established a population of Gila chub in Bear Canyon, as well as during the 2004 efforts to expand the fishes range in the Santa Catalina Mountains and reduce threats from catastrophic losses in Sabino Canyon. Due to poor rainfall patterns and an overall lack of suitable habitat at the time, chub were only stocked in pools located directly below Sycamore Dam in Bear Canyon. Because of this initial stocking, chub have expanded downstream and can now be found throughout Bear Canyon as suitable habitat is available Kline 2006; Ehret 2008, 2009). During these survey efforts no other fish species have been documented within Bear Canyon (Foster 2005; Kline 2006; Ehret 2008, 2009).

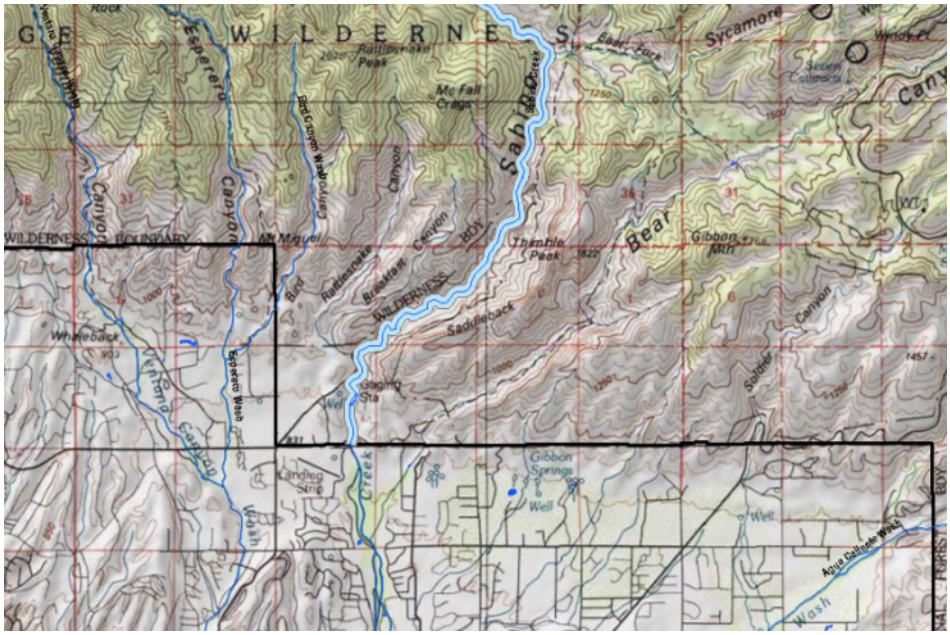

Figure 30. Overview map of Bear and Sabino Canyon confluences. Light blue along Sabino Canyon depicts critical habitat designation.

Consultation Species or Critical Habitat

Potential impacts to Gila chub and Mexican spotted owl addressed below. Refer to the Middle Santa Cruz River Complex Analysis for potential impacts to Gila chub, Gila topminnow and northern Mexican gartersnakes downstream in the Santa Cruz River.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Gila Chub

Suitable habitat and documented occurrences for Gila chub occur within both Sabino Canyon and Bear Canyon. Additionally, critical habitat is designated within Sabino Canyon. Outside of these two locations there is no other suitable habitat for Gila chub to occur within the drainage.

Potential Impacts

The persistent native fish populations in this location are found in Sabino Canyon and Bear Canyon. Due to the presence of Sabino Dam located upstream of the confluence of Sabino Canyon and Bear Canyon, it is unlikely that stocked trout that were to escape from Rose Canyon lake could travel upstream into Sabino Canyon and have impacts on Gila chub populations. Any trout that were to escape and end up in Sabino Canyon, along with any Gila chub that may be washed out of Sabino Canyon below Sabino dam, could persist for a short period of time while water persists in the ephemeral channel below Sabino Dam. Although no stream flow gauge data exist for the stream channel below Sabino Dam, stream channel gauge data collected approximately ¼ quarter mile above Sabino Dam documents the small amount of surface flow reaching Sabino dam (Figure 27).

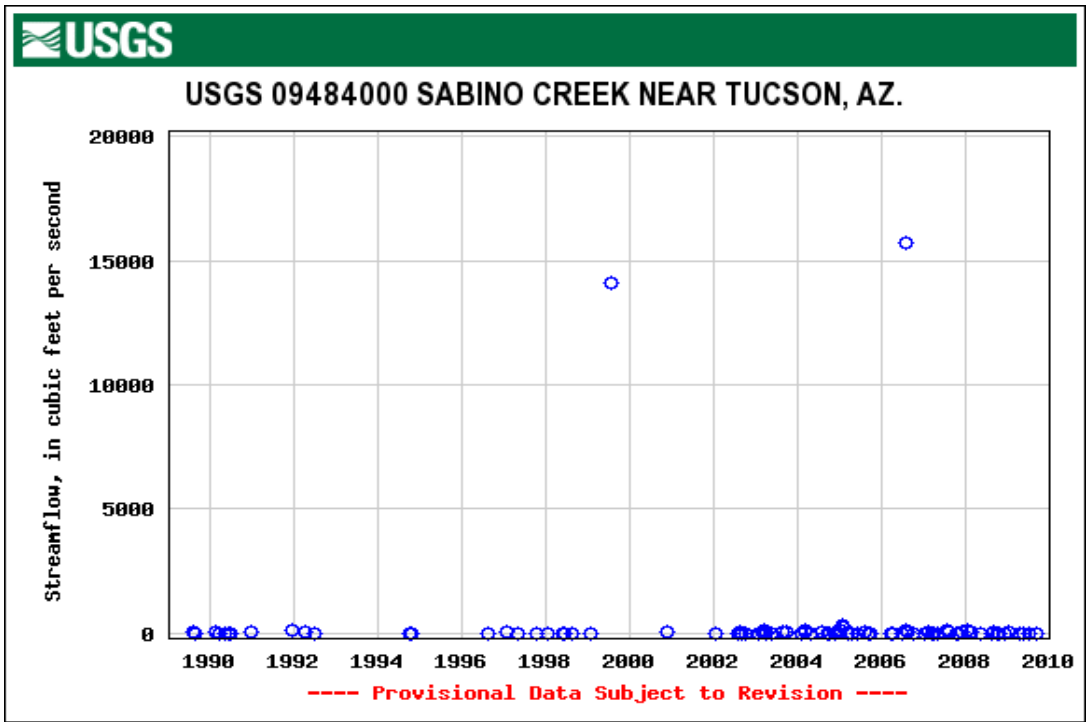

Figure 25. USGS Gauge data from Sabino Creek located approximately ¼ mile above Sabino dam.

Stocked trout and Gila chub may co-exist together downstream of Sabino dam in pools filled during runoff events. The period of co-existence would likely be brief, from a couple of hours to several weeks, depending on season and rainfall or run-off patterns. During these brief periods of time impacts to Gila chub could be in the form of competition for food and space or, depending on the size of chub, possibly predation on chub by trout. Although interactions could occur because of the ephemeral nature of the aquatic habitat and these temporary locations where both species are together, the impacts cannot be measured and will likely be insignificant because both species will perish once aquatic habitat is lost due to it drying.

Impacts within Bear Canyon can be expected to be similar to those expected within Sabino Canyon when stocked trout escape from Rose Canyon Lake and become deposited in pools inhabited by Gila chub. Impacts for such instances could be in the form of competition for space and food, and once again depending on the size of chub in the pools, with trout predation is possible as well.

In both instances where trout escape and move downstream into perennial habitats occupied by Gila chub it is likely that impacts would once again be in the form of competition for food and for space as well as predation if chub of the appropriate size are available. Such interactions in the perennial locations are likely to occur until trout die from elevated water temperatures in the summer months.

Because there is no perennial habitat beyond the confluence of Sabino Canyon with Tanque Verde Wash, any trout that were washed downstream into these lower tributaries would only persist for a short duration following the rainfall event, and would die once conditions dried. In the unlikely event that water did persist in these lower tributaries for any length of time, summer water temperatures at this elevation would exceed upper survival limits for trout, and preclude their persistence for extended periods of time.

Mexican Spotted Owl and Critical Habitat

This stocking location is within Mexican spotted owl (MSO) critical habitat (CH) and the northern part of lake is in a buffer. There is little vegetation along most of the shoreline of the stocking location and can be accessed by foot.

Potential Impacts

The stocking site, extended area for fish movements from the stocking site, and/or the area of potential angler access are within the 0.25 mile buffer around MSO PACs in the general vicinity of the site. No physical effects to MSO habitat in the PAC are anticipated because anglers are not expected to be present in the PAC. There may be some disturbance to MSOs from human presence and associated noise if those owls are using the edge of the PAC or the buffer area for foraging or other normal activities. The disturbance effects do not occur in the PAC where nesting, roosting, and most foraging occur.

Indirect effects may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs or KHCs. These actions may include trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

The CH designation included most other protected and restricted habitats for the MSO. Indirect effects to CH may include actions that can affect forest structure and maintenance of adequate prey species identified as PCEs. These actions may include trampling of vegetation, soil compaction, removal of small woody debris or other physical degradation potentially altering the productivity and succession/regeneration of the vegetation. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PCE's of critical habitat from destruction or adverse modification. In

making that statement, recreational activities, including angling were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure. The act of a relatively small number of people walking through habitat is not likely to cause the kind of effects that would result in adverse effects to the PCEs/KHCs of MSO CH and/or restricted and protected habitats.

Lakeside Lake

Site Description

Lakeside Lake is an urban pond located at Chuck Ford-Lakeside Park on 8300 East Stella Road in Tucson, at 2700 foot elevation (Figure 31). This 14-acre lake is in the UFP. Constructed by the City of Tucson in the 1960's and reconstructed in the late 1970's as part of their urban park system, the lake was built for park aesthetics, recreational fishing, water supply for landscape irrigation, and for flood retention and control. This deep artificial lake has a concrete dam, a sealed bottom of soil cement and a steep sloping soil cement/dirt edge around the shoreline perimeter. Lake depths average 15 feet with a maximum of 35 feet. Tucson's Chuck Ford-Lakeside Park has a variety of improvements, including restrooms, ramadas, picnic tables, lighting, handicap accessibility, baseball and soccer fields, a children's playground, and a boat ramp.

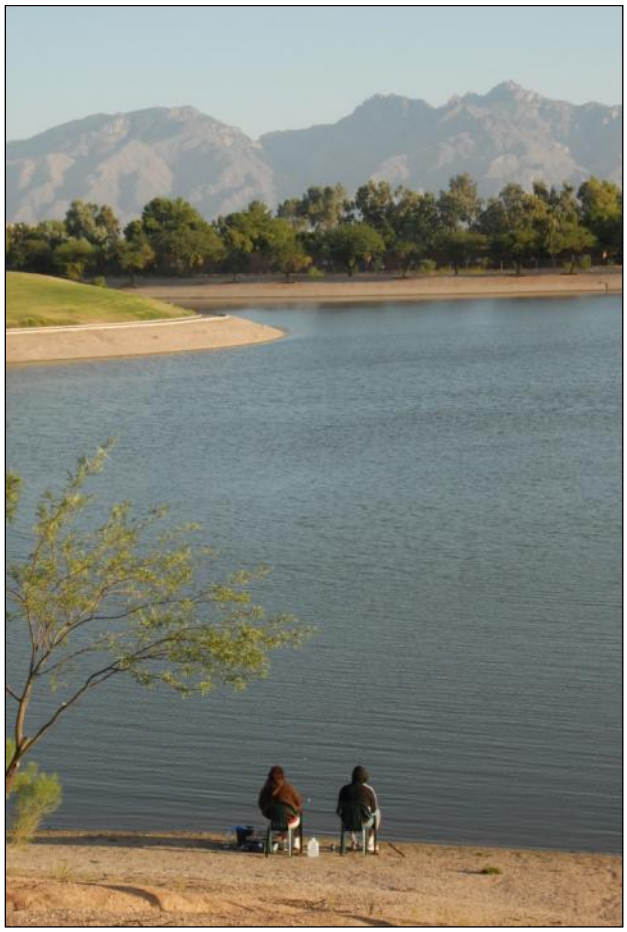

Figure 31. Photo of Lakeside Lake.

Management of Water Body

Since 1986, Lakeside Lake at Chuck Ford-Lakeside Park has been managed as an intensively stocked put-and-take fishery (Table 15) to provide year round high-use urban fishing opportunities for anglers of all ages and abilities. Special regulations are in place for this UFP water that manages the harvest of trout, catfish, bass, and sunfish. Live baitfish use is not allowed.

Creel survey results from 2005 found 41,500 angler use days per year, an angler satisfaction rate of 89% and a 23% youth participation rate (Swanson and Hill 2006).

Put-and-take stockings occur from September through early July each year, with trout stocked in November through March, and catfish stocked in the fall and spring. Sunfish and largemouth bass are stocked in the fall and/or spring. Due to high temperatures, rainbow trout do not persist through the summer. Besides providing put-and-take fishing, some of the stocked warm water species remain to spawn and augment the modest sport fish populations of the lake.

Table 15. Historic UFP fish stocking of Lakeside Lake.

Species	Years	Num. of Stockings	Num. Stocked
Rainbow trout	1986-2008	198	122,848
Channel catfish	1986-2008	264	158,400
Bluegill/Hybrid sunfish	1986-2008	44	38,720
Largemouth bass	1986-2008	11	10,560
TOTAL		517	330,528

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill, and redear sunfish would be stocked multiple times each year; the numbers of each of these species stocked would range from 0 to 25,000 fish annually.

Largemouth bass (sub-catchables, catchables) would be stocked annually in numbers ranging from 0 to 2,000.

Largemouth bass (fry/fingerlings, sub-catchables, catchables), bluegill sunfish (fry/fingerlings, sub-catchables, catchables), and redear sunfish (fry/fingerlings, sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines indentified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity

Lakeside Lake is considered an open system water body because it has a substantial urban watershed inflow and a spillway. The lake was primarily supplied with reclaimed water and urban runoff until 2008. Through negotiations with the Arizona Department of Environmental Quality for a National Pollution Discharge Elimination System (NPDES) permit, the use of reclaimed water for water supply was stopped and converted to a ground-water supply. There are pumps that withdraw water from the lake for landscape and turf irrigation. In 2001, the City of Tucson installed a sophisticated two stage aeration system to improve water quality, particularly dissolved oxygen and pH.

The lake is subject to overflow runoff events (winter storms and summer monsoons) one or two times a year on average. The Atterbury Wash watershed above Lakeside captures runoff from a substantial area (about 11,000 acres) that brings runoff into the lake during winter and summer rains. Water leaving the lake will flow in a northerly direction in Atterbury Wash 0.6 miles to Pantano Wash, then northwesterly 6.7 miles into Rillito Wash, then 12.3 miles westerly to the confluence with the Santa Cruz River. Pantano Wash joins Rillito Creek downstream of Sabino Canyon, which is the drainage containing Rose Canyon Lake. The ephemeral Atterbury watershed above Lakeside Lake includes some golf course ponds, but no other perennial waters or persistent aquatic habitat.

Fish Movement

During an overflow event, the possibility exists for stocked fish or offspring of stocked fish to move over the spillway into the sequence of ephemeral washes below. Any fish caught in these episodic flooding events would be subjected to a variety of environmental and physical stressors including: turbulence, high sediment loads, drop structures, physical damage, clogged gills, and disorientation. As flood flows in these ephemeral drainages recede, any remaining fish would be subject to rapid temperature changes, loss of oxygen, stranding, and desiccation/mortality. The only persistent aquatic habitat available downstream is located approximately 20 miles away on the Santa Cruz River below the Roger Road wastewater treatment discharge site. To reach this location, fish would need to move downstream in the watercourse described in the Water Distribution/Connectivity section, then move upstream on the Santa Cruz. No sampling has been done to determine if fish have spilled in the drainage below Lakeside.

Community Description

Department records (Swanson and Hill 2006) report seasonal rainbow trout, channel catfish, largemouth bass, bluegill/hybrid sunfish, goldfish, and black crappie.

Consultation Species or Critical Habitat

Refer to the Middle Santa Cruz River Complex Analysis for potential impacts to Gila chub, Gila topminnow and northern Mexican gartersnakes downstream in the Santa Cruz River.

Reid Park Lake

Site Description

Reid Park Lake is located at Reid Park on East 22nd Street and Randolph Way in central Tucson. There are two adjoining lakes, 0.5-acre and 1.0-acre, that are not stocked by the Department. Constructed by the City of Tucson in the 1950's, these small lakes were built for park aesthetics, recreational fishing, and for use in watering park landscape. These artificial lakes have sealed bottoms and concrete perimeter edges. Lake depths average 5 feet with a maximum of 8 feet. Tucson's popular Reid Park, located next to the Tucson Zoo, has a variety of improvements including restrooms, ramadas, picnic tables, lighting, handicap accessibility, sports fields, and a children's playground.

Management of Water Body
Reid Park Lake has been managed by the City of Tucson as a light-use recreational fishery, primarily for children, with a modest warm water fishery. Special regulations are in place for this park water that reduces the harvest of trout and catfish.

There have been no surveys of angling use of these facilities. For many years the City of Tucson used to allow only children to fish the lakes with an inexpensive permit. The Tucson Parks and Recreation Department conducts kids fishing clinics and derbies at this location several times annually.

Proposed Action
The Department proposes to stock rainbow trout, channel catfish, bluegill sunfish, redear sunfish, and largemouth bass for the period covered by this consultation.

Catchable rainbow trout, channel catfish, bluegill sunfish, and redear sunfish would be stocked annually; the numbers of each of these species stocked would range from 0 to 2,000 fish annually.

Largemouth bass (sub-catchables, catchables) would be stocked annually in numbers ranging from 0 to 500.

Largemouth bass (fry/fingerlings, sub-catchables, catchables), bluegill sunfish (fry/fingerlings, sub-catchables, catchables), and redear sunfish (fry/fingerlings, sub-catchables, catchables) may be stocked on an as needed basis at any time during the period covered by this consultation to restore a depleted fishery, or recover the fishery following catastrophic events that cause major fish kills, or for construction events that require draining the lake. Numbers of fish stocked for this purpose would be determined according to stocking guidelines indentified in the Urban Fishing Start-up and Augmentation Stocking Guidelines.

Water Distribution / Connectivity
Reid Park Lake is considered a closed system water body because it has no drainage inflow and no outflow or spillway. The lakes are supplied with ground-water fed through a pipeline. Pumps pull lake water from the lake to irrigate surrounding park turf grass.

Fish Movement
There is no opportunity for fish to leave this lake. There is no lake outflow. Water pumped from the lake has screened intakes and supplies the turf sprinkler systems.

Community Description
Largemouth bass, bluegill, and channel catfish have been documented from these lakes. Other fish species are unknown.

Consultation Species or Critical Habitat
Reid Park Lake is considered a closed system with no hydrological connection to the sub-watershed and no consultation species or impacts have been identified.

MIDDLE SANTA CRUZ RIVER COMPLEX ANALYSIS

Water Distribution / Connectivity
All but two of the Tucson Area Urban Lakes has water connectivity with the Santa Cruz River; Reid Park and Sahuarita lakes are closed systems. The three remaining waters are periodically subjected to extreme overflow events in the form of winter storms or summer monsoons, or operational maintenance errors that result in a water discharge into the Santa Cruz River or its tributaries. Fagan Tank is also a closed system.

Fish Movement
During an overflow event, the possibility exists for stocked fish or offspring of stocked fish to move over the spillway into the ephemeral washes below Kennedy, Silverbell and Lakeside Lakes. Any fish caught in these episodic flooding events would be subjected to a variety of environmental and physical stressors including: turbulence, high sediment loads, drop structures, physical damage, clogged gills, and disorientation. As flood flows in these ephemeral drainages recede in hours or days, any remaining fish would be subject to rapid temperature changes, loss of oxygen, stranding, and desiccation/mortality. If stocked fish were to escape and make it to the Santa Cruz River, the poor water quality associated with the treated effluent, the irregular flows, and the high water temperatures during the summer would prohibit long term survival of escaped fish.

Stocked trout can escape from Rose Canyon Lake when it overflows via a spillway over the dam and drop approximately 50 feet into Rose Canyon. Rose Canyon joins Sycamore Canyon, where there is the remnants of an old reservoir known as Sycamore Reservoir. Beyond the old dam at Sycamore Reservoir, Bear Canyon narrows to a bedrock canyon and there is sporadic perennial water located in pools created by depressions in the bedrock. These tinajas are created and destroyed due to the large amount of sediment that continues to move through the drainage as a result of the 2003 Aspen fire. Because these tinajas do come and go so frequently, there is no way to predict where fish would be and would not be from year to year; however, because they do exist there is opportunity for short-term survival of escaped fish in Bear Canyon following significant flow events.

Community Description
Refer to the Santa Cruz River aquatic community description section as it is interrelated to the three Tucson UFP lakes; Kennedy, Lakeside, and Silverbell.

Consultation Species or Critical Habitat
Potential impacts to Gila chub, Gila topminnow and northern Mexican gartersnakes downstream in the Santa Cruz River are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frogs are analyzed at a site, complex and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Mexican gartersnakes are analyzed on a complex and downstream scale due to the movement potential into the stocked area and fish movement potential up or downstream into areas where the snakes may occur.

Gila Chub
The nearest documented occurrences of Gila chub are within Sabino Canyon. None have been found in the main stem Santa Cruz River.

Potential Impacts

No potential impacts beyond those identified in the Rose Canyon Lake consultation section would be anticipated from stocked species on Gila chub, due to the distance of nearest occurrence and lack of potential for exposure due to the system being predominately closed with no to limited connectivity.

Gila Topminnow
The nearest documented occurrences of Gila topminnow are at Cienega Creek. None have been found in the main stem Santa Cruz River that is the watershed that these waters are connected to.

Potential Impacts

No potential impacts would be anticipated from stocked species on Gila topminnow, due to the distance of nearest occurrence and lack of potential for exposure due to the system being predominately closed with no to limited connectivity.

Northern Mexican Gartersnake

Stocking - Site Analysis: Northern Mexican gartersnakes are considered extirpated from the Santa Cruz River downstream of Nogales at the International Border, at Portrero Canyon/Springs, and in Tucson at Tanque Verde Creek, Rillito Creek, and Agua Caliente Spring, thus they would not be exposed to sport fish stocked into sites within the Lower and Middle Santa Cruz River complexes (USFWS 2008a; HDMS)

Downstream Analysis: Northern Mexican gartersnakes would not be exposed to dispersing stocked sport fish that escape from sites within the Lower and Middle Santa Cruz River complexes because they are considered extirpated from the Santa Cruz River downstream of Nogales at the International Border, at Portrero Canyon/Springs, and in Tuscson at Tanque Verde Creek, Rillito Creek, and Agua Caliente Spring (USFWS 2008a; HDMS).

BRAWLEY WASH-LOS ROBLES WASH COMPLEX

Physical Geographic Description

Drainage Area

The Brawley Wash – Los Robles Wash Sub-Watershed drains 1390 square miles and contains one proposed stocking site (Arivaca Lake). Los Robles Wash is a tributary of the Santa Cruz River that turns into Brawley Wash as it drains north. Brawley Wash joins the Santa Cruz River north and west of Tucson. Brawley Wash only flows enough to transport fish after heavy monsoon rains in the summer months (Figure 32).

Range of Elevations

Elevations range from 6880 feet at Kitt Peak near the headwaters, to 600 feet at the confluence with the Santa Cruz.

Tributaries

Ephemeral washes dominate the sub-watershed. Two ephemeral tributaries draining into Arivaca Lake are Bartolo Canyon and Chimney Canyon. Downstream from the lake is Cedar Creek, which becomes Arivaca Creek near the town of Arivaca.

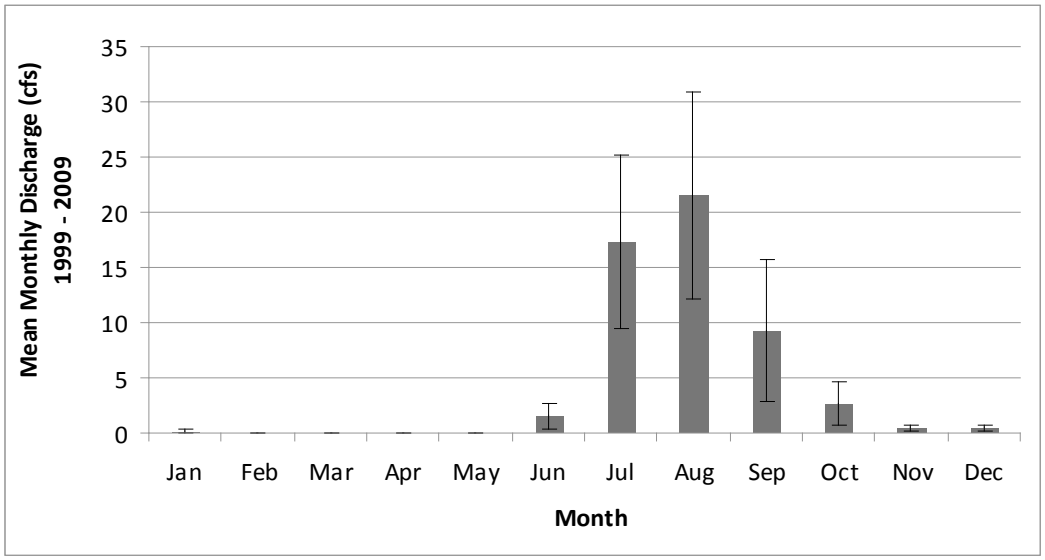

Figure 32. USGS Gauge of monthly mean flows for Brawley Wash 1999-2009.

Arivaca Lake

Site Description

Arivaca Lake, a run-off fed reservoir created by a dam constructed by the Department with Federal Aid Sport Fish Restoration monies in 1957, is in Cedar Canyon at the confluence with Chimney Canyon. As such the property must be maintained as a sport fishery or the monies must be repaid to Federal Aid in today's dollars. The lake and surrounding property is owned by the Department and adjacent lands are owned by the Forest Service and USFWS National Wildlife Refuge properties. The lake is located 7 miles from Arivaca, AZ (Figure 33).

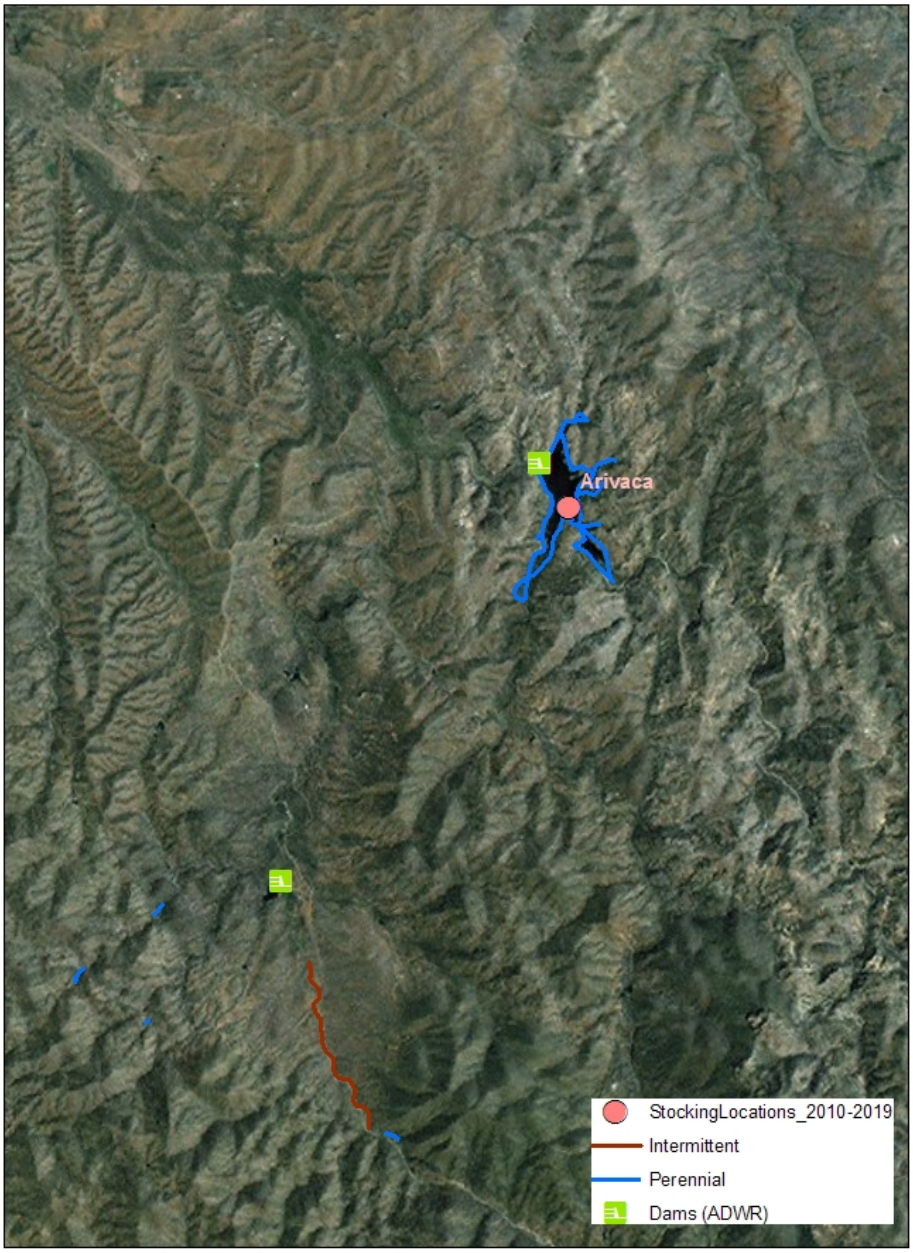

Figure 33. Arivaca Lake drainage. Red lines denote ephemeral stretches and blue lines denote perennial stretch.

Management of Water Body
The fishery at Arivaca Lake is a naturally reproducing warm water fishery consisting of largemouth bass, channel catfish, bluegill, and redear sunfish. The lake has historically been managed as a trophy largemouth bass fishery, and that management strategy continues today. After a fish kill in 1999, sunfish populations rebounded quickly; however, the lake was restocked with largemouth bass and channel catfish (Table 16). In 2001, angler surveys showed that anglers expended 22,963 angler use days (Pringle 2004).

Table 16. Historic Department fish stocking at Arivaca Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Channel catfish	1970	1999	19	137,233
Largemouth bass	1970	1999	5	16,142
Redear sunfish	1977	1978	2	18,620
Sunfish hybrid	1970	1970	2	9,000
Bullfrog Tadpole	1971	1971	1	5,000
Threadfin shad	1974	1974	1	1,000
Total				184,995

Proposed Action
The Department proposes to stock channel catfish, bluegill, and redear sunfish for the period covered by this consultation.

Channel catfish (sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), and redear sunfish (fry/fingerling, sub-catchables, catchables) may be stocked as needed at any time during the period covered by this consultation, to augment or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
The Department maintains a water right of approximately 1300 acre-feet of water, with the only source of that water being rain runoff. Chimney Canyon and Cedar Canyon on the southern end of the lake provide the majority of the water for this lake, with several other minor canyons around the lake contributing some water as well. Typically this lake will spill during heavy rainfall events in the late summer and winter; however, this has only occurred twice in the past ten years due to drought conditions at the lake.

Water can spill via an incorporated spillway at the dam. It travels downstream in the ephemeral Cedar Canyon approximately 0.75 miles, before the channel becomes poorly defined. Then flows spread out into sheet flow, before continuing downstream in the poorly defined channel

approximately 3.5 miles where it enters active agricultural fields. Then it flows into Arivaca Cienega, which is also the confluence with Arivaca Wash (Figure 35). Flows reaching Arivaca Wash would then flow in a westerly direction in and connect with a small perennial stretch of Arivaca Creek just west of the town of Arivaca. Leaving this point, water then would travel 6 miles before turning north and becoming part of the ephemeral Altar Wash. Water would then flow in the Altar Wash north for approximately 20 miles, where numerous washes in the Altar Valley converge to form the Brawley Wash about 14 miles south of Three Points. The Brawley Wash then travels nearly 40 miles before its confluence with the Santa Cruz River near Red Rock.

Fish Movement

Upstream of the lake, both Cedar Canyon and Chimney Canyon and the smaller tributaries to these two canyons are ephemeral and contain no known barriers to upstream movement. Cedar Canyon begins 4 miles south of the lake on Bartolo Mountain; Cedar Canyon branches with Bartolo Canyon approximately 3 miles upstream of the lake. There is no fish habitat in any of these canyons. Chimney Canyon gets it start just north of the Town of Ruby and flows approximately 4 miles before emptying into Arivaca Lake on the southern end. There are numerous unnamed smaller tributaries associated with Chimney Canyon, however, none of them along with Chimney Canyon contain fish habitat in the absence of rainfall events. If fish were able to move up into these canyons, they would only survive a matter of days due to the lack of habitat and loss of water to evaporation.

Fish can spill from Arivaca after heavy summer rains. Fish would leave the lake and enter Cedar Canyon, which becomes poorly defined after 0.75 miles, and flows spread out into sheet over a wide, sandy bottom. After an additional 4 miles the drainage enters an active alfalfa field before entering Arivaca Cienega. There is no suitable habitat for stocked species in this reach, and it is very unlikely fish would get past the fields and cienega as the flow spreads out into a shallow sheet of water that fish cannot move through. Beyond the cienega the wash runs past the town of Arivaca and into a short, shallow, perennial reach of Arivaca Creek with very low to no flow (Figure 34). No stocked species have ever been documented in this reach (LCRB Aquatic GAP), most likely due to the difficulty of a stocked species reaching it, and the lack of pool habitat in the reach. Beyond this stretch the entire drainage consists of large washes with wide sandy bottoms (Figure 35) none of which contain water or fish habitat except during heavy rainfall periods. In the unlikely event fish could move down as far as these washes they would not persist because the water would quickly dry up.

There are numerous stock tanks in the vicinity of Arivaca Lake, both upstream and downstream, that may contain sport fish. These tanks are on private property and have not been surveyed by the Department, but 11 of them have had aquatic stocking permits for many sport fish species, such as largemouth bass, channel catfish, bluegill, redear sunfish and various minnows, issued to them historically (D. Mitchell, pers. comm.).

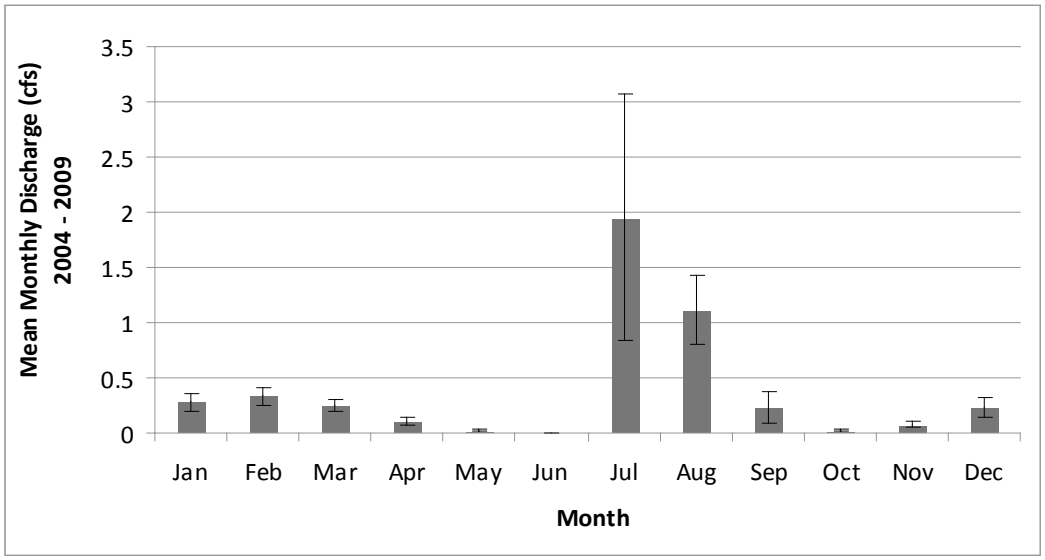

Figure 34. USGS Gauge data for the perennial section of Arivaca Creek 2004-2009.

Figure 35. Aerial photo of poor channel definition below Arivaca Lake where flows become sheet flows.

Community Description
Currently, the lake's fish population consists of naturally reproducing largemouth bass, redear sunfish, bluegill, and mosquitofish populations with multiple age classes of each. In 1999, the lake experienced a fish kill and the majority of fish in the lake were lost. In response to the fish kill, the Department completed internal environmental compliance documents along with Section 7 documents to begin the process of reestablishing the fish population, and was approved for the stocking of largemouth bass, bluegill, redear sunfish, and channel catfish. However, only largemouth bass and channel catfish were needed to be stocked. Based on fish population surveys conducted since the fish kill in 1999, all populations of fish with the exception of channel catfish have rebounded and are at or near pre-kill conditions (Table 17). Historical stocking information shows threadfin shad were stocked in the lake in 1974; however, this species can no longer be found in the lake. All other species historically stocked by the Department still persist in the lake and reproduce annually. Arivaca Lake, Cedar Canyon, and Arivaca Cienega all harbor bullfrogs. Northern Mexican gartersnakes are historically known from Arivaca Lake and may still occur in the area (see analysis below).

Table 17. Electrofishing Survey of Arivaca Lake 2008.

Species	**Num. Sampled**
Largemouth Bass	225
Bluegill	49
Redear Sunfish	71
Green Sunfish	2

Consultation Species or Critical Habitat
Potential impacts to Chiricahua leopard frog and northern Mexican gartersnake are discussed below.

Chiricahua Leopard Frog

Local Analysis: Although Arivaca Lake is within the historical range of the Chiricahua leopard frog, the likelihood that frogs could be exposed to fish stocked in Arivaca Lake is low. There are no historical records for Chiricahua leopard frogs from Arivaca Lake, however, there are 5 historical records for Chiricahua leopard frogs from 4 sites within the buffered stocking complex; Arivaca Creek (1992), Frog Tank (1993), Bolsa Tank (1989), Oro Blanco Wash (1992-Pre) and California Gulch (1989). Subsequent surveys in 1994-1995 in Oro Blanco Wash and California Gulch and extensive site visits from 2007-2009 to Frog and Bolsa Tanks have been negative for Chiricahua leopard frogs (Figure 12, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm., C. Akins pers. comm., T. Jones pers. comm., HDMS). Data suggest that it is

likely that Chiricahua leopard frogs no longer occupy the buffered stocking complex that includes Arivaca Lake and the presence of non-native fish and bullfrogs make the habitat less suitable for Chiricahua leopard frogs (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). In addition, as mentioned in the *Fish Movement* section, it is unlikely that fish stocked in Arivaca Lake would disperse up or downstream of the stocking site and persist for more than a few days.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing fish from the Arivaca Lake buffered stocking complex is low. As mentioned in the *Fish Movement* section, it is very unlikely for fish stocked in Arivaca Lake to disperse up or downstream of the stocking site and persist for more than a few days. There are records for Chiricahua leopard frogs outside the buffered stocking complex (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm., HDMS, C.R. Schwalbe unpublished), however, occupied frog sites outside the buffered stocking complex exceed the five mile distance a Chiricahua leopard frog would likely disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Mexican Gartersnake

Site-Specific Analysis: Although Arivaca Lake and the surrounding area lies within the historical range of northern Mexican gartersnakes, their current status is unknown (USFWS 2008a; HDMS). Through extensive trapping effort along the Arivaca Cienega in 1994 and 2000, Rosen and Schwalbe (2002) detected a single northern Mexican gartersnake from the cienega in 2000, which indicates the species may be persisting in the area at low densities (Rosen et al. 2001). No recent systematic surveys for gartersnakes have been conducted at the cienega or elsewhere within the 20 km buffer. Therefore, northern Mexican gartersnakes may occupy the 20 km buffer surrounding Arivaca Lake, at least in low numbers. There are also historical records (1934, 1970) from Arivaca Creek and (1941) along Forest Service Road 39, West of Ruby (Rosen and Schwalbe 1988, HDMS, AGFD Riparian Herpetofauna Database). Rosen and Schwalbe (1988) described a skin shed found in 1986 along the stream below the Ruby Road crossing as probably that of a northern Mexican gartersnake. The presence of non-native fish and bullfrogs in Arivaca Lake make the habitat less suitable for northern Mexican gartersnakes. In addition, as mentioned in the Fish Movement section, it is very unlikely for fish stocked in Arivaca Lake to disperse up or downstream of the stocking site and persist for more than a few days. Therefore, the likelihood that northern Mexican gartersnakes will be exposed to stocked channel catfish, bluegill and redear sunfish in Arivaca Lake is low.

Downstream Analysis: There are no northern Mexican gartersnake records downstream of the Arivaca Lake buffered stocking complex (HDMS). There is a recent (2001) northern Mexican gartersnake record from Presumido Canyon in the Baboquivari Mountains >22 air mi west of Arivaca Lake, though snakes from that area are unlikely to disperse to the stocking site (HDMS, AGFD Riparian Herpetofauna Database). Therefore, northern Mexican gartersnakes are unlikely to be exposed to dispersing fish from the Arivaca Lake buffered stocking complex because

gartersnakes are unlikely to occur downstream. Additionally, as mentioned in the Fish Movement section, it is very unlikely for fish stocked in Arivaca Lake to disperse up or downstream of the stocking site and persist for more than a few days.

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Bill Williams River Watershed

Physical geographic description

Drainage Area
The Bill Williams River Basin (Figure 1) drainage area covers approximately 5,373 mi^2 in west-central Arizona. The Bill Williams River proper measures approximately 50 miles in length, covers approximately 1,109 mi^2, with its upstream-most approximately5.3 miles consisting of water impounded behind Alamo Dam. Downstream of Alamo Dam, the river flows approximately45 miles before reaching its confluence with the Colorado River at Lake Havasu. The western portion of the basin is within the Basin and Range province and the eastern portion is within the Central Highlands province.

There are 3 major rivers in the watershed including the Bill Williams proper, the Big Sandy (2,852 mi^2), and Santa Maria River (1,442 mi^2), the latter two form the headwaters of the Bill Williams River at Alamo Lake. The Big Sandy River drainage comprises more than 100 miles of perennial and ephemeral streams flowing from the north, with the Burro Creek Sub-Watershed (713 mi^2) joining the Big Sandy approximately 17 miles upstream from where the river enters Alamo Lake.

The Santa Maria River including its headwaters, courses for more than 90 miles consisting of mostly ephemeral flow with limited perennial stretches from the northeast part of the drainage and flows directly into Alamo Lake which is impounded by Alamo Dam.
Sites proposed for stocking in the drainage are small stock tanks located within the east-central portion of the watershed on intermittent and/or ephemeral drainage courses with infrequent spillage/connection to downstream waters. There are a total of 14 stocking sites in the Bill Williams River Watershed. Four sites are located in the Santa Maria Sub-Watershed: Bass, Blue, Granite Mountain #1, and Granite Mountain #2 tanks; and ten sites in the Burro Creek Sub-Watershed: Carter, Antelope, Harmon #2, Bar 37, Little Antelope, McElhaney, Harman, Stubbs, and Swale tanks, as well as Coors Lake. Coors Lake is the only closed system in this watershed. There are 426 known registered stock ponds within the Big Sandy Basin (ADWR unknown date).

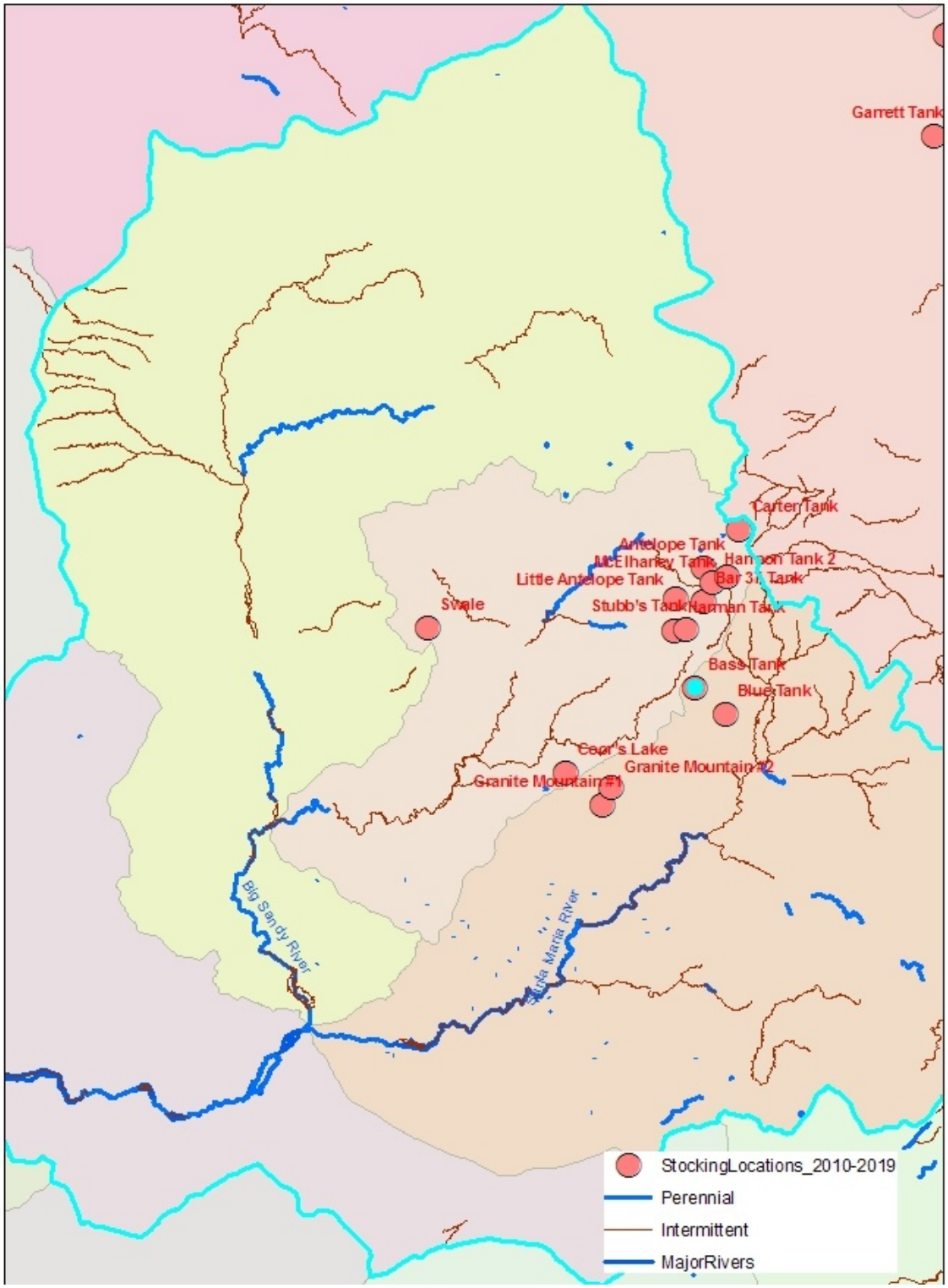


Figure 1. Bill Williams Watershed.

Range of elevations

The Big Sandy River reaches to elevations of approximately 2,400 feet but has feeder tributaries such as Tuckayou Wash that range up to 5,300 feet elevation. The Santa Maria River reaches to approximately 2,600 feet elevation, with tributaries reaching higher into the 6,000 feet range. The Bill William River drops from an elevation of approximately 1,100 feet down to an elevation of 449 feet.

Tributaries

Other significant streams with perennial flow include Burro and Trout Creeks which feed into the Big Sandy River, and Sycamore and Kirkland Creeks, which are tributaries of the Santa Maria River. Numerous intermittent streams are located in the northeastern portion of the basin. Several springs resulting in localized surface flow can also be found in the eastern and north central areas of the watershed.

Vegetation

The watershed of the Bill Williams River spans diverse physiography ranging from high elevation forested mountains along the western margin of the central highlands province to low-lying, rugged desert mountains and intervening alluvial valleys in the basin and range province. The biotic communities include the Great Basin conifer woodlands, Interior chaparral and Sonoran desert scrub. Riparian vegetation includes cottonwood/willow, mesquite, tamarisk and mixed broadleaf (Burro Creek). Riparian vegetation grows in many locations within the valley of the watershed with adjacent sparsely vegetated uplands. Riparian vegetation along the river is dominated by several woody species common to low elevation southwestern riparian ecosystems, including Fremont cottonwood (*Populus fremontii S. Watson)*, Goodding willow (*Salix gooddingii Ball*), saltcedar (*Tamarix ramosissima Ledebour*), seep willow (*Baccharis salicifolia* (R. & P.)), and mesquite (*Prosopis spp*.) Herbaceous vegetation tends to be quite sparse, except adjacent to areas where water and light availability are high. The herbaceous flora comprises the greatest plant diversity along the river.

Figure 2. Land ownership in the Bill Williams Watershed.

SANTA MARIA SUB-WATERSHED

Physical geographic description

The Santa Maria River begins at the confluence of Sycamore Creek and Kirkland Creek on the properties of the Mule Shoe Ranch. From this point it runs 47-miles southwest into Alamo Lake and is characterized by broad, shallow, sandy-bottomed runs with few riffles and low gradient. Pools and eddies occur only in areas where the open floodplain has constricted due to the narrow canyons (Kepner 1980). The Santa Maria River is classified as a “flashy” type desert stream prone to prolonged dry periods followed by extreme high water events that transport large

amounts of sedimentary materials (Kepner 1980). These events often preclude establishment of reproducing populations of all the proposed stocking species or temporarily remove suitable habitats for them. The Santa Maria flows to the southwest and meets the Big Sandy to flow into Alamo Lake.

Range of elevations

The elevation range of the Santa Maria is from 2,640ft at the Kirkland/Sycamore Creek junction to 1,240ft at Alamo Lake.

Tributaries

Several intermittent and perennial tributaries drain into the Santa Maria River including: Sycamore Creek, Smith Canyon, Loco Creek, Waterman Creek, and Peoples Canyon Creek. The Santa Maria River has 3 perennial reaches

The Santa Maria River stocking complex contains four proposed stocking locations: Bass, Blue, Granite Mountain #1 and #2 tanks (Figure 3). The individual tanks are described in more detail below.

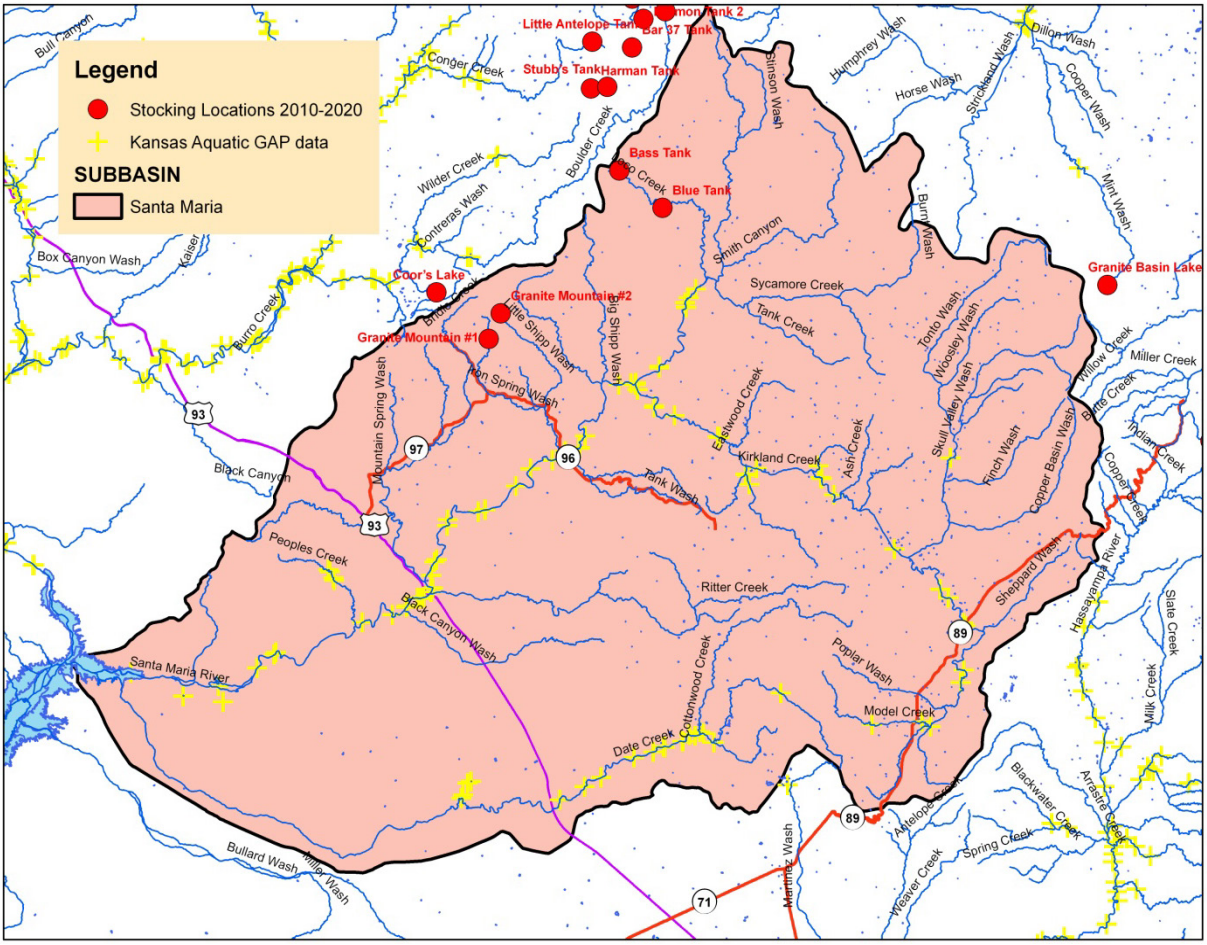


Figure 3. Overview of the Santa Maria River Sub-Watershed, showing points of available fish collection data from the Kansas State Aquatic GAP database.

SANTA MARIA COMPLEX

Bass Tank

Site Description

Bass Tank is a 1.3 acre earthen cattle tank maintained by precipitation. The tank is located about 16 miles north and east of Bagdad, Arizona. It is situated on a private parcel owned by the Yolo Ranch. It sits at approximately 5,170 feet elevation at the headwaters of Loco Creek, a small ephemeral tributary of Sycamore Creek, which in turn feeds into the Santa Maria River (Figure 4 and Figure 5). The tank is surrounded by State Trust Land. The tank was constructed in 1971 according to water rights records filed with the Arizona Department of Water Resources (38-27125). This tank has not been known to dry completely in the last 20-years. The tank has a spill way into Loco Creek that is evident in aerial photos. However, in 2002 water levels were very low (Figure 6 and Figure 7).

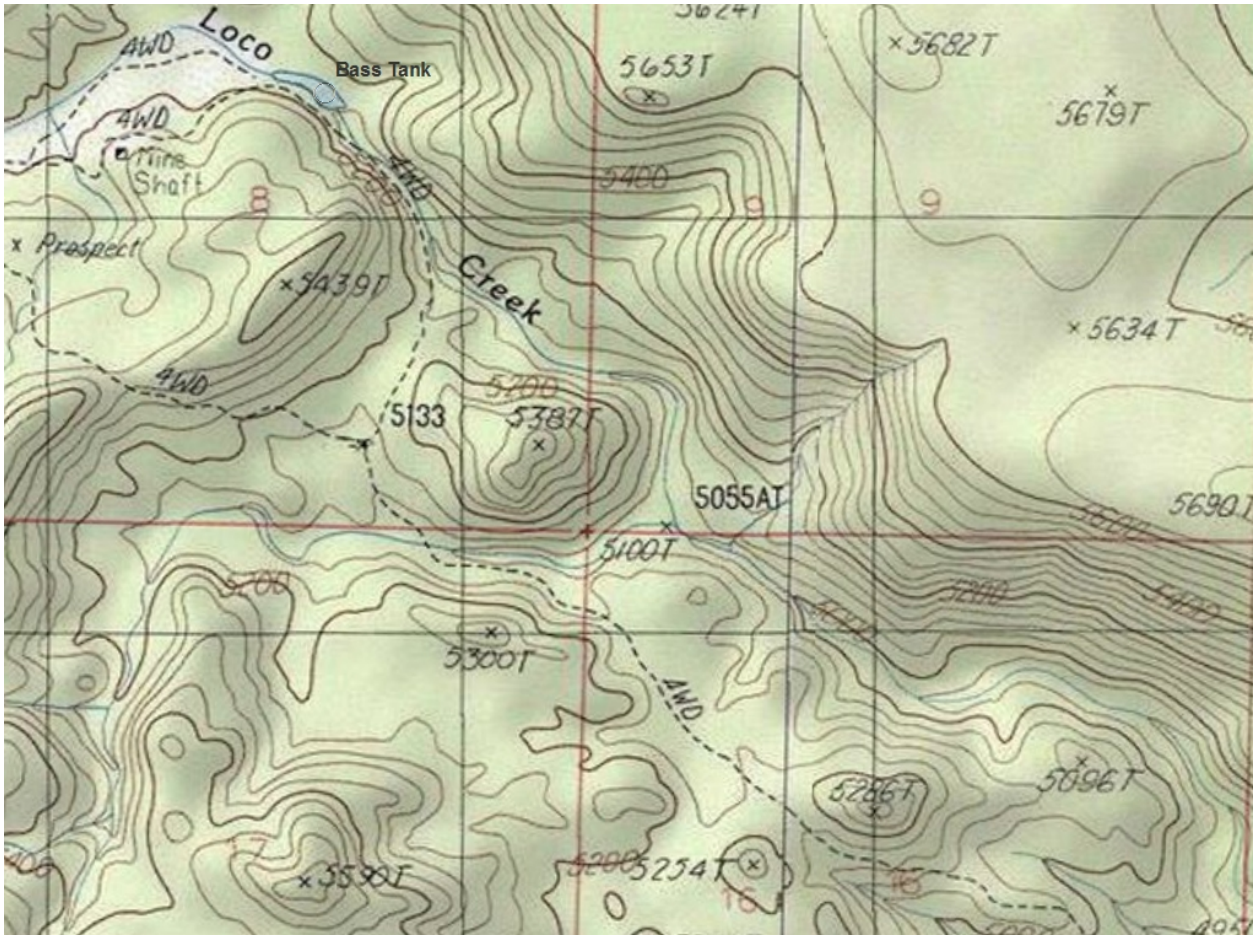


Figure 4.Bass Tank on Loco Creek.

Figure 5. Bass Tank imagery on Loco Creek

Management of Water Body

The fishery at Bass Tank is maintained in cooperation with Yolo Ranch. It is managed as a self-sustaining warm water fishery with largemouth bass and bluegill sunfish. As with all the small ponds or cattle waters in the area, Bass Tank dries periodically to the point where warm water sport fish species may stunt or die. Re-stocking needs are evaluated periodically.

Figure 6. Bass Tank, July 2002.

Figure 7. Bass Tank photograph.

Table 1. Stocking history at Bass Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Bluegill	2002	2002	1	500
Largemouth bass	1997	1997	1	200
Total			2	700

Future management objectives would be to provide a largemouth bass, redear sunfish and bluegill sunfish fishery. Periodic stocking to maintain catchable sizes may be necessary due to drying and/or catastrophic wildfire.

Proposed action

The Department proposes to stock largemouth bass, bluegill sunfish and redear sunfish for the period covered by this consultation.

Redear sunfish would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol. Largemouth bass (fry/fingerling, sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), redear sunfish (fry/fingerling, sub-catchables, catchables), may be stocked as needed at any time during the year to augment the fishery or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution \ Connectivity

Bass Tank receives water from snowmelt and precipitation events. There are no USGS stream gauges on Loco Creek. The probability of a spill is low from Bass Tank because of the limited watershed contribution and the relative large capacity of the tank. No spill has been documented at Bass Tank; however water has been seen below the tank within the ephemeral Loco Creek. Bass Tank sits high in the Loco Creek drainage and extends approximately 6.5 miles through Loco Creek via ephemeral drainage. Loco Creek is then intermittent and extends another approximately 5 miles to its mouth with Sycamore Creek. Loco Creek has natural barriers upstream existing in several areas due to the geologic make-up (bedrock dominated) of the creek. There is approximately ½ mile of rugged ephemeral wash above Bass Tank, but no ponds/tanks that can harbor fish limiting any opportunity for persistence. Large waterfalls are not known from Loco Creek but extensive areas of sharp elevation change in narrow, slot rocky canyons do exist (Figure 8 and Figure 9).

Sycamore Creek from its confluence with Loco Creek extends another 6.5 miles to the confluence with Kirkland Creek and has intermittent flow and usually a few small perennial pools along its course. From this confluence the channel is called the Santa Maria River. The Santa Maria River is intermittent and dominated by large stretches of dry streambed with some limited perennial pool habitat persisting through the driest periods.

Fish Movement

Loco Creek is a high gradient, bedrock dominated stream that does not provide adequate aquatic habitats for most fishes to persist (Figure 8 and Figure 9). Fish movement through Loco Creek would be during spring runoff events and flash floods that create increased sediment loads, high turbidity, rapid currents, altered habitat conditions, increased stress levels of organisms in transport, altered fish behavior and mortality, all of which limit the ability of survival during transport. There is approximately ½ mile of rugged ephemeral wash above Bass Tank, but no ponds/tanks that can harbor fish. No fish have ever been sighted by the fisheries biologist in 10 years of observation and it is the biologist's opinion that Loco Creek does not provide adequate aquatic habitat to support fish. (A. Clark pers. comm.)

Figure 8. Loco Creek below Blue Tank.

Figure 9. Loco Creek below Boundary Spring.

Community Description

Surveys at Bass tank have been done in summer months using netting methods (Table 2). Two 150-foot gillnets were used in 1988 and allowed to fish overnight. Two to three hoopnets were used in 1991, 1995, 1997, and 1998 in overnight sets adjacent to shoreline cover. Anecdotal reports from Department technicians performing the surveys claimed bullfrogs were plentiful. A visit to the tank in 2002 by Andy Clark and Wildlife Manager Darren Tucker confirmed that the tank was very low and numerous bullfrogs were persisting; however, no fish were seen or angled.

In 2009, the Region III Fisheries Program and Wildlife Manager Tucker checked water levels and angled one bluegill. No largemouth bass were seen or caught by four anglers fishing approximately 30 minutes. No other aquatic wildlife has been noted at the tank and no threatened or endangered species are known from the area.

Roundtail chub have been historically documented in Sycamore Creek approximately 11 miles downstream from Bass Tank. A survey completed in 2009, did not document any fish species in Loco Creek near Boundary Spring about 6 miles upstream of Sycamore Creek or roundtail chub in Sycamore Creek. Desert sucker, Sonora sucker and green sunfish were found in isolated pools of Sycamore Creek downstream of the mouth of Loco Creek in 2009 (A. Clark, pers. comm.).

Table 2. Surveys at Bass Tank by year, method, species, number caught, and lengths (in mm).

Survey Year	Survey method(s)	Species encountered	Num.	Length (mm)
1988	Gill Net	Largemouth bass	9	181-504
		Bluegill	2	181-186
1991	Hoop Net	Largemouth bass	1	165
		Bluegill	9	124-159
1995	Hoop Net	Largemouth bass	3	202-310
		Bluegill	14	169-195
1997	Hoop Net	Largemouth bass	5	162-256
		Bluegill	68	170-202
1998	Hoop Net	Largemouth bass	3	162-240
		Bluegill	95	110-210
2002	Visual	Largemouth bass	0	
		Bluegill	0	
2009	Angling	Bluegill	1	215

Consultation Species or Critical Habitat

No aquatic species of concern are within the vicinity of this stocking site. Roundtail chub are discussed in the Santa Maria complex analysis as they may maintain populations in downstream tributaries to the Santa Maria River.

Blue Tank

Site Description

Blue Tank is a 3.5 acre earthen livestock tank maintained by precipitation on State Trust Land leased by the Yolo Ranch (Figure 10 and Figure 12). It sits at approximately 4,695 feet elevation in a small ephemeral tributary of Loco Creek, a tributary to Sycamore Creek that feeds into the Santa Maria River. According to Arizona Department of Water Rights records (Reservoir Application No. 3R-2596), Blue Water Dam was constructed in 1967. The spillway is evident in aerial imagery and a photo of the earthen berm dam is below (Figure 11).

Figure 10. Blue Tank

Figure 11. Berm dam at Blue Tank. Water spills to the left of the Cottonwood trees.

Figure 12. Blue Tank in 2007.

Management of Water Body

Currently Blue Tank is managed as a self-sustaining warmwater fishery with largemouth bass and bluegill sunfish. As with most small ponds or livestock waters in the area, Blue Tank dries periodically to the point where warmwater sport fish species may stunt or die. Stocking is periodically evaluated by angling or netting surveys (Table 3).

Table 3. Stocking History for Blue Tank.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1993	2002	1	5,500
Largemouth bass	1993	2007	4	2,914
Total			4	8,414

Future management objectives would center on providing stock sizes of largemouth bass, redear and bluegill sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire.

Proposed Action

The Department proposes to stock largemouth bass, bluegill sunfish and redear sunfish for the period covered by this consultation.

Redear sunfish would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol. Largemouth bass (fry/fingerling, sub-catchables, catchables), bluegill sunfish (fry/fingerling, sub-catchables, catchables), redear sunfish (fry/fingerling, sub-catchables, catchables), may be stocked as needed at any time during the year to augment the fishery or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution \ Connectivity

Blue Tank receives water from snowmelt and precipitation events and from upstream of the watershed which is less than 1 square mile in area. There are no USGS stream gauges on Loco Creek. However, the probability of spill is low from Blue Tank because of the limited watershed contribution and the relative large capacity of the tank; however, a spill was observed in 2007 (A. Clark, pers. comm.). Water exiting the spillway at Blue tank drains slightly more than 1/10th mile down a small tributary of Loco Creek. From this point Loco Creek courses 7 miles to its mouth with Sycamore Creek. Sycamore Creek from that point is intermittent and drains another 6.5 miles to the confluence with Kirkland Creek forming the Santa Maria River.

The Santa Maria River is intermittent dominated by large stretches of dry streambed with some limited perennial pool habitat persisting through the driest periods. Loco Creek is ephemeral bedrock dominated with natural barriers existing in several areas.

Fish Movement

Loco Creek is a high gradient, bedrock dominated stream that does not provide adequate aquatic habitats for most fishes to persist. Fish movement through Loco Creek would be during periodic spring runoff events and flash floods that create increased sediment loads, high turbidity, rapid currents, altered habitat conditions, increased stress levels of organisms in transport, altered fish behavior and mortality, all of which limits the ability of survival during transport. Upstream movement by fish is very limited in this stream and consists of 4 miles of mostly rugged and unsuitable habitat up to Bass Tank. Large waterfalls are not known from Loco Creek but extensive areas of sharp elevation change in narrow and slot rocky canyons. Figure 8 and Figure 9 provide representative photos of the habitats.

Community Description

Surveys at Blue tank are periodic and usually done in summer months using netting methods. In 1988, two 150-foot gill nets were used and allowed to fish overnight. Two to three hoop nets were used in 1991, 1995, 1997, and 1998 in overnight sets adjacent to shoreline cover (Table 4). Anecdotal reports from Department technicians performing the surveys claimed bullfrog were very plentiful. A visit to the tank in 2002 by Andy Clark and Wildlife Manager Darren Tucker confirmed that the tank had adequate water but no fish or other aquatic wildlife was present. In 2009, the Region III Fisheries Program staff and Wildlife Manager Tucker checked water levels and confirmed the presence of largemouth bass by visual observation. No threatened or endangered species are known from the area.

Roundtail chub have been historically documented in Sycamore Creek 7-miles downstream from Blue Tank, most recently in 1999. Recent surveys in 2009 have not documented any fish species in Loco Creek or roundtail chub in Sycamore Creek. Desert sucker, Sonora sucker and green sunfish were found in isolated pools of Sycamore Creek downstream of the mouth of Loco Creek in 2009 (A. Clark pers. comm.).

A large wildfire impacted the watershed in late summer 2004. Fine sediments from the surrounding hills created a fish kill in the spring of 2005. The kill was not complete however, as bluegill were angled from the tank in 2006 (D. Tucker pers. comm.) The full impact of siltation is not known at Blue Tank. Due to its remoteness and relatively light fishing pressure, Blue Tank is not sampled frequently. Bullfrogs, crayfish and tiger salamanders have been historically documented from the tank in addition to bluegill and largemouth bass (Chmiel 2007a).

Table 4. Surveys at Blue Tank by year, method, species, number caught, and lengths (in mm).

Survey Year	Survey method	Species	Number	Length (mm)
1988	Gill Net	Largemouth bass	2	280-293
		Bluegill	3	120-182

1991	Hoop Net	Largemouth bass	5	167-243[1]
		Bluegill	123	115-239
1995	Hoop Net	Largemouth bass	0	
		Bluegill	39	120-214
1997	Hoop Net	Largemouth bass	0	
		Bluegill	43	109-224
1998	Hoop Net	Largemouth bass	4	198-243
		Bluegill	66	102-212
2002	Visual survey	Largemouth bass	0	
		Bluegill	0	
2007	Hoop Net	Largemouth[2] bass	0	
		Bluegill	0	

[2] Largemouth bass were observed but not captured.

Consultation Species or Critical Habitat

No aquatic species of concern are within the vicinity of this stocking site. Roundtail chub are discussed in the Santa Maria complex analysis as they may maintain populations in downstream tributaries to the Santa Maria River.

Granite Mountain #1 Tank

Site Description

Granite Mountain #1 is a 1.6 acre livestock water tank located on State Trust Land about 3.5 miles from Bagdad Arizona at approximately 3,675 feet elevation. It is maintained by precipitation and is located 6.8 miles upstream of Little Shipp Wash (Figure 14), on an ephemeral tributary called Iron Springs Wash (Figure 13). This tank is also referred to as Gray Tank.

[1] Young of the year largemouth bass and bluegill were observed in Blue Tank in 1991.

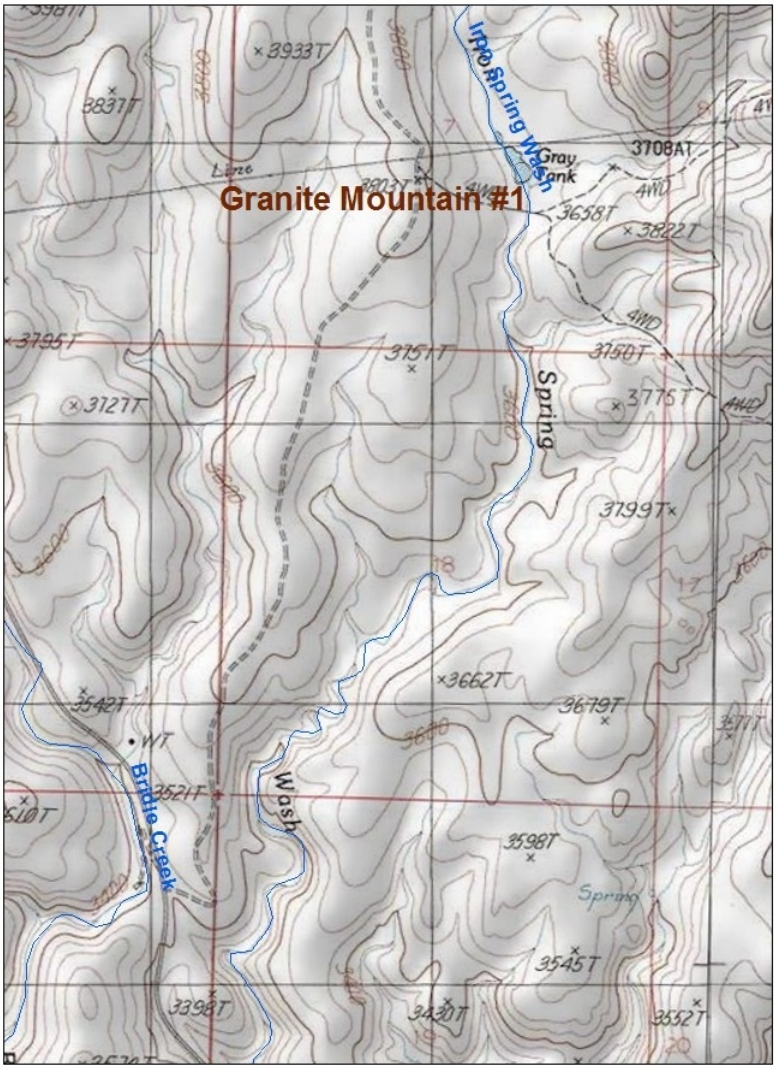


Figure 13. Overview map of Granite Mountain 1.

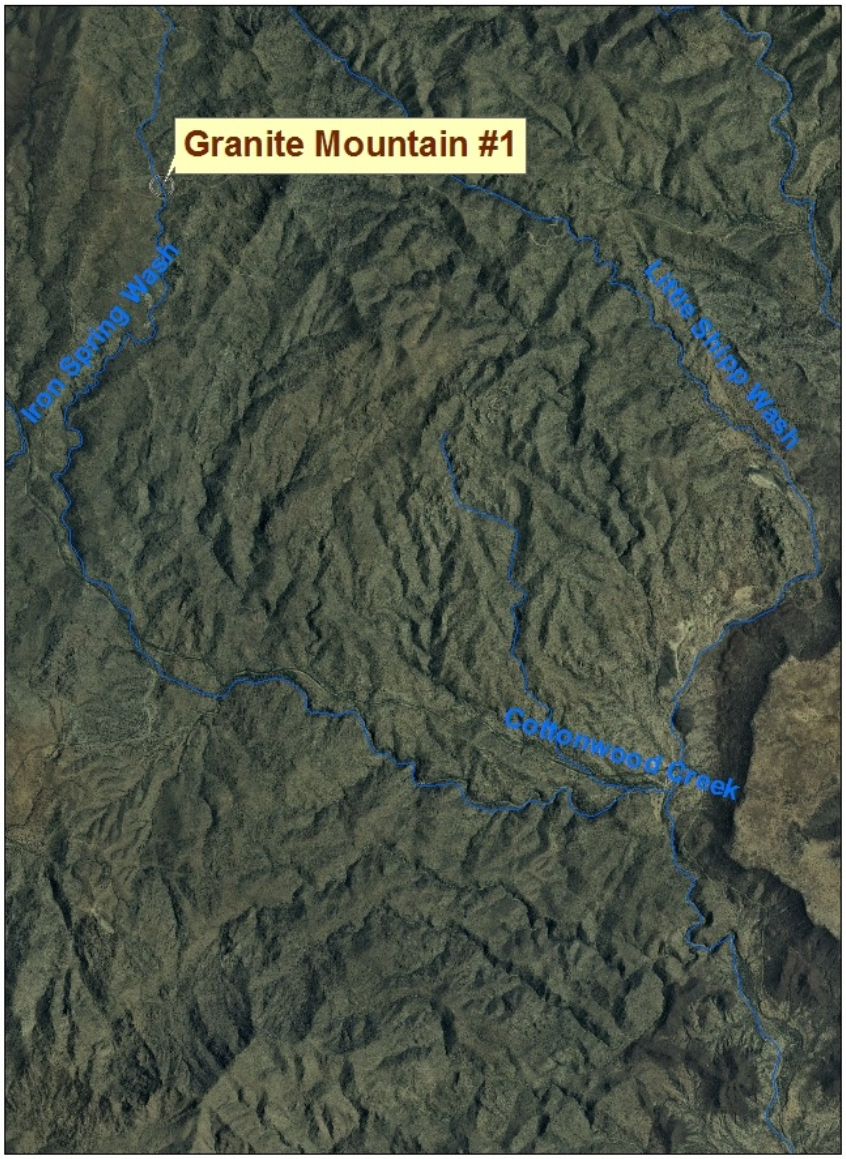


Figure 14. Granite Mountain 1 with tributaries.

Management of Water body

Currently, Granite Mountain #1 Tank is managed as a self-sustaining warmwater fishery with bluegill and green sunfish present. As with most small ponds or cattle waters in the area, Granite Mountain #1 dries periodically to the point where warm water sport fish species may stunt or die. Restocking has not been evaluated to date.

Future management objectives would center on providing stock sizes of redear and bluegill sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be

necessary due to drying and/or catastrophic wildfire. Periodic sampling using hoop-nets or gillnets would be used to monitor populations.

Proposed Action

The Department proposes to stock bluegill sunfish and redear sunfish for the period covered by this consultation.

Redear sunfish would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol. Bluegill sunfish (fry/fingerling, sub-catchables, catchables), redear sunfish (fry/fingerling, sub-catchables, catchables), may be stocked as needed at any time during the year to augment the fishery or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution \ Connectivity

Water exiting Granite Mountain #1 may travel 6.4 miles down Iron Spring Wash, an ephemeral tributary to Little Shipp Wash, which is an ephemeral tributary to the Santa Maria River. Little Ships Wash , then drains another 3 miles to the confluence of the Santa Maria River, joining it about 8 miles downstream from Sycamore/Kirkland confluence. The watershed is made up of primarily bedrock canyon reaches and is prone to flash flooding. The nearest USGS gauging station is approximately 35 miles down the drainage in the Santa Maria River near Baghdad AZ (Figure 15). Despite peak recorded flows in the Santa Maria of up to 25,000 cfs (in 1979), about half of the peak flows are under 5,000 cfs in the Santa Maria River. Granite Mountain #1 has not been known to spill and the probability of future spilling is extremely low because of the limited watershed contribution and the relative large capacity of the tank. No spill has been documented.

Fish Movement

Iron Spring Wash and Little Ship Wash are high gradient, bedrock dominated streams that do not provide adequate aquatic habitats for fishes to persist. Fish movement through these systems would be during primarily spring runoff events and flash floods that create increased sediment loads, high turbidity, rapid currents, altered habitat conditions, increased stress levels of organisms in transport, altered fish behavior and mortality, all of which limit the ability of survival during transport. There are no known barriers to downstream movement from Iron Spring Wash or Little Shipp Wash; however, there is very limited upstream movement due to bed rock features and gradient. There is about 1.5 miles of rugged ephemeral wash above Granite Mountain Tank #1, but no other tanks/ponds.

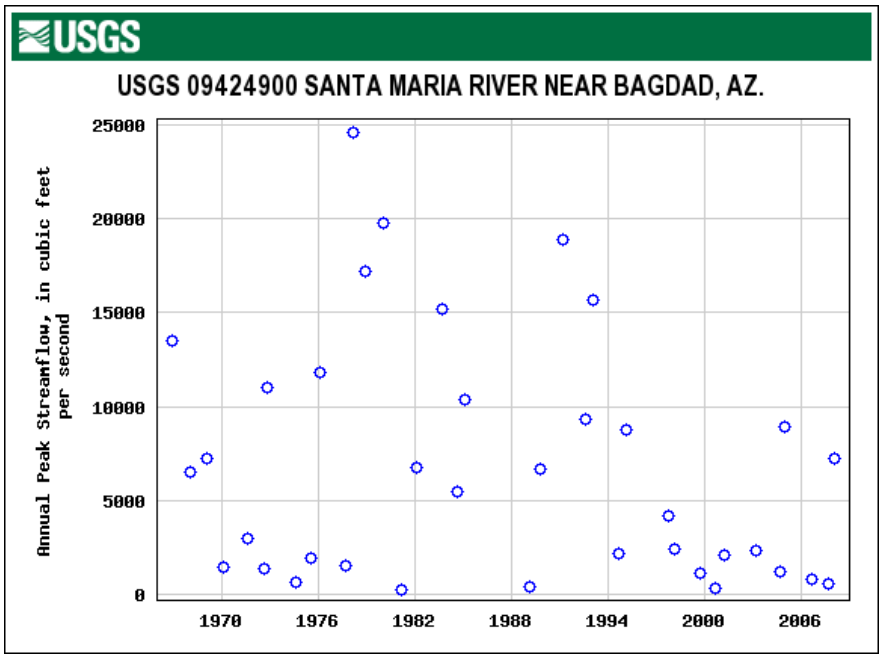


Figure 15. Annual peak flows at Santa Maria River near Bagdad.

Community Description

The fishery at Granite Mountain #1 has not been sampled since 1995 and there are no records of stocking. Surveys prior to this year found bluegill, green sunfish and waterdogs, although origins remain unknown. Limited surveys have been conducted in the Santa Maria River due to its ephemeral nature and access challenges on privately held lands. Surveys that have been conducted on the Santa Maria and large tributaries are discussed in the Complex discussion.

Table 5. Surveys at Granite Mountain Tank #1 by year, method, species, number caught, and lengths (in mm):

Survey Year	**Survey method**	**Species**	**Number**	**Length/Range (mm)**
1986	Angling	Bluegill	4	140-152
1988	Gill net	Green sunfish	6	78-167
1991	Hoop net	Green sunfish	39	122-192
1995	Hoop net	None		

Consultation Species or Critical Habitat

No aquatic species of concern are within the vicinity to the stocking site. Roundtail chub are discussed in the Santa Maria complex analysis as they may maintain downstream populations in tributaries to the Santa Maria River.

Granite Mountain #2 Tank

Site Description

Granite Mountain #2 is a 3.7 acre earthen livestock water tank located on State Trust Land about 5 miles east of Bagdad Arizona at 3,800 feet elevation. Water in the tank is maintained by precipitation. The tank is located on Little Ship Wash which is an ephemeral tributary to the Santa Maria River (Figure 16 and Figure 17). Granite Mountain #2 is also referred to as Brushy Basin Tank.

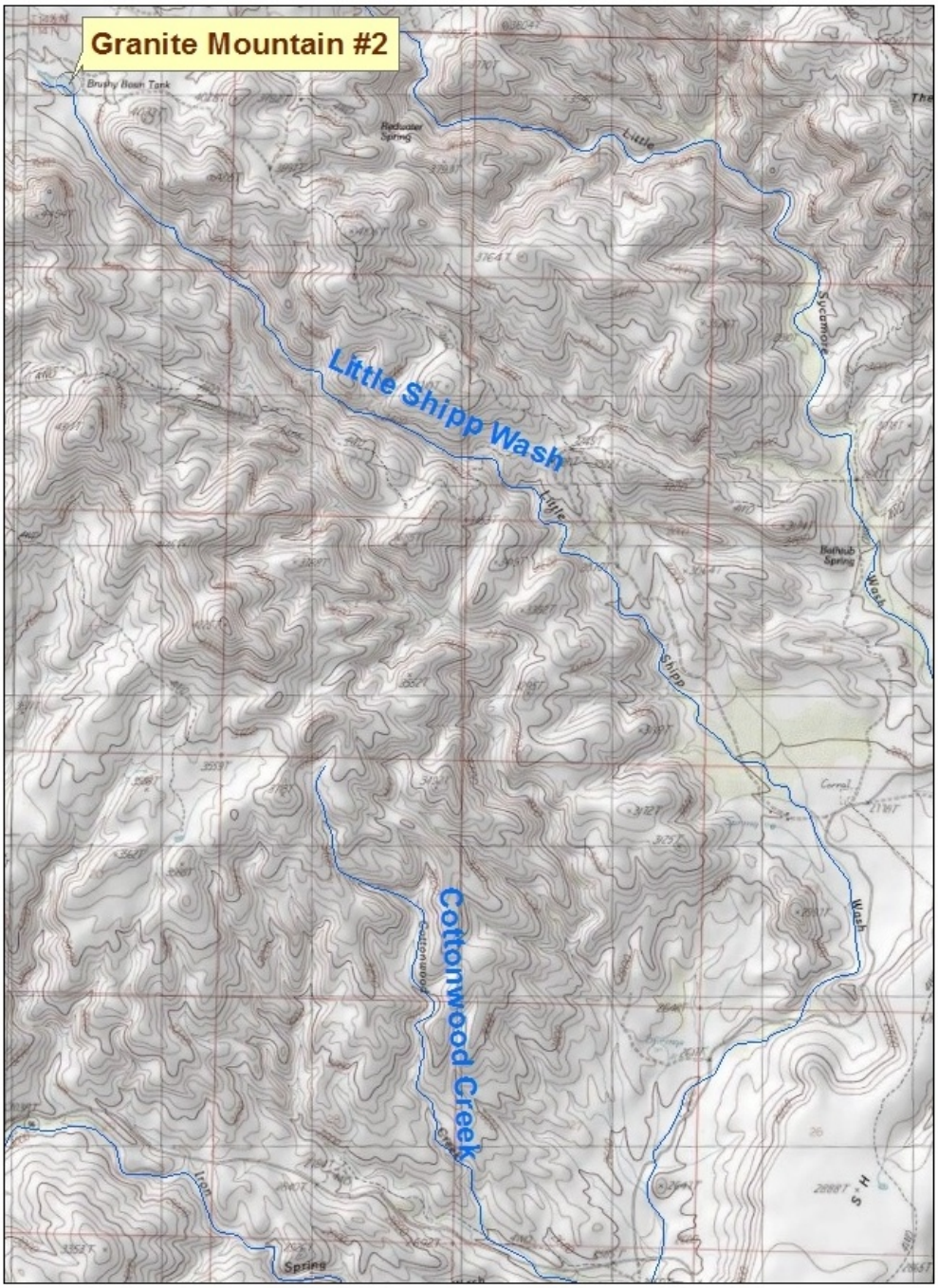


Figure 16. Granite Mountain 2 along Little Shipp Wash

Figure 17. Granite Mountain 2 imagery

Management of Water body

Currently Granite Mountain #2 Tank is managed as a self-sustaining warmwater fishery with bluegill sunfish and green sunfish present, although bluegill are the only species previously stocked (Table 6). As with most small ponds or cattle waters in the area, Granite Mountain #2 dries periodically to the point where warmwater sport fish species may stunt or die. Restocking has not been evaluated.

Table 6. Stocking history at Granite Mountain #2 Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Bluegill	2001	2001	1	1,000
Total			1	1,000

Future management objectives would center on providing stock sizes of redear and bluegill sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire. Periodic sampling using hoop-nets or gillnets would be used to monitor populations.

Proposed action
The Department proposes to stock bluegill sunfish and redear sunfish for the period covered by this consultation.

Redear sunfish would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol. Bluegill sunfish (fry/fingerling, sub-catchables, catchables), redear sunfish (fry/fingerling, sub-catchables, catchables), may be stocked as needed at any time during the year to augment the fishery or to recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Granite Mountain #2 is 9.7 miles upstream of the confluence of Little Shipp Wash and the Santa Maria River. Little Shipp Wash is ephemeral from the tank downhill for 6.8 miles to Iron Spring Wash. Thereafter, drainage flows another 3.7 miles where it joins the Santa Maria River approximately 3/10ths mile down from Quail Spring Wash. The Santa Maria River is ephemeral for approximately 4-7 more miles before it enters a perennial segment which is dominated by very shallow, sandy runs. Granite Mountain #2 has not been known to spill and the probability of spill is extremely low because of the limited watershed contribution and the relative large capacity of the tank. No spill has been documented.

Fish Movement
Little Shipp Wash is a high gradient, bedrock dominated stream that does not provide adequate aquatic habitats for fishes to persist. Spilling, if it occurred, would be most likely to occur during spring runoff events and and flash floods that create increased sediment loads, high turbidity, rapid currents, altered habitat conditions, increased stress levels of organisms in transport, altered fish behavior and mortality, all of which limit the ability of survival during transport. No barrier to downstream movement of fishes is known from Little Shipp Wash. There is very limited upstream movement due to bed rock features and gradient. There is no possibility for upstream movement as it backs to Granite Mountain.

Community Description

The fishery at Granite Mountain #2 has not been sampled since 1995. Surveys prior to this year found bluegill, hybrid sunfish, green sunfish and black crappie although origins are not known.

Limited surveys have been conducted in the Santa Maria River due to its ephemeral nature and access challenges on privately held lands. Surveys that have been conducted on the Santa Maria and large tributaries are discussed in the Complex discussion.

Table 7. Surveys at Granite Mountain Tank #2 by year, method, species, number caught, and lengths (in mm):

Year	Survey method	Species encountered	Number	Length/Range (mm)
1986	Angling	Bluegill	5	133-171
1988	Gill net	Hybrid sunfish	44	100-181
1991	Hoop net	Green sunfish	171	126-262
1995	Hoop net	Hybrid sunfish	472	120-186
		Black crappie	1	217

Consultation Species or Critical Habitat
No aquatic species of concern are within the vicinity of the stocking site. Roundtail chub are discussed in the complex analysis as they may maintain populations in tributaries to the Santa Maria River.

SANTA MARIA COMPLEX ANALYSIS
Four small ponds or cattle waters are proposed to be maintained as sport fishing opportunities within the Santa Maria Complex. These waters, although small, offer significant recreational opportunity to rural western Yavapai County. All the waters would be maintained as self-sustaining warm water fisheries supplemented by stocking on an as-needed basis. Occasional sampling by hoop net or gill net would dictate this need. Largemouth bass, bluegill, and redear sunfish would be the three non-native fish species utilized. Stockings would typically be in summer months although spring or fall stockings may be warranted depending on species availability from suppliers. Surveys would be performed in Loco Creek, Sycamore Creek and the Santa Maria River every other year over 6 years for a total of 3 sampling events in each stream system. If largemouth bass, bluegill or redear sunfish are discovered in these streams, stockings would be halted and consultation re-initiated.

Water Connectivity / Distribution
Bass Tank and Blue Tank receive water from snowmelt and precipitation events. There are no USGS stream gauges on Loco Creek. The probability of a spill is low from Bass Tank and Blue Tank because of the limited watershed contribution and the relative large capacity of the tanks. No spill has been documented at Bass Tank; however, water has been seen below the tank,

making a spill of Bass Tank a possibility. Bass Tank sits high in the Loco Creek drainage which extends about 6.5 miles through ephemeral reaches of Loco Creek and then about 5miles of intermittent reach to get to Sycamore Creek.

Loco Creek is intermittent and courses another approximately5 miles to its mouth with Sycamore Creek. Loco Creek is bedrock dominated with natural barriers existing in several areas. Upstream movement of fish is very limited in this stream but there are no barriers to downstream movement. Large waterfalls are not known from Loco Creek but extensive areas of sharp elevation change in narrow, slot canyons do exist. Sycamore Creek from its confluence with Loco Creek drains another 6.5 miles to the confluence with Kirkland Creek and has intermittent flow and a few small perennial pools along its course. From this point it becomes the Santa Maria River. The Santa Maria River is intermittent dominated by large stretches of dry streambed with some limited perennial pool habitat persisting through the driest periods.

Water exiting Granite Mountain #1 may travel 6.4 miles down Iron Spring Wash, an ephemeral tributary to Little Shipp Wash. Granite Mountain #2 is located in Little Ship Wash which is a high gradient, bedrock dominated stream that does not provide adequate aquatic habitats for fishes to persist. No barrier to downstream movement of fishes is known from Little Ship Wash. There is very limited upstream movement due to bed rock features and gradient. There is no possibility for upstream movement as both tanks essentially abut Granite Mountain.

This Complex Analysis includes the point from the junction of the Santa Maria River at the confluence of Little Shipp Wash to Alamo Lake. The Santa Maria River is intermittent dominated by large stretches of dry streambed with some limited perennial pool habitat persisting through the driest periods. There is a perennial segment of the Santa Maria approximately 16 miles upriver from the mouth of Alamo Lake, near where the river crosses under State highway 93, which is dominated by very shallow, sandy runs. However, flooding events are comparatively infrequent in the watershed above the proposed stocking sites, and habitat is largely unsuitable to support the proposed species within the ephemeral drainages including Loco Creek and Sycamore Creek. Nonetheless, isolated and disjunct pools and/or other small perennial segments of water may contain sufficient habitat so that fish could persist.

Fish Movement

Loco Creek is a high gradient, bedrock dominated stream that does not provide adequate aquatic habitats for most fishes to persist. Fish movement through Loco Creek would be during periodic spring runoff events and involve extensive sediment loads and require extreme physical demands. Upstream movement by fish is very limited in this stream and consists of 4 miles of mostly rugged and unsuitable habitat from Blue Tank up to Bass Tank. Large waterfalls are not known from Loco Creek but extensive areas of sharp elevation change in narrow, slot canyons

do exist. Probability of spill is low from Bass and Blue Tank because of the limited watershed contribution and the capacity of the tanks.

Spilling from the Granite Mountain sites in Little Shipp Wash would be most likely to occur during spring runoff events and involve extensive sediment loads and physical demands by fish. No barrier to downstream movement of fishes is known from Little Ship Wash. There is very limited upstream movement due to bed rock features and gradient. There is no possibility for upstream movement from the tanks as both essentially abut Granite Mountain.

Stream discharge in this complex typically follows a bimodal hydrological cycle with winter and summer precipitation causing flash flooding and hydrologic connectivity in the system punctuated by low or no flows in spring and fall when the system becomes intermittent, interrupted perennial or completely dry (Kepner 1980). Flash flooding is generally short in duration but capable of transporting vast quantities of inorganic material and organic debris that affect drainage channels (Kepner 1980). The Santa Maria River, although in the Bill Williams Drainage as is Burro Creek, often has differing periods between high water events. About one event of 10,000 cubic feet per second (cfs) or more has been recorded every 10 years since 1967. The Yavapai County Flood Control District confirmed that the Santa Maria does not see significant flooding events but every 10 years (Mark Massis pers. com). In more recent years, the frequency of high water events has declined. Until January 2010, there had not been a high water event exceeding 10,000 cfs since 1993.

Community Description

Historically, tributaries as well as mainstem portions of the Santa Maria River maintained viable native fish populations (Kepner 1980; Fresques et al. 1997; Morgan et al. 1997). These populations consisted mainly of roundtail chub (called “bonytail” by the local ranchers), desert sucker, Sonora sucker, longfin dace and speckled dace. However, since the about 1995, these populations have been in decline. More recent spot check type surveys in 2003, 2007 and 2009 have not found roundtail chub in Sycamore Creek or the mainstem Santa Maria River (Cummins 2009 (2), Table 8 and Table 9). Green sunfish and desert sucker have been found in locally high numbers in persistent pools in Sycamore Creek and the Santa Maria River mainstem (Cummins 2009 (2) and Table 8 and Table 9). Loco Creek was sampled in 2009 (Figure 19). No fish were collected during this electrofishing survey. Fish stocking into the tanks by the Department did not start until the 1990’s for the waters proposed for stocking. Most had existing populations of bullhead catfish, largemouth bass, black crappie and bluegill and/or green sunfish stocked by ranchers working the area.

The only listed fish species occurrence upstream of Alamo Lake within the watershed it the Gila topminnow, located at Yerba Mansa Spring (Weedman and Young 1997). This topminnow population is located in a pond formed by an impounded spring and is outside of the Santa Maria

River channel. Two other small sites in the Santa Maria drainage were stocked with topminnow but failed to persist (Peoples Canyon and Tres Alamos).

No designated critical habitat for listed fish occur upstream of Alamo Lake. However, a 12-month finding on a petition to list a distinct population segment (DPS) of roundtail chub in the lower Colorado River basin as threatened or endangered under ESA and to designate critical habitat was delivered by the US FWS on June 30, 2009. After review of available scientific and commercial information, the US FWS found that the petitioned listing action is warranted, but precluded by higher priority actions. Roundtail chub has consequently been added to the list of candidate species and impacts to the species are assessed in this consultation process.

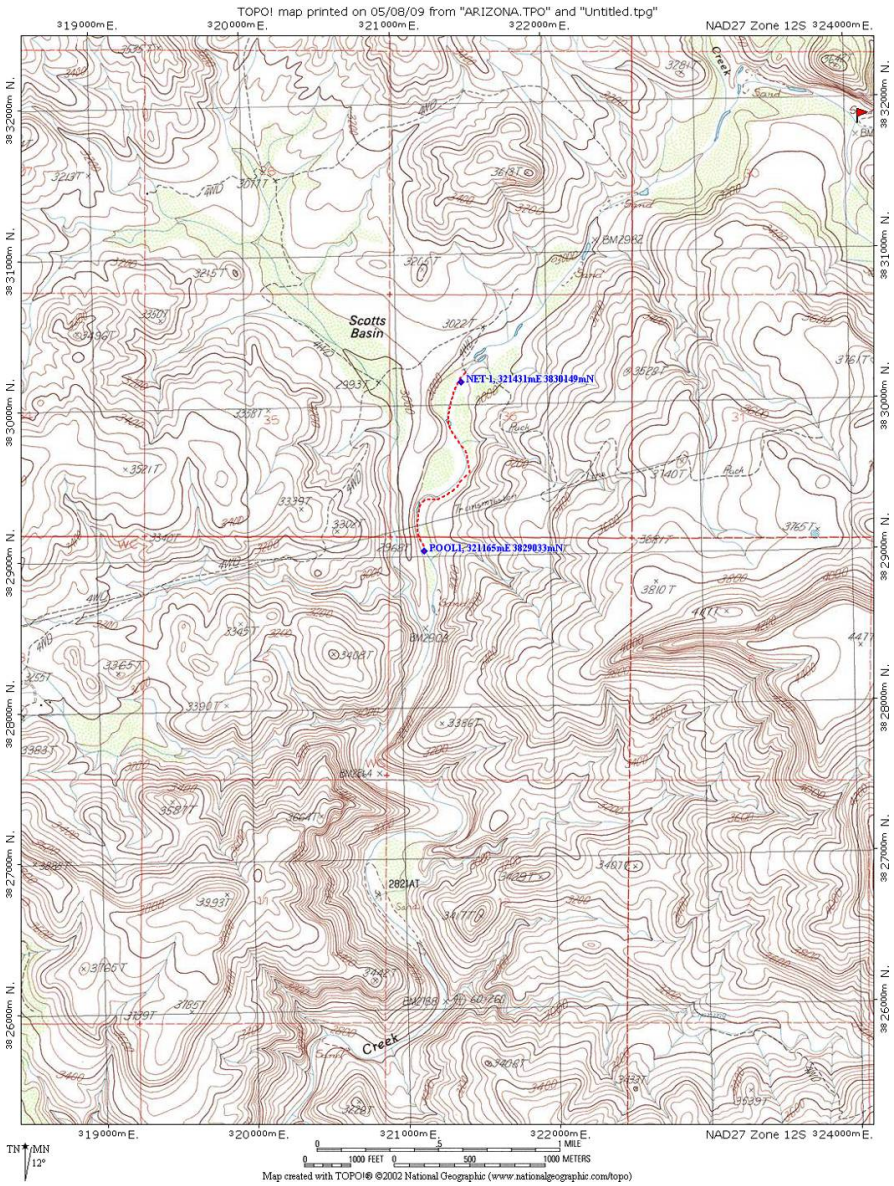


Figure 18. Sampling sites on Sycamore Creek May 6-8, 2009. Mouth of Loco Creek is in upper right hand portion of map.

Table 8. Sample results from backpack electrofishing, Sycamore Creek May 6, 2009.

Effort in minutes = 16.2. Site is "pool 1" in Figure 18.

Species	Number	Size Range (millimeters)
Green sunfish	34	80-174
Yellow bullhead	4	92-187

Table 9. Sample results from gillnetting, Sycamore Creek May 6, 2009.

Effort in hours = 3 hours. Site is "Net 1" in Figure 18.

Species	**Number**	**Size Range (millimeters)**
Sonora sucker	37	147-300
Green sunfish	23	100-180

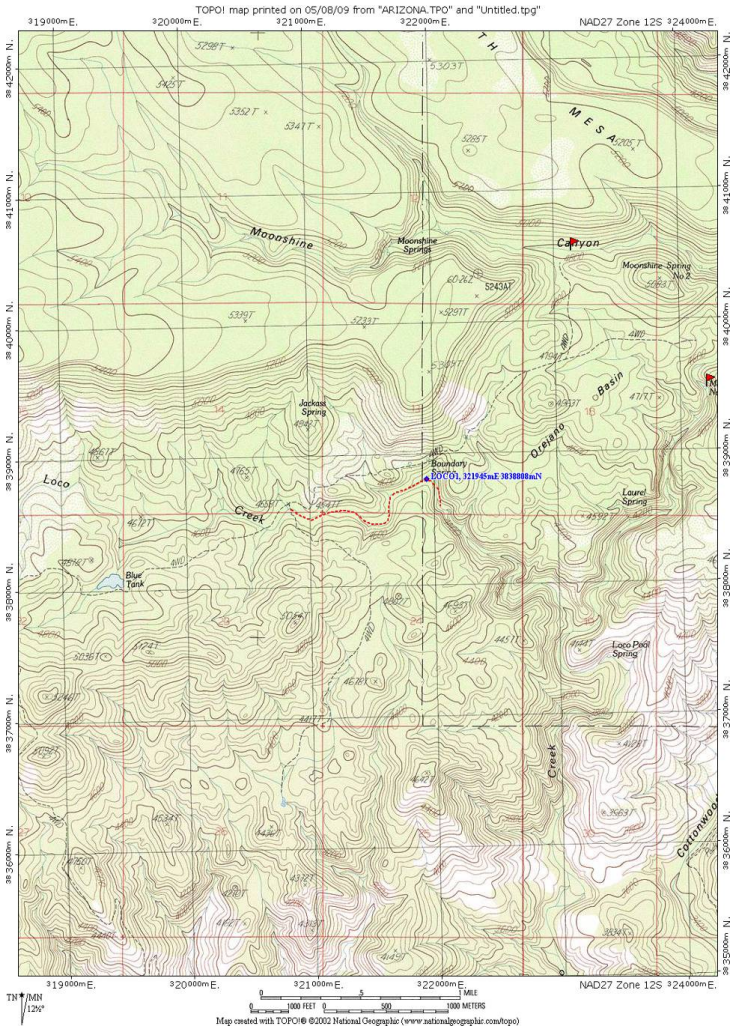


Figure 19. Sample site on Loco Creek where no fish were collected in May 7, 2009.

Consultation Species or Critical Habitat

Impacts to roundtail chub are discussed below because populations may exist in the Santa Maria River and several of its tributaries (Kirkland Creek and Sycamore Creek) downstream of the

tanks proposed for stocking (HDMS Data: Santa Maria River 1979, 1998 and 1999; Sycamore Creek 1991 and 1999; Kirkland Creek 1980 and 1999).

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

The populations of Gila topminnow and desert pupfish downstream in Peoples Canyon were considered extirpated in 1989 (Weedman and Young 1997) and are not further discussed. Designated critical habitat for the Southwestern willow flycatcher exists within the Big Sandy River, far downstream from all stocking sites. This species is therefore, not considered further due to the distance from the proposed sites and lack of habitat suitability near the stock tanks. Roundtail chub are analyzed and discussed below.

The presence of Alamo Dam and the existing warm water fishery within Alamo Lake (which maintains a self-sustaining community of non-native fish without supplemental stockings) serves to drastically minimize the potential for impacts of proposed stocking activities from designated critical habitat and the presence of the endangered razorback sucker and bonytail chub in Lake Havasu. Alamo Lake is managed primarily for flood control. As such, it is managed at approximately16% capacity or lower, with a capacity (depending on pool volume at the time) of over 800,000 acre feet.

Roundtail Chub

Roundtail chub is currently the only fish species of concern in this system. Roundtail chub tend to do well in desert stream systems in which they evolved, provided periodic flooding occurs to ensure habitat for their young (Rinne 1996). Since 1967, the Santa Maria River does not appear to flood often enough to sustain roundtail chub, although roundtail chub may maintain populations in tributaries to the Santa Maria River such as Kirkland Creek or Sycamore Creek. The last survey which detected roundtail chub in the Santa Maria below Little Shipp Wash was in 1999 (HDMS Data). Surveys conducted as described above in the community descriptions did not document chub occurrence.

Roundtail chub are thought to live up to 10 years but more commonly die off after 7-8 years (Brouder et al. 2000). In general, if low flow conditions persist over 6-7 years consecutively, observations suggest roundtail chub populations decline (A. Clark pers. comm.). The gauge data (Table 10) show generally low flows and that peak flow conditions in this complex during run off did not exceeded 10,000 cfs between 1993 and 2008, however, in January 2010; a high water event exceeded 10,000 cfs. It is unknown whether reproduction of roundtail chub occurred in response to this flow event

Conservation actions are being planned in the Santa Maria River drainage to benefit roundtail chub under the recent 6 species Conservation Agreement (AGFD 2006). Conservation actions would include stocking of roundtail chub in some stock tanks in the area to both increase chub populations as well as continue to provide unique sport fishing opportunities. However, due to land development, access, and lack of water, the opportunities for roundtail chub population enhancement is limited in the Santa Maria River Basin.

Native species, especially roundtail chub, desert sucker and Sonora sucker are very dependent on high flow events for recruitment. When these high flow events occur, the native species may successfully recruit, despite the presence of non-native fish species. W. L. Minckley substantiates this when he states "*Gila r. robusta* is one native fish that appears capable of maintaining its populations fairly well despite the numbers of introduced fishes that now infest the waters of Arizona" (Minckley 1973). Regardless, nonnative species that compete with or prey on roundtail chub still remain a serious and persistent threat to the continued existence of roundtail chub (USFWS 2009c).

Potential Impacts

The species proposed for stocking into the Santa Maria River basins do not appear to be limiting factors for native fish populations within this watershed for reasons discussed below.

Few surveys from the Santa Maria have been conducted in recent years. Spot check surveys in 2003, 2007 and 2009 yielded very little to no water in areas sampled. None of the species proposed for stocking were found in any historic surveys (all data considered; see methods for data sources), with the exception of one largemouth bass collected from the Kirkland Junction confluence in 1999 and two bluegill in the Santa Maria River. All but one of the species (redear sunfish) have been present in both drainages (Little Ship Wash and Loco Creek) in stocking tanks since at least 1988, when the first records of species occurrence in area tanks were collected. Based on data collected from these drainages over 30 years, only one occurrence of largemouth bass and 2 occurrences of bluegill in the Santa Maria River have been recorded, all in 1999 (Kansas State Aq. GAP database). All data points available in this dataset (174 point/species combinations spanning 1947-2003) for the Santa Maria watershed were depicted in Figure 3. The largemouth bass and one of the bluegill collections were at or near a private ranch

with a pond on the premises, believed to be stocked with these species. It is unknown if largemouth bass are still present in this pond. The other bluegill collection, about 7 miles downstream from the previously described location is suspect because the available 1999 Scientific Collecting Permit Report doesn't agree with the SonFishes/Kansas GAP databases. Bluegill have not been collected elsewhere in the Santa Maria River, and there are no collections of redear sunfish.

A larger data set depicting the relationship between flow events and roundtail chub recruitment is available for the Verde River system. Data collected in the headwaters reaches of the Verde River by the Region III Fisheries Program between 2000 and 2005 using canoe electrofishing recorded reduced young age classes of chub in surveys in 2000 through 2004; during this time there were also no high flow events (see Verde River section). The sampling used methodology and techniques were designed to collect all fish species and age classes. Adult chub numbers also began to drop in this timeframe.

At the same time that adult numbers of chub were dropping in the Verde River, the recorded flows in the Santa Maria (Table 10) were consistently lower than in past years and large peak flows were not as common or as strong as in years prior to 1994 (Table 10). Assuming roundtail chub recruited in 1995, that cohort would have likely died of old age between 2002 and 2004, which coincides with the electrofishing data collected in the Verde River. If an assumption made that the relationship between flow events and chub populations in the Verde River holds true for chub population responses to flow events in the Santa Maria River, a decline in roundtail chub is possibly due to the low flows over the past years, which would have prevented successful reproduction in the Santa Maria watershed. Decline in fishes is likely due primarily to the low or no flows. Stocked fish species have not been found other than in the two occurrences listed above.

Largemouth bass characteristically become most abundant in lentic waters, i.e. lakes, ponds, reservoirs, and in slow–moving, downstream portions of larger streams (Minckley 1973). Habitat suitability indices for bluegill sunfish and largemouth bass developed by the U. S. Fish and Wildlife Service, Biological Services Program in the early 80's show these two species prefer slow to slack water habitats that have woody cover and warm water conditions (Stuber et al. 1982a; Stuber et al. 1982b). These species typically do not maintain viable populations in systems, like the Santa Maria, with frequent flash type flooding and wide extremes in seasonal temperatures.

Table 10. Peak stream flow from USGS 09424900 Santa Maria River near Bagdad, AZ.

Water Year	**Date**	**Stream-flow (cfs)**
1967	Dec. 07, 1966	13,500

1968	Jan. 28, 1968	6,500
1969	Jan. 26, 1969	7,200
1970	Mar. 03, 1970	1,420
1971	Aug. 25, 1971	2,940
1972	Aug. 13, 1972	1,350
1973	Oct. 19, 1972	11,000
1974	Aug. 05, 1974	6002
1975	Jul. 29, 1975	1,890
1976	Feb. 09, 1976	11,800
1977	Sep. 11, 1977	1,500
1978	Mar. 01, 1978	24,600
1979	Dec. 18, 1978	17,200
1980	Jan. 30, 1980	19,800
1981	Mar. 06, 1981	191
1982	Feb. 11, 1982	6,750
1983	Sep. 24, 1983	15,200
1984	Aug. 17, 1984	5,450
1985	Feb. 10, 1985	10,400
1989	Feb. 06, 1989	394
1990	Oct. 04, 1989	6,650
1991	Mar. 01, 1991	18,900
1992	Aug. 23, 1992	9,310
1993	Feb. 09, 1993	15,700
1994	Sep. 03, 1994	2,170
1995	Feb. 14, 1995	8,790
1997	Sep. 26, 1997	4,200
1998	Feb. 15, 1998	2,350
1999	Sep. 24, 1999	1,130
2000	Aug. 29, 2000	312
2001	Mar. 07, 2001	2,090
2003	Mar. 17, 2003	2,280
2004	Sep. 19, 2004	1,150
2005	Dec. 29, 2004	8,900
2006	Aug. 25, 2006	739
2007	Sep. 22, 2007	533
2008	Jan. 27, 2008	7,230

It is unlikely that Bass or Blue Tanks spill often because of the limited watershed contribution and the relatively large capacity of the tanks. However, water has been seen below Bass Tank and a spill was observed from Blue Tank in 2007. When these two tanks spill the water would run into Loco Creek. Loco Creek is a high gradient, bedrock dominated stream that does not provide adequate aquatic habitats for most fishes to persist because it dries up between the tanks and Sycamore Creek. Fish movement through Loco Creek would be during periodic spring runoff events and flash floods that create increased sediment loads, high turbidity, rapid currents, altered habitat conditions, increased stress levels of organisms in transport, altered fish behavior and cause mortality limiting the ability to survive during transport.

Granite Mountain #1 and #2 have not been known to spill, although water was found below Granite Mountain #2 in 2007. The probability that either will spill in the next 10 years at flows with the capacity to carry fish is low because the watershed contribution of these tanks is limited. Also, the relatively large capacity of the tank would minimize potential for spill.

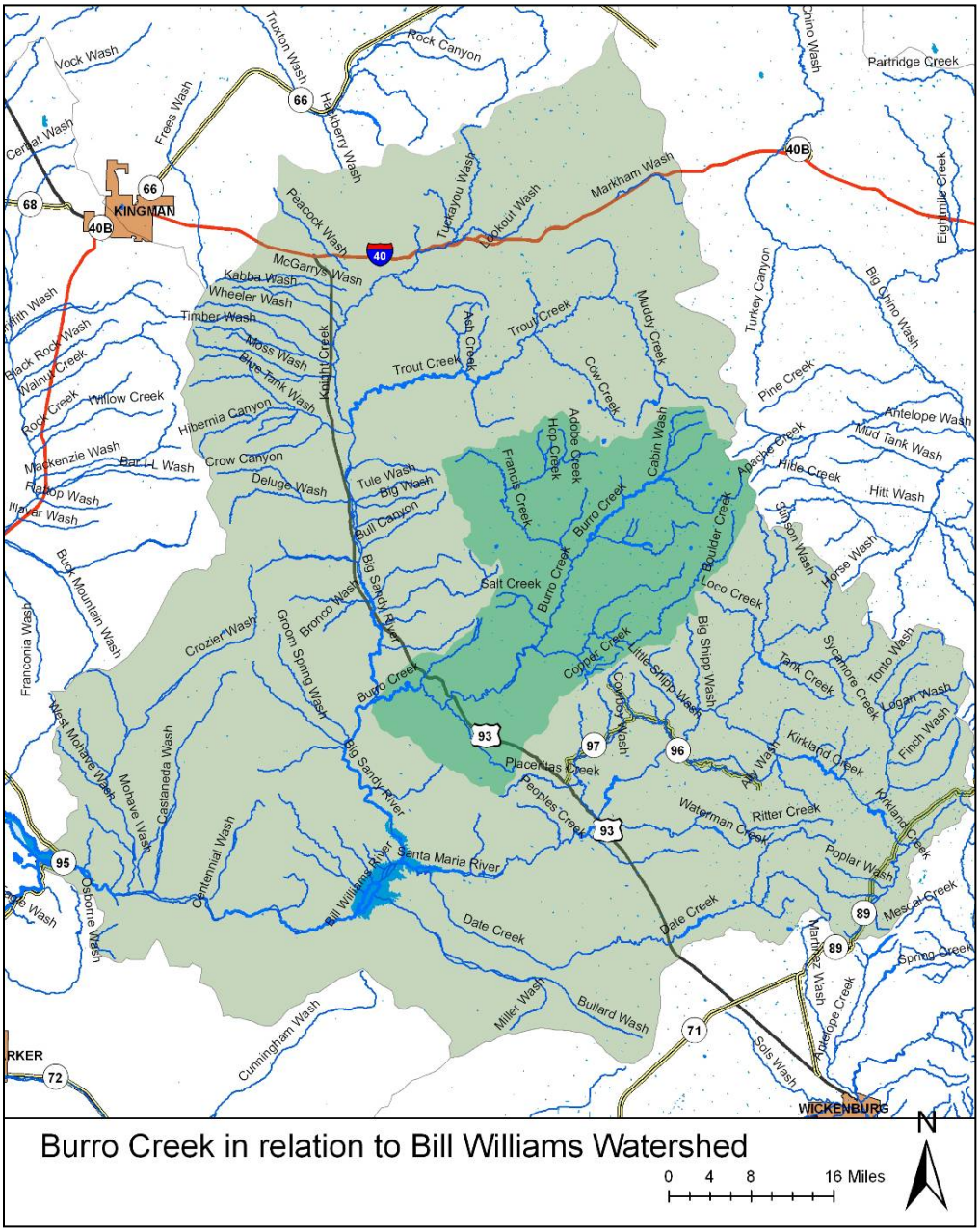
If stocked fish were to interact with roundtail chub in this system, the effects would be some unknown level of competition and possibly predation. If roundtail chub spawned in 2010, when the system reached over 15,000 cfs in January, there is also the potential for predation on eggs, larvae and young roundtail chub.

BIG SANDY RIVER SUB-WATERSHED

BURRO CREEK COMPLEX

Physical geographic description

Burro creek begins at the confluence of Cabin Wash and Pine Creek in the Santa Maria Mountains of North West Yavapai County. It flows from an elevation of over 6,000 feet in the tributaries (4,400 feet at the confluence of Pine Creek and Cabin Wash) to 1,500 feet at the confluence with the Big Sandy River and covers over 50 miles from top to bottom (Figure 20).


Burro Creek in relation to Bill Williams Watershed
0 4 8 16 Miles
N
KINGMAN
WICKENBURG
Bill Williams River
Santa Maria River
Big Sandy River
Burro Creek
Salt Creek
Francis Creek
Hop Creek
Adobe Creek
Cabin Wash
Boulder Creek
Loco Creek
Big Shipp Wash
Little Shipp Wash
Cottonwood Creek
Cowboy Wash
Placenias Creek
Peoples Creek
Waterman Creek
Ritter Creek
Kirkland Creek
Tank Creek
Sycamore Creek
Tonto Wash
Logan Wash
Finch Wash
Poplar Wash
Mescal Creek
Spring Creek
Martinez Wash
Antelope Creek
Sols Wash
Date Creek
Bullard Wash
Miller Wash
Cunningham Wash
Centennial Wash
Castaneda Wash
Mohave Wash
West Mohave Wash
Osborne Wash
Franconia Wash
Buck Mountain Wash
Crozier Wash
Groom Spring Wash
Bronco Wash
Deluge Wash
Crow Canyon
Hibernia Canyon
Willow Creek
Rock Creek
Walnut Creek
Black Rock Wash
Mackenzie Wash
Bat LL Wash
Flattop Wash
Illinois Wash
Kith Wash
Cerbat Wash
Vock Wash
Frees Wash
Truxton Wash
Hackberry Wash
Rock Canyon
Peacock Wash
McGarrys Wash
Kabba Wash
Wheeler Wash
Timber Wash
Moss Wash
Blue Tank Wash
Knight Creek
Tuckayou Wash
Lookout Wash
Markham Wash
Trout Creek
Ash Creek
Muddy Creek
Cow Creek
Turkey Canyon
Big Chino Wash
Chino Wash
Partridge Creek
Eightmile Creek
Pine Creek
Antelope Wash
Mud Tank Wash
Apache Creek
Hillside Creek
Hitt Wash
Stinson Wash
Horse Wash
Tule Wash
Big Wash
Bull Canyon
Bull Creek
Big Sandy River
Burro Creek
Placenias Creek
Peoples Creek
Date Creek
Date Creek
Santa Maria River
Bill Williams

Drainage area

Burro Creek sub-watershed covers approximately 712 square miles and drains southwest into the Big Sandy River (Figure 20). It is predominantly characterized by riffles, runs and pool habitats but during dry months is reduced to intermittent pools (Kepner 1979). Burro Creek is interrupted perennial in the upper most reaches near the confluence of Conger Creek, perennial near the confluence of Francis Creek, intermittent/ephemeral in the upper/middle reaches, near the confluence of Boulder Creek above and below until it reaches a perennial segment for 7 miles, interrupted by a small intermittent/ephemeral stretch before reaching the confluence with the Big Sandy River (AGFD 1993 and 1997) (Figure 2). No perennial flows feed into the Bill Williams River (BWRCSC 2010).

Tributaries

Several intermittent and perennial tributaries drain into Burro Creek including Pine, Conger, Francis, Salt, and Boulder Creeks. Francis Creek receives discharge from wells from confluence with Burro Creek with Francis Creek supplying public water for Bagdad and a large mining operation (ADWR no date) .

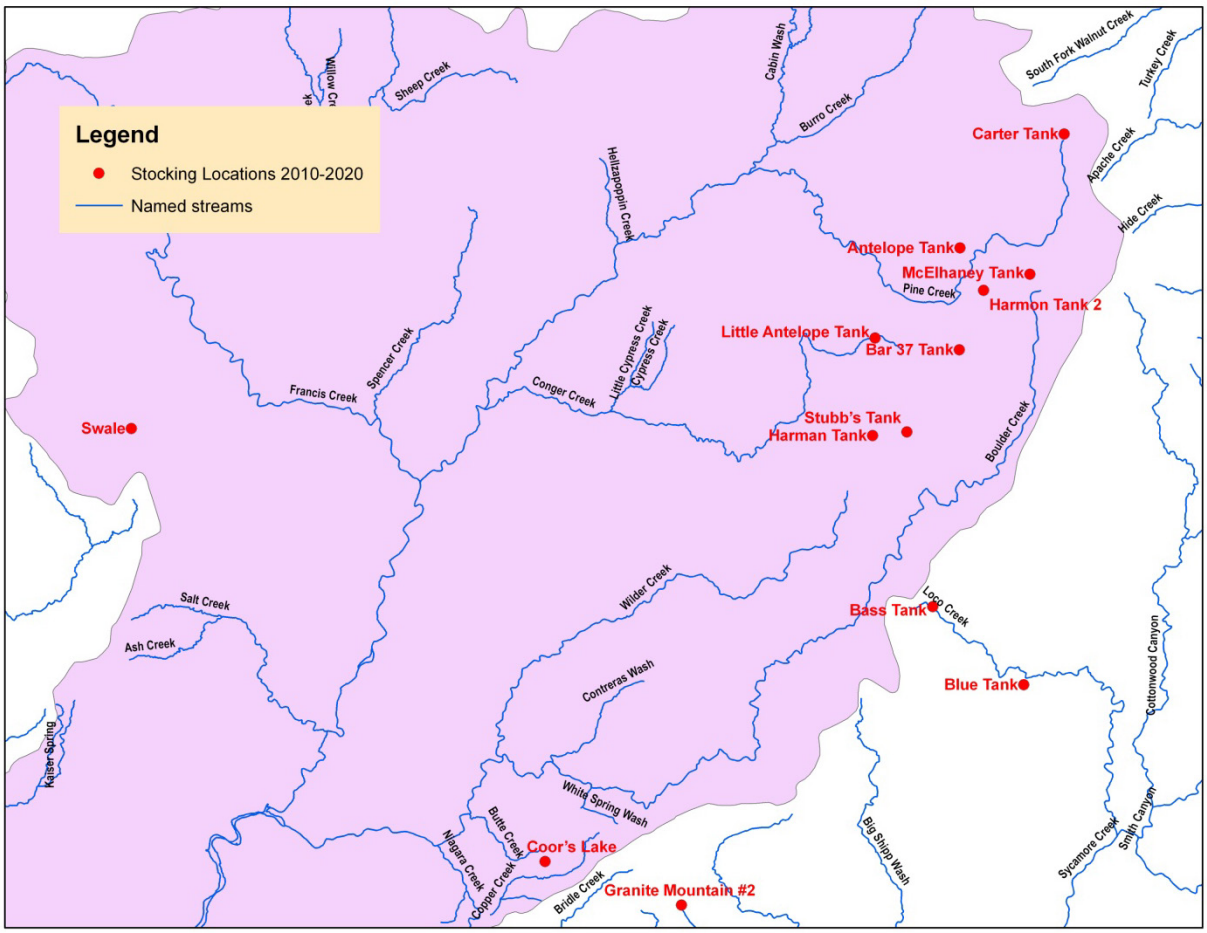


Figure 21. Overview map of the Burro Creek watershed.

Vegetation

The biotic communities within Burro Creek consist of Great Basin conifer woodland, and interior chaparral in upper elevations and Sonoran desert scrub in the lower reaches. There are vast stretches of thick cottonwood/willow stands, especially above the Francis Creek confluence. The US 93 campground (BLM) area contains a decent canopy cover approximately 1-mile long. Riparian vegetation remains sparse from there until closer proximity to the Big Sandy.

Stocking Site Descriptions

Ten stocking sites in the Burro Creek Complex are proposed: Carter Tank, Coors Lake, Antelope Tank, Bar 37 Tank, Harman Tank, Harmon Tank 2, Little Antelope Tank, McElhaney Tank, Stubb's Tank and Swale.

Carter Tank is located at approximately 6,200 feet elevation near the very top of Pine Creek about 14 miles upstream from the confluence with Burro Creek (Figure 22). Antelope Tank is

located in a small tributary drainage to Pine Creek about 8.5 miles upstream from the same confluence. Harmon Tank #2 is located in an ephemeral tributary about 0.75 miles up from Pine Creek and about 6 miles up from the Pine Creek confluence with Burro Creek. Bar 37 Tank is located about 1.5 miles upstream from Pine Creek in a tributary, and about 5.8 miles above the Pine Creek confluence with Burro Creek. Pine Creek and all its tributaries appear to be ephemeral channels except for the last mile above Burro Creek. Burro Creek is perennial.

Carter Tank

Site Description

Carter Tank is a 0.5 acre earthen livestock tank located on the Prescott National Forest approximately 40 miles north and west of Prescott at approximately 6,200 feet elevation (Figure 23). It is maintained by precipitation and is located on a small ephemeral tributary located at the beginning of Pine Creek, a tributary to Burro Creek. The date this tank was created is unknown but from stocking records it is a minimum of 35 years old. The probability of a spill is low and the downstream channels are ephemeral. There is no defined wash or spillway evident from aerial photos.

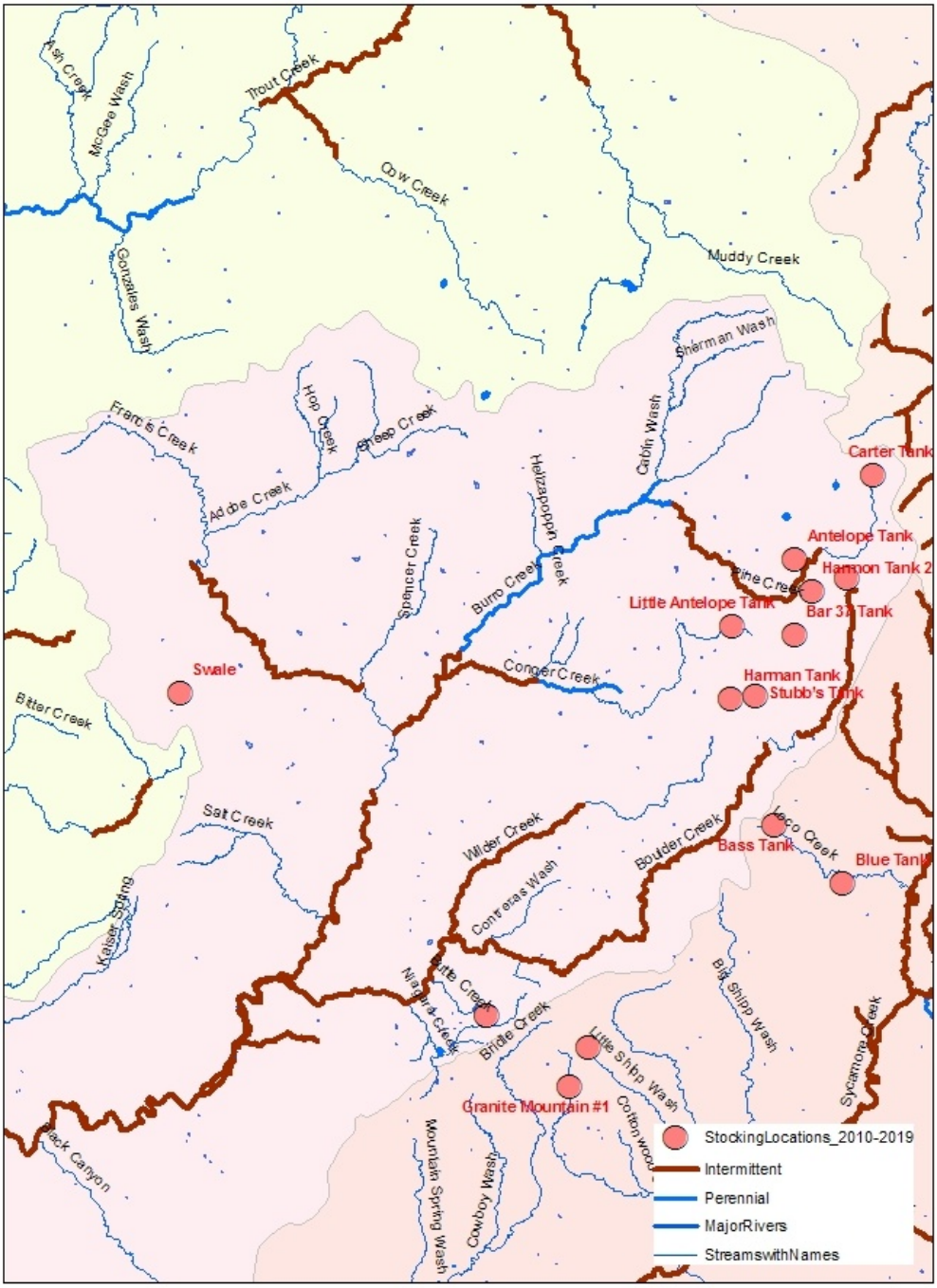


Figure 22. Overview of stock tanks in Pine Creek watershed.

Figure 23. Carter Tank, July 2002.

Management of Water Body
Currently, Carter Tank is managed as a self-sustaining warmwater fishery with channel catfish. Historically, the tank was managed for channel catfish, bluegill and largemouth bass (Table 11). As with most small ponds or cattle waters in the area, Carter Tank dries periodically to the point where warmwater sport fish species may stunt or die. Periodic sampling is done using hoop and gillnets. Carter Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of channel catfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire.

Table 11. Stocking history for Carter Tank

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Channel catfish	1974	1978	3	2,000
Bluegill sunfish	2000	2000	1	2,000
Largemouth bass	1997	1997	1	200
Total			5	4,200

Proposed Action

The Department proposes to stock channel catfish for the period covered by this consultation.

Channel catfish (sub-catchables, catchables), may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Carter tank sits in the headwater area of Pine Creek and as such has a small watershed that contributes water via snow runoff. No defined spillway exists at Carter Tank. The frequency of water spilling over Carter Tank is unknown, but believed to be infrequent as probability of a spill is low and the downstream channels are ephemeral. In addition, there is no evidence of a defined wash or spillway from the tank.

Pine Creek below Carter tank flows approximately seven miles through low gradient ponderosa pine lined wash before hitting a bedrock created dam at Pine Creek Dam. From this point, it flows an additional three miles before gradient increases and Pine Creek starts into a deeply incised canyon-bound channel. The remaining five miles can be characterized as very steep, very narrow stream bed that is very susceptible to flash flooding. This stretch has natural barriers to upstream movement of fishes. Pine Creek is ephemeral for the last one mile before its confluence with Burro Creek, which becomes perennial for approximately 10 miles before becoming intermittent near the confluence with Conger Creek. Pine Creek Dam typically retains water due to canopy shading and a bedrock substrate. No aquatic vegetation or animal life is known to be in the localized aquatic area.

Fish Movement
Fish movement out of Carter tank is not known nor documented to occur. Carter Tank has been known to go dry periodically and has been infrequently stocked. It is currently assumed fishless as it was known to have dried completely in 2003 and has not been restocked. No barriers to fish movement are known below Carter tank in Pine Creek. There is no opportunity for fishes to move upstream out of Carter Tank as no riparian or aquatic habitat exists upstream. If fishes were to move downstream out of Carter Tank, habitat conditions due to the ephemeral nature of Pine Creek in the stretch below the tank making it unlikely for survival during the warmer months as the creek dries. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is

reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Table 12. USGS Burro Creek gauging station 09424447 from 1980 to 2007.

YEAR	Monthly mean in cfs (Calculation Period: 1980-08-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980								2.22	2.29	1.3	3.87	7.93
1981	9.67	10.5	28.8	7.33	2.46	1.3	0.84	1.11	16	1.08	12.9	11.5
1982	18.1	163.1	379.7	20.4	3.6	1.01	0.6	0.475	0.375	0.536	2.22	338.3
1983	75.4	579.1	1,371	30.7	8.43	1.32	1.44	8.48	403.4	68.7	8.2	49.1
1984	17.6	11.3	8.77	5.12	2.06	0.889	6.24	121.3	17	1.93	4.27	710.4
1985	405.7	399	28	11	4.52	1.12	0.391	0.258	0.418	0.453	95.8	61.6
1986	9.25	171.9	420	14.6	1.72	0.321	0.447	17.5	2.93	4.05	7.01	13.9
1987	20.9	12.9	49.3	5.7	0.694	0.199	6.14	0.276	0.185	0.706	112.1	13.8
1988	116.7	215.4	9.97	93.2	4.37	0.233	0.026	188.2	11.4	0.211	0.501	9.39
1989	30.9	15.9	4.95	1.57	0.56	0.121	0.926	1.97	0.012			
2004									347.8	1,042	906.6	208.4
2005	1,363	1,730	114.2	48.9	25.1	7.04	2.79	186.1	7.13	384.3	379.8	374.9
2006	372.7	369.1	366.3	364.3	360	357.8	347.5	344.5			1,700	1,690
2007	1,690	1,690	1,682	1,673	1,665	1,655	1,588	1,731	1,756			
Mean Monthly Flow	344.2	447.4	371.9	189.7	173.2	168.9	162.9	200.3	197.3	136.8	269.4	290.8

Community Description

No fish surveys have been performed at Carter Tank since 1992, due to its remoteness and periodic drying (Table 13).

Table 13. Surveys at Carter Tank by year, method, species, number caught, and lengths (in millimeters):

Survey Year	Survey method(s)	Species encountered	Number	Length/Range (mm)
1986	Angling	Largemouth bass	4	292-406
1987	Hoop Net and Seine	Largemouth bass	3	73-95
		Bluegill	84	33-240
1992	Hoop net	Largemouth bass	1	368
		Bluegill	19	116-250
		Crayfish	25	

Consultation Species or Critical Habitat

No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Antelope Tank

Site Description

Antelope Tank (Figure 24) is a 3.7 acre earthen livestock tank located on the Prescott National Forest at approximately 6,000 feet elevation and 42 miles north and west of Prescott. It is maintained by precipitation and is located on a small ephemeral drainage 0.6 miles upstream from Pine Creek (Figure 22). The exact date of its creation is unknown but from stocking records Antelope Tank is a minimum of 35 years old.

Figure 24. Antelope Tank, July 2002.

Management of Water Body

Currently, Antelope Tank is managed as a self-sustaining warmwater fishery. Largemouth bass, channel catfish, and bluegill having been stocked historically (Table 14). As with most small ponds or cattle waters in the area, Antelope Tank dries periodically to the point where warm water sport fish species may stunt or die. Restocking is evaluated on an infrequent basis via using hoop and gillnets. Antelope Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of largemouth bass, channel catfish, bluegill and redear sunfish for anglers to enjoy. Periodic stocking of fish up to and including catchables to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire. Redear sunfish has not previously been stocked by the Department

and is not currently present in Antelope Tank or in the drainage, (except downstream at Alamo Lake).

Table 14. Stocking history for Antelope Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Channel catfish	1974	2003	4	3,500
Bluegill	2001	2003	1	2,000
Largemouth bass	1999	1999	1	100
Total			6	5,600

Proposed Action

The Department proposes to stock bluegill sunfish, redear sunfish, channel catfish and largemouth bass for the period covered by this consultation

Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), redear sunfish (sub-catchables, catchables), and bluegill sunfish (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Antelope Tank sits in a large open flat at the top of a small tributary of Pine Creek. It is a comparatively large stock tank with a decent storage capacity. Two small shallow drainages feed the tank from the north end. The frequency of water spilling from Antelope Tank is not known; however, given its capacity and position in the watershed, spills are believed to be infrequent. There is no defined spillway for Antelope Tank.

Water spilling from Antelope Tank would travel down an unnamed tributary 0.6 miles to Pine Creek and from this point water would flow 1.5 miles to Pine Creek Dam. Pine Creek Dam typically retains water due to canopy shading and a bedrock substrate. No aquatic vegetation or aquatic animal life is known from this natural feature.

From Pine Creek Dam, it flows an additional three miles before the gradient increases into a deeply incised canyon-bound channel. The remaining five miles can be characterized as a steep, narrow stream bed that is very susceptible to flash flooding. This stretch has natural barriers to upstream movement of fishes. No barrier to downstream movement of fishes is known from Pine Creek. Pine Creek is ephemeral for the last mile before its confluence with Burro Creek, which has perennial flow.

Fish Movement

Fish movement out of Antelope Tank is not known to occur. Antelope Tank has been known to go dry periodically and has been infrequently stocked. It is currently assumed fishless as it was known to have dried completely in 2003 and has not been restocked. No barriers to downstream fish movement are known below Antelope tank in Pine Creek. There is very little opportunity for fishes to move upstream out of Antelope Tank due to slope and lack of aquatic habitat. If fishes were to move downstream out of Antelope Tank, extreme conditions would make survival of stocked species unlikely due to the ephemeral nature of Pine Creek in the stretch below the tank making it unlikely for survival during the warmer months as the creek dries. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Community Description

No surveys have been done at Antelope Tank since 1998, due to its remoteness and frequency of drying (Table 15).

Department personnel, Andy Clark and Wildlife Manager Darren Tucker, visually inspected Antelope Tank in July 2002 and observed that the tank's water level was very low and there was no aquatic life. The Department last stocked into Antelope Tank in April 2003. Local ranchers claimed the tank went dry in late summer of 2003 and it has not been restocked since.

Table 15. Surveys at Antelope Tank by year, method, species, number caught, and lengths (in mm).

Survey Year	Survey method	Species	Number	Length/Range (mm)
1977	Seine	Waterdogs	?	?
1978	Gill net	Waterdogs	10	
1987	Gill net	None		
1998	Hoop Net	Largemouth bass	4	173-282
		Yellow bullhead	3	200-365
		Bluegill	122	110-210

Consultation Species or Critical Habitat
No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Harmon Tank #2
Site Description
Harmon Tank #2 is a 0.5 acre earthen livestock tank (Figure 25) located on the Prescott National Forest approximately 41 miles north and west of Prescott at 5,930 feet elevation. It is maintained by precipitation and is located on a small ephemeral drainage 0.6 miles upstream from Pine Creek (Figure 22). The exact date of its creation is unknown but from stocking records Harmon Tank #2 is a minimum of 23 years old.

Figure 25. Harmon Tank #2, July 2002.

Management of Water Body
Currently, Harmon Tank #2 is managed as a self-sustaining warmwater fishery with channel catfish and bluegill sunfish having been stocked historically (Table 16). As with most small ponds or cattle waters in the area, Harmon #2 dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. Harmon Tank #2 is seasonally accessible by road. Redear sunfish has not previously been stocked by the Department and is not currently present in Harmon Tank #2 or the drainage (except downstream at Alamo Lake).

Table 16. Stocking history for Harmon Tank #2.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Bluegill	2003	2003		300
Channel catfish	1987	2003		200
Total				500

Proposed Action
The Department proposes to stock bluegill sunfish and redear sunfish, for the period covered by this consultation.

Redear sunfish (sub-catchables, catchables), and bluegill sunfish (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Harmon Tank #2 sits in small valley at the top of a small tributary of Pine Creek. It is a relatively small tank with low capacity. Two small shallow drainages feed the tank from the south east end. The frequency of water spilling from Harmon Tank #2 is not known, however, spills are believed to be infrequent as the tank is located in a small watershed and is maintained by precipitation, thus, probability of spill is extremely low. No defined spillway is evident at Harmon Tank #2.

Water spilling from Harmon Tank #2 would travel down an unnamed tributary 0.6 miles to Pine Creek. From this point water would flow 1.5 miles to Pine Creek Dam. From this point, it flows an additional three miles before gradient increases and Pine Creek starts into a deeply incised canyon-bound channel. The remaining five miles can be characterized as very steep, very narrow stream bed that is very susceptible to flash flooding. This stretch has natural barriers to upstream movement of fishes. Pine Creek is ephemeral for the last one mile before its confluence with Burro Creek, which also has perennial flow. Pine Creek Dam typically retains water due to canopy shading and a bedrock substrate.

Fish Movement
Fish movement out of Harmon Tank #2 is not known to occur. Harmon Tank #2 has been known to go dry periodically and has been infrequently stocked. It is currently assumed fishless as it was known to have dried completely in 2003 and has not been restocked. No barriers to downstream fish movement are known below Harmon Tank #2 in Pine Creek. There is very little opportunity for fishes to move upstream out of Harmon Tank #2 due to lack of riparian or aquatic habitat. If fishes were to move downstream out of Harmon Tank #2, extreme conditions

would make survival of stocked species unlikely due to the ephemeral nature of Pine Creek in the stretch below the tank making it unlikely for survival during the warmer months as the creek dries. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Community Description

In 2001, anglers reported catching dozens of small bullhead catfish (A. Clark pers. comm.). Department personnel, Andy Clark and Wildlife Manager Darren Tucker, visually inspected Harmon Tank #2 in July 2002 and observed that the tank's water level was very low and there was no aquatic life. The Department last stocked Harmon Tank #2 in April 2003. Local ranchers claimed the tank went dry in late summer of 2003 and the tank has not been restocked since then. Harmon Tank #2 was sampled as recently as 2007, to ascertain the status of the bluegill and channel catfish stocking in 2003 and attempt to verify that the tank went dry (Table 17).

Table 17. Surveys at Harmon Tank #2 by year, method, species, number caught, and lengths.

Survey Year	Survey method(s)	Species encountered	Number	Length/Range (mm)
1991	Hoop net	Bluegill	65	<50-173
		Channel catfish	3	296-338
1992	Hoop net	Bullhead	2	244-273
		Bluegill	15	125-152
2007	Hoop net	Waterdogs	68	?

Consultation Species or Critical Habitat

No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Bar 37 Tank

Site Description

Bar 37 Tank is a 3.4 acre earthen livestock tank (Figure 26) located at 5,820 feet elevation and adjacent to the Prescott National Forest on a parcel of deeded land owned by the Yolo Ranch. It sits approximately 42 miles north and west of Prescott. It is maintained by precipitation and is

located on a small ephemeral drainage 1.6 miles upstream from Pine Creek (Figure 22). The exact date of its creation is unknown but from survey records Bar 37 Tank is a minimum of 24 years old.

Figure 26. Bar 37 Tank, July 2002.

Management of Water Body

Currently Bar 37 Tank is managed as a self-sustaining warm water fishery with largemouth bass, channel catfish and bluegill sunfish, although only bluegill and channel catfish have been stocked by the Department (Table 18). As with most small ponds or cattle waters in the area, Bar 37 Tank dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. Bar 37 Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of largemouth bass, channel catfish, bluegill and redear sunfish for anglers to enjoy. Periodic stocking of fish up to and including catchables to maintain sizes usable to anglers may be necessary due to drying

and/or catastrophic wildfire. Redear sunfish and largemouth bass have not previously been stocked by the Department and are not currently believed to be present in Bar 37 Tank. Largemouth bass are present elsewhere and have been stocked in the drainage previously, but redear sunfish are only previously known from downstream at Alamo Lake.

Table 18. Stocking history for Bar 37 Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Bluegill		2003		300
Channel catfish		2003		200
Total				500

Proposed action

The Department proposes to stock bluegill sunfish, redear sunfish, channel catfish and largemouth bass for the period covered by this consultation

Largemouth bass (fry/fingerling, sub-catchables, catchables), channel catfish (sub-catchables, catchables), redear sunfish (sub-catchables, catchables), and bluegill sunfish (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Bar 37 Tank sits in a small valley at the top of a moderate sized tributary of Pine Creek. It is a comparatively large tank with decent storage capacity. A small ephemeral drainage feeds the tank from the south end. The frequency of water spilling from Bar 37 Tank is not known, however given its size and capacity, spills are believed to be infrequent. There is no defined spillway at Bar 37 Tank.

Water spilling from Bar 37 Tank would travel down an unnamed tributary 1.5 miles to Pine Creek. The mouth of this tributary is 0.4 miles downstream of Pine Creek Dam. From this point, it flows an additional three miles before gradient increases and Pine Creek enters a deeply incised canyon-bound channel. The remaining five miles are characterized as a steep, narrow stream bed that is very susceptible to flash flooding. This stretch has natural barriers to upstream movement of fishes. No barrier to downstream movement of fishes is known from Pine Creek. Pine Creek is ephemeral for the last mile before its confluence with Burro Creek, which has perennial flow.

Fish Movement

Fish movement out of Bar 37 tank has not been documented. This tank did not go dry in 2003 as many of the tanks in the area did. No barriers to downstream fish movement are known below Bar 37 Tank or in Pine Creek. There is very little opportunity for fishes to move upstream out of Bar 37 Tank due to slope and lack of aquatic habitat. If fishes were to move downstream out of Bar 37 Tank, extreme conditions would make survival of stocked species unlikely due to the ephemeral nature of Pine Creek in the stretch below the tank making it unlikely for survival during the warmer months as the creek dries. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Community Description

Bar 37 Tank was sampled as recently as 2007 to ascertain the status of the bluegill and channel catfish stocking in 2003 (Table 19).

Table 19. Surveys at Bar 37 Tank by year, method, species, number caught, and length.

Year	method	Species	Number	Length/Range (mm)
1986	Angling	Yellow bullhead	8	114-216
1987	Gill net	Yellow bullhead	7	184-208
1988	Gill net	Yellow bullhead	13	160-197
1991	Gill net	Yellow bullhead	6	181-194
		Bluegill	1	163
1992	Hoop net	Yellow bullhead	3	214-226
		Channel catfish	1	298
		Bluegill	10	186-198
1995	Hoop net	Yellow bullhead	3	175-199
		Bluegill	24	141-210
1997	Hoop net	Yellow bullhead	36	148-202
		Bluegill	102	94-176
2007	Hoop net	Yellow bullhead	1	250
		Bluegill	1	198

Consultation Species or Critical Habitat
No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Little Antelope Tank

Site Description
Little Antelope Tank (Figure 27) is a 4 acre earthen livestock tank located on State Trust Land approximately 25 miles north of Bagdad at 5,790 feet elevation. It is maintained by precipitation and is located on an intermittent/ephemeral section of Conger Creek. The exact date of its creation is unknown but from survey records Little Antelope Tank is a minimum of 21 years old.

Figure 27. Little Antelope Tank, August 2007.

Management of water body
Currently, Little Antelope Tank is managed as a self-sustaining warmwater fishery with largemouth bass, channel catfish and bluegill sunfish, although only largemouth bass have been stocked by the department (Table 20). As with most small ponds or cattle waters in the area, Little Antelope Tank dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. Little Antelope Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of largemouth bass, redear and bluegill sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire. Periodic sampling using hoop-nets or gillnets would be used to monitor populations. Redear and bluegill sunfish have not previously been stocked by the Department in this tank. Redear sunfish are not currently present elsewhere in the drainage, (except downstream at Alamo Lake), but bluegill have been stocked in other tanks in the past.

Table 20. Stocking history for Little Antelope Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Largemouth bass		2003	1	400
Total				

Proposed Action

The Department proposes to stock bluegill sunfish, redear sunfish and largemouth bass for the period covered by this consultation

Largemouth bass (fry/fingerling, sub-catchables, catchables), redear sunfish (sub-catchables, catchables) and bluegill sunfish (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Little Antelope Tank sits near the top of a moderate sized tributary to Conger Creek. It is a comparatively large tank with decent storage capacity. The outflow from the tank flows (ephemeral) two miles downstream to another earthen stock tank, Halfway House Tank. The dam at Halfway House Tank is roughly 400 yards upstream from where this unnamed tributary meets Conger Creek. Conger Creek is intermittent/ephemeral for 6.5 miles until it reaches a 3 mile perennial segment maintained by a large spring. Below this perennial stretch, Conger Creek is intermittent/ephemeral for 3.5 miles where it drains into the downstream end of a perennial portion of Burro Creek. About 54 miles downstream of the Conger Creek confluence Burro Creek joins the Big Sandy River. The tank spilled in September 2004 and a small spillway does exist at this tank.

Fish Movement

Fish movement out of Little Antelope Tank has not been documented. This tank did not go dry in 2003, as many of the tanks in the area did. No barriers to downstream fish movement are known

below Little Antelope Tank or in Conger Creek. There is very little opportunity for fishes to move upstream out of Little Antelope Tank due to slope and lack of aquatic habitat upstream. If fishes were to move downstream out of Little Antelope Tank, extreme conditions would make survival of stocked species unlikely due to the ephemeral nature of Conger Creek in the stretch below the tank making it unlikely for survival during the warmer months as the creek dries. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Community Description

Little Antelope Tank was sampled as recently as 2007 to ascertain the status of the largemouth bass stocking in 2003 (Table 21). The origin of bluegill or mosquitofish is unknown as the Department has not stocked nor authorized this water to be stocked with these species.

Table 21. Surveys at Little Antelope Tank by year, method, species, number caught, and length.

Year	method	Species	Number	Length/Range (mm)
1988	Hoop net and seine	Bluegill	74	64-194
		Largemouth bass	3	127-470
		Yellow bullhead	7	165-280
2007	Hoop net and Seine	Bluegill	47	27-140
		Mosquitofish	3	fry

Lower Conger Creek was surveyed by electrofishing at two sites on May 14, 1998 by the Department. Roundtail chub, longfin dace, Sonora sucker, desert sucker and green sunfish were found. This survey was to duplicate BLM surveys done by Kepner, 1979 at the confluence with Burro Creek and about ¾ mile upstream from the confluence. The BLM did not collect green sunfish.

Conger Creek was sampled by electrofishing in May 2003. The purpose of the survey was to check the status of the roundtail chub population, and if other species such as green sunfish were persisting. Results can be found in Table 22. On October 14, 2004, fourteen roundtail chub of various lengths were collected from Conger Creek just below the spring. The purpose of these

surveys was to collect roundtail chub specimens for a fish health assessment within the watershed. All specimens were sent for testing to the Pinetop Fish Health Center. Habitat consisted of primarily riffles, runs and a few small pools. Larger roundtail chub and desert suckers were observed in two pools too deep to survey with a backpack electrofishing unit. Seven desert suckers were also surveyed in this section (Fong 2004 (1)). No largemouth bass or other non natives were documented in these recent survey efforts, further supporting the lack of establishment of stocked fish species potentially from the tank.

Table 22. Conger Creek survey results, May 2003. Samples from Conger Spring area using backpack electrofisher. Effort = 35.35 minutes.

Species	**Number sampled**	**Size Range (mm)**
Roundtail chub	74	65-200
Speckled dace	28	55-98
Desert sucker	20	80-170

Consultation Species or Critical Habitat
No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

McElhaney Tank
Site Description
McElhaney Tank (Figure 28) is a 1.5 acre earthen livestock tank located on the Prescott National Forest at approximately 6,000 feet elevation and 27 miles north of Bagdad. It is maintained by precipitation and is located on Connell Gulch, 8.7 miles upstream from the confluence with Stubb's Wash. The exact date of its creation is unknown but based on available data in Arizona water rights filings (Application #38-22420); water was first put to beneficial use in 1950.

Figure 28. McElhaney Tank, August 2007.

Management of Water Body

Currently, McElhaney Tank is managed as a self-sustaining warmwater fishery with largemouth bass and bluegill sunfish having been historically stocked (Table 23). As with most small ponds or cattle waters in the area, McElhaney Tank dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. McElhaney Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of largemouth bass, bluegill sunfish and redear sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire. Redear sunfish has not previously been stocked by the Department and is not currently present in McElhaney Tank or in the drainage, (except downstream at Alamo Lake).

Table 23. Stocking history at McElhaney Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Largemouth bass	1993	2003	3	1100

Bluegill sunfish	1993	2003	2	5200
Total				

Proposed action
The Department proposes to stock bluegill sunfish, redear sunfish, and largemouth bass for the period covered by this consultation

Largemouth bass (fry/fingerling, sub-catchables, catchables), redear sunfish (sub-catchables, catchables) and bluegill sunfish (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
McElhaney Tank sits in a clearing surrounded by Ponderosa Pine forest at just slightly over 6,000 feet in elevation. It is at the headwaters of Connell Gulch and is fed by one wash that drains the west side of Camp Wood Mountain. McElhaney tank is not a large tank but retains water during most extended drought periods primarily because of shading and elevation. From the dam at McElhaney Tank, Connell Gulch flows nine miles to its confluence with Stubb's Gulch. The confluence of Connell Gulch and Stubb's Wash forms the headwaters of Boulder Creek. Boulder Creek is ephemeral/intermittent for 23 miles and drains into Burro Creek.

Burro Creek is intermittent/ephemeral for 19 miles until it reaches a perennial segment for 7 miles before reaching the Big Sandy River. McElhaney Tank is maintained primarily by snow runoff and spills from this tank would be most likely to occur during spring runoff. McElhaney Tank spilled in September 2004.

Fish Movement
Fish movement out of McElhaney Tank has not been documented. This tank did not go dry in 2003 as many of the tanks in the area did. No barriers to downstream fish movement are known below McElhaney or in Boulder Creek. There is very little opportunity for fishes to move upstream out of McElhaney Tank due to lack of aquatic habitat upstream. If fishes were to move downstream out of McElhaney, extreme conditions would make survival of stocked species unlikely due to the ephemeral nature of Boulder Creek in the stretch below the tank making it unlikely for survival during the warmer months as the creek dries. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in

transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

In addition, Connell Gulch runs through the headquarters of the Yolo Ranch, downstream of the tank along Boulder Creek. The ranch maintains a privately owned pond containing resident largemouth bass, bluegill and fathead minnow (Figure 29). The private pond is not in the flood plain, but is situated between two drainages feeding Connell Gulch and therefore a potential source for largemouth bass and bluegill found downstream. The pond can spill, and did in Sept. 2004. Earlier spills are unknown, but likely occurred with other run-off events and future spills would likely be rare but unpredictable.

Figure 29. Yolo Ranch along Boulder Creek

Community Description

Connell Gulch was surveyed by backpack electrofishing in May 2004 by Department staff just below the Yolo Headquarters; 844 seconds were expended to sample 58 fathead minnow ranging in size from 35 mm to 72 mm. Leopard frogs were also sampled and identified as Rio Grande leopard frog (Fong 2004 (7)).

Table 24. Surveys at McElhaney Tank by year, method, species, number caught, and length.

Survey Year	Survey method	Species	Number	Length/Range (mm)
1988	Gill net	Largemouth bass	1	402
1991	Hoop net	Largemouth bass	6	197-218 & young of year
		Bluegill	153	98-178 & young of year
1992	Hoop net	Largemouth bass	4	143-248
		Bluegill	218	114-178
1995	Hoop net	Largemouth bass	2	234-255
		Bluegill	80	110-199
1997	Hoop net	Bluegill	15	104-221
2007	Hoop net	Waterdogs	?	?

Consultation Species or Critical Habitat

No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Harman Tank

Site Description

Harman Tank (Figure 30) is a 5.25 acre earthen livestock tank located on State Trust Land at 5,660 feet elevation. It is approximately 20 miles north of Bagdad. Harman is maintained by precipitation and is located 1.8 miles upstream on an ephemeral tributary of Stubb's Wash. The exact date of its creation is unknown but from survey records it is at least 23 years old.

Figure 30. Harman Tank, August 2007.

Management of Water Body
Currently, Harman Tank is managed as a self-sustaining warmwater fishery with channel catfish (Table 25). As with most small ponds or cattle waters in the area, Harman Tank dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. Harman Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of channel catfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire.

Table 25. Stocking history for Harman Tank.

Species	First Year	Last Year	Number of Stockings	Number Stocked
Channel catfish	1988	2003	3	2,520
Total			3	2,520

Proposed Action
The Department proposes to stock channel catfish for the period covered by this consultation

Channel catfish (fry/fingerling, sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Harman Tank sits in a large open flat near the top of a moderately sized tributary to Stubb's Wash. Two smaller drainages feed it from the north end. Harman is a comparatively large tank with a decent storage capacity. It is fed by snow runoff and to a lesser degree summer rains. Spills around the dam at Harman would most commonly be during spring runoff events in above-average snowfall years. Harman Tank did overflow in September 2004.

Water leaving Harman Tank would travel two miles of ephemeral drainage to Stubb's Wash. Stubb's Wash is also ephemeral and drains 0.6 miles into Boulder Creek. Boulder Creek has extensive pockets of water that persist during dry times and is considered interrupted perennial for 23 miles before draining into Burro Creek. Burro Creek is intermittent/ephemeral for 19 miles until it reaches a perennial segment for seven miles before reaching the Big Sandy River.

Fish Movement
Fish movement out of Harman Tank has not been documented. This tank did not go dry in 2003 as many of the tanks in the area did. No barriers to downstream fish movement are known below Harman Tank or in Boulder Creek. There is very little opportunity for fishes to move upstream out of Harman Tank due to slope and lack of habitat. No riparian or aquatic habitat exists upstream. If fishes were to move downstream out of Harman Tank, extreme conditions would make survival of stocked species unlikely due to the ephemeral nature of both Stubb's Wash and Boulder Creek below the tank making it unlikely for survival during the warmer months as the creek dries; however, a few pools may not completely dry. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Community Description
Harman Tank was sampled as recently as 2007 to ascertain the status of the channel catfish stocking in 2003 (Table 26). Two 2-foot diameter hoop nets were deployed overnight. Channel and bluegill were captured (Cummins 2007 (2)). Harman Tank has also been sampled historically since 1987 (Table 27).

Table 26. Survey results from hoop net samples at Harman Tank, August 23, 2007.

Species	Number sampled	Size Range (mm)
Channel catfish	11	106-255
Bluegill sunfish	3	114-163

Table 27. Surveys at Harman Tank by year, method, species, number caught, and length.

Year	Method	Species	Number	Length/Range (mm)
1987	Gill net	None		
1988	Angling and Hoop net	Channel catfish	11	261-600
1991	Seine	crayfish	>1,000	
1992	Hoop net	crayfish	50	
1994	Hoop net	Bluegill	23	125-221
		Yellow bullhead	22	280-320

Consultation Species or Critical Habitat
No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Stubb's Tank
Site Description
Stubb's Tank (Figure 31 and Figure 32) is a 3.4 acre earthen livestock tank located on a parcel of deeded land owned by the Yolo Ranch adjacent to Prescott National Forest and State Land Department lands at about 5,660 feet elevation. The tank is also referred to as Hosea Tank and is located approximately 22 miles northeast of Bagdad. It is maintained by precipitation and is located on a small ephemeral drainage 1.6 miles upstream from Stubb's Wash. The exact date of its creation is unknown but from survey records Stubb's Tank is a minimum of 23 years old.

Management of Water Body
Currently Stubb's Tank is managed as a self-sustaining warmwater fishery with largemouth bass and bluegill sunfish, although channel catfish have also been stocked in the past (Table 28). As with most small ponds or cattle waters in the area, Stubb's Tank dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. Stubb's Tank is seasonally accessible by road.

Figure 31. Stubb's Tank, June 2006.

Figure 32. Stubb's Tank photograph.

Future management objectives would center on providing stock sizes of largemouth bass, redear and bluegill sunfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire. Redear sunfish has not previously been stocked by the Department and is not currently present in Stubb's Tank or in the drainage, (except downstream at Alamo Lake).

Table 28. Stocking history for Stubb's Tank.

Species	First Year	Last Year	Number of Stockings	Num. Stocked
Bluegill	1997	2003	3	4,300
Channel catfish	2001	2001	1	400
Largemouth bass	1997	2007	4	3,014
Total			5	7,714

Proposed Action

The Department proposes to stock bluegill, redear sunfish, and largemouth bass for the period covered by this consultation

Largemouth bass (fry/fingerling, sub-catchables, catchables), redear sunfish (sub-catchables, catchables) and bluegill sunfish (sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. In addition, redear sunfish would be established in the fishery. All numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Stubb's Tank sits in a large open juniper lined flat near the top of a small tributary to Stubb's Wash. The dam at Stubb's began to erode significantly on its western edge starting in September 2004. High flows in the summer of 2007 created a large wash out as a result of very heavy rainfall and corresponding runoff in the area (Figure 33 and Figure 34). The dam remained functional but capacity of the tank was reduced. The Yolo ranch repaired the dam in the summer of 2008. The tank, prior to 2005, had not been known to spill. It has a small contributing watershed and is a comparatively large tank. Water leaving Stubb's Tank would flow down an unnamed wash one mile until meeting Stubb's Wash. Stubb's Wash is also ephemeral and drains 0.6 miles where it meets Connell Gulch forming Boulder Creek. Boulder Creek has numerous/extensive pockets of water that persist during dry times and is considered interrupted perennial for 23 miles before draining into Burro Creek. Burro Creek is intermittent/ephemeral for 19 miles until it reaches a perennial segment for 7 miles before reaching the Big Sandy River.

Figure 33. Breech at Stubb's Dam, October 2007.

Figure 34. Stubb's Dam breech looking downstream, October 2007.

Fish Movement

Fish movement out of Stubb's Tank has not been documented. This tank did not go dry in 2003 as many of the tanks in the area did. No barriers to downstream fish movement are known below Stubb's Tank or in Boulder Creek. There is very little opportunity for fishes to move upstream out of Stubb's Tank due to slope and lack of aquatic habitat. If fishes were to move downstream out of Stubb's Tank, extreme conditions would make survival of stocked species unlikely due to the ephemeral nature of Stubb's Wash and Boulder Creek below the tank making it unlikely for survival during the warmer months as the creek dries; however, a few pools may not completely dry. If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

Community Description

Stubb's has historically held water consistently through dry periods and has been locally known for its largemouth bass fishery. Survey efforts in summer of 2002 yielded high numbers of fish (Table 29), but mortality was high due to low oxygen and netting stress. Local anglers reported reduced catch rates on largemouth bass in following years. Stubb's Tank was sampled as recently as 2007 to determine impacts to the fishery resulting from the 2004 flooding.

Table 29. Surveys at Stubb's Tank by year, method, species, number caught, and length.

Year	Method	Species	Number	Length/Range (mm)
1987	Seine	Bluegill	41	72-150 & young of year
1991	Seine	Largemouth bass	42	YOY
		Bluegill	27	YOY
		Crayfish	100s	
1992	Hoop net and Seine	Bluegill	78	74-249
		Crayfish	250	
1994	Hoop net	Bluegill	83	140-245
		Largemouth bass	2	212-221
1996	Hoop net	Largemouth bass	1	355
		Bluegill	88	84-225

1998	Hoop net	Largemouth bass	1	270
		Bluegill	45	110-199
2002	Hoop net	Bluegill	257	22-271
		Largemouth bass	46	135-450
2007	Hoop net	Crayfish	?	

Consultation Species or Critical Habitat
No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Complex Analysis as they are found within Burro Creek.

Swale Tank
Site Description
Swale Tank is a 10 acre earthen livestock tank (Figure 35) located approximately 28 miles east of Wikiup at 4,520 feet elevation on land managed by the Bureau of Land Management. It is maintained by precipitation and is located 3.5 miles upstream on Black Canyon, an ephemeral tributary of Francis Creek. According to ADWR records, this tank was built prior to a water rights filing in 1979 and appears on topo maps created from 1973 aerial photos.

Figure 35. Swale Tank, October 2004.

Management of Water Body
Currently, Swale Tank is managed as a self-sustaining warmwater fishery with channel catfish, which have been stocked in the past (Table 30). As with most small ponds or cattle waters in the area, Swale Tank dries periodically to the point where warmwater sport fish species may stunt or die. Restocking is evaluated on an infrequent basis using hoop and gillnets. Swale Tank is seasonally accessible by road.

Future management objectives would center on providing stock sizes of channel catfish for anglers to enjoy. Periodic stocking to maintain sizes usable to anglers may be necessary due to drying and/or catastrophic wildfire.

Table 30. Stocking history for Swale Tank.

Species	First Year	Last Year	Number of Stockings	Number Stocked
Channel catfish	1992	1997	2	1,550
Total			2	1,550

Proposed Action
The Department proposes to stock channel catfish for the period covered by this consultation.

Channel catfish (fry/fingerling, sub-catchables, catchables) may be stocked as needed at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Swale Tank sits in an open valley on top of Goodwin Mesa in the Aquarius Mountains. As stated above, it is a large tank with decent retention capacity. Swale is maintained primarily by snow melt, but can receive high runoff from summer storms as well. The tank went dry in 2003 but filled to capacity and spilled in September 2004. The extent of the spill is unknown, but site visits to the tank in the winter of 2004 revealed water levels several feet from spilling (S. Fong pers. comm.). Prior to 2004, Swale Tank was not known to spill. Water leaving Swale Tank would flow 3.7 miles down Black Canyon to its confluence with Francis Creek. Water spilling from Swale Tank drops approximately 6 feet onto large rocks. Another 6-foot drop onto rocks occurs down Black Canyon approximately 1 mile. Black Canyon does not maintain sufficient aquatic habitat for fish during most years.

Francis Creek is intermittent for five miles then has perennial flow for 2.1 miles to the confluence with Burro Creek. Burro Creek is perennial for 4.2 miles and then becomes ephemeral/intermittent for 30 miles to the confluence with the Big Sandy River.

Fish Movement

Fish movement out of Swale Tank has not been documented. The tank was confirmed dry in 2003. No barriers to downstream fish movement are known below Swale Tank or in either Black Canyon or Francis Creek. There is little opportunity for fishes to move upstream out of Swale Tank due to limited aquatic habitat. Slaughter tank resides approximately 0.6 miles up an ephemeral wash from Swale Tank (Figure 36). It is unknown if there are fish or other aquatic organisms in Slaughter Tank, nor what the nature of the spillway is like. Absent information, we presume that escaped fish from Swale Tank could enter Slaughter Tank. Upstream from Slaughter Tank there is no riparian or aquatic habitat. If fishes were to move downstream out of Swale Tank, extreme conditions would make survival of stocked species unlikely due to two vertical drops onto rocks and very limited aquatic habitats in addition to ephemeral nature of the system.

If the tank spilled during winter run-off or due to sporadic monsoonal events, flash flooding conditions would limit the survivability of fish moving downstream. These conditions create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and mortality. In addition, the steep rocky canyon bound channel of the creek would make it further unlikely fish would survive. Extreme seasonal high water events do occur in this drainage as is reflected in the USGS stream gauge data on Burro Creek approximately 45 miles downstream of Burro Creek (Table 12).

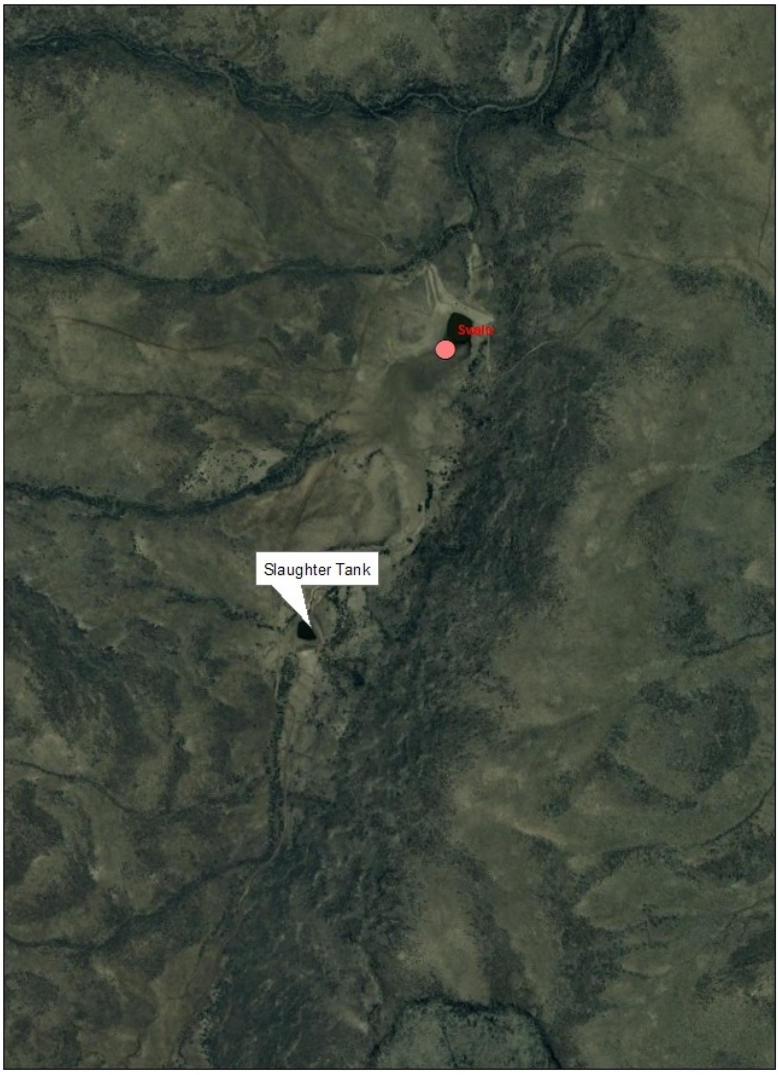


Figure 36. Swale and Slaughter Tanks

Community Description

No surveys have been done a Swale Tank since 1996 due to its remoteness and infrequency of stockings (Table 31). Channel catfish were confirmed present by anglers in 2000 (K. Morgan, pers. comm.). Channel catfish were documented dying as a result of low water and corresponding poor water quality in the summer of 2002 (G. Elms, pers. comm.). The tank dried completely in 2003 and has not been restocked. It is currently presumed fishless.

Table 31. Surveys at Swale Tank by year, method, species, number caught, and length.

Year	method	Species	Number	Length/Range (mm)
1988	Hoop net and Seine	Channel catfish	19	95-634

1996	Hoop net and Seine	Channel catfish	8	90-100

Channel catfish were first stocked in 1992 and had opportunity to access Francis Creek and have not been documented there. Fish surveys in 1966 reported: carp, speckled dace and roundtail chub as being present in Francis Creek just downstream of the Black Canyon confluence. Roundtail chub are known from Francis Creek further downstream. More recent fish surveys (1991-1995) in Francis Creek downstream from the confluence reported: longfin dace, Sonora sucker, roundtail chub, green sunfish, desert sucker and speckled dace. Channel catfish were first stocked in 1992 and had opportunity to access Francis Creek and have not been documented there. Channel catfish are likely to persist in the system should they wash out of Swale Tank; however, they have been stocked in Swale Tank twice since 1992 and have not been documented in Francis Creek or downstream in Burro Creek. Peak stream flow provided in (Table 34) shows that discharges in Burro Creek in 1993 were over double those measured in 2004 when the tank was known to spill. It is highly probable that this tank also spilled during the 1993 winter season.

Consultation Species or Critical Habitat
No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Coors Lake
Site Description
Coors Lake is a 35 acre impoundment of Butte Creek in western Yavapai County (Figure 37) at 3,700 feet elevation. The earthen dam that created Coors Lake was completed in 1982 by the Cyprus-Bagdad Copper Company (Hinkle 1987). The lake sits about 2 miles north of the town of Bagdad, and approximately one mile northeast of the Bagdad open pit copper mine now owned and operated by Freeport McMoran Corp.

The land ownership status of Coors Lake and the lake access road borders private land. Access currently is open to the public through a dirt road that originates immediately in front of the main gate of the mine. Coors Lake is considered a closed system; stocked fish cannot exit the system, nor can fish enter the lake.

Figure 37. Coors Lake, May 2007.

Management of Water Body

Coors Lake has been managed as a self-sustaining warmwater fishery featuring largemouth bass, black crappie, bluegill sunfish, and channel catfish. In 1982, Coors was first stocked with largemouth bass from nearby Vaughn's Pond. Vaughn's was the original lake on mine property but was filled in due to deposition of unmineralized overburden. Since that time the lake has received several supplemental stockings (Table 32). The various owners of the mine have also stocked channel catfish and largemouth bass into Coors Lake. The lake is accessible by road year round.

The Arizona Department of Environmental Quality (ADEQ) issued a human health fish consumption advisory on largemouth bass at Coors Lake in 2004. The advisory was based on the accumulation of mercury in the flesh of these fish. The advisory was deemed warranted after testing mercury concentrations in the flesh of largemouth bass and black crappie. Elevated mercury levels were not found in the black crappie population. Shortly after the advisory was issued, an incomplete fish kill occurred mostly affecting the largemouth bass population. The kill was attributed to very low water levels and deteriorating water quality due to dense aquatic vegetation. Largemouth bass were restocked in 2006 by the owner at the time, Phelps Dodge. AGFD has monitored the fish populations of Coors Lake since 1986 primarily by electrofishing.

Local Bagdad residents make up the primary user base for the lake. Historically the users have treated Coors as a catch and release fishery for bass, though regulations allow for harvest. Wildlife Manger, Gene Elms, observed that catfish and crappie were the primary species that were taken home for consumption. Angler surveys from 2004 suggested that the harvest of fish from the lake decreased after the Arizona Department of Environmental Quality established the human health consumption advisory.

Table 32. Stocking history for Coors Lake.

Species	First Year	Last Year	Number of Stockings	Number Stocked
Channel catfish	1987	2001	6	4950
Bluegill	2001	2002	2	3000
Largemouth bass	1987	2006	3	4467
Total			11	12,417

The Department's Regional Fisheries Management Plan drafted in 2006 identified the management objective for Coors Lake is to provide and maintain yearlong quality and diverse angling opportunities to Coors Lake visitors. The plan identifies management for a warm water fishery including bluegill sunfish, channel catfish, largemouth bass and black crappie. Redear sunfish has more recently been identified as an additional species. Redear sunfish has not previously been stocked by the Department and is not currently present in Coor's Lake or in the drainage, (except downstream at Alamo Lake). Factors influencing/limiting the fishery include:

- Sustaining Adequate Water Levels: Due to the small local watershed the lake is dependent upon supplemental water from ground water supplies provided by PDBI.
- Aquatic weed growth: Limits angler access and may, under low water conditions, contribute to summer kill due to oxygen depletion.
- Mercury bioaccumulation in predator species.

Other factors that may require supplemental stockings or regulation change proposals: a trend of low catch rates of a certain species in population surveys or creel surveys, fish kills, low numbers or quality of prey species, significant increases in angler use.

Proposed Action

The Department proposes to stock bluegill, channel catfish, black crappie, largemouth bass, and redear sunfish, for the period covered by this consultation

Largemouth bass (fry/fingerling, sub-catchables, catchables), redear sunfish (sub-catchables, catchables), bluegill sunfish (sub-catchables, catchables), black crappie (sub-catchables, catchables) and channel catfish (sub-catchables, catchables) may be stocked on an as needed basis at any time during the year to augment existing populations or recover the fishery following catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

The dam at Coors Lake was originally created to prevent seasonal floods from entering the open pit; however, subsequent unmineralized overburden deposits have isolated the lake from Butte Creek, a tributary to Boulder Creek and Burro Creek (Figure 38). The watershed basin that feeds Coors is relatively small at approximately 800 acres (Hinkle 1987). Coors Lake is maintained partially by precipitation runoff and by active groundwater pumping by the Cyprus Bagdad Mining Company (Figure 39). Active pumping is required to keep Coors Lake as a viable lake capable of supporting a sport fishery. There is no outflow from the lake to any tributary.

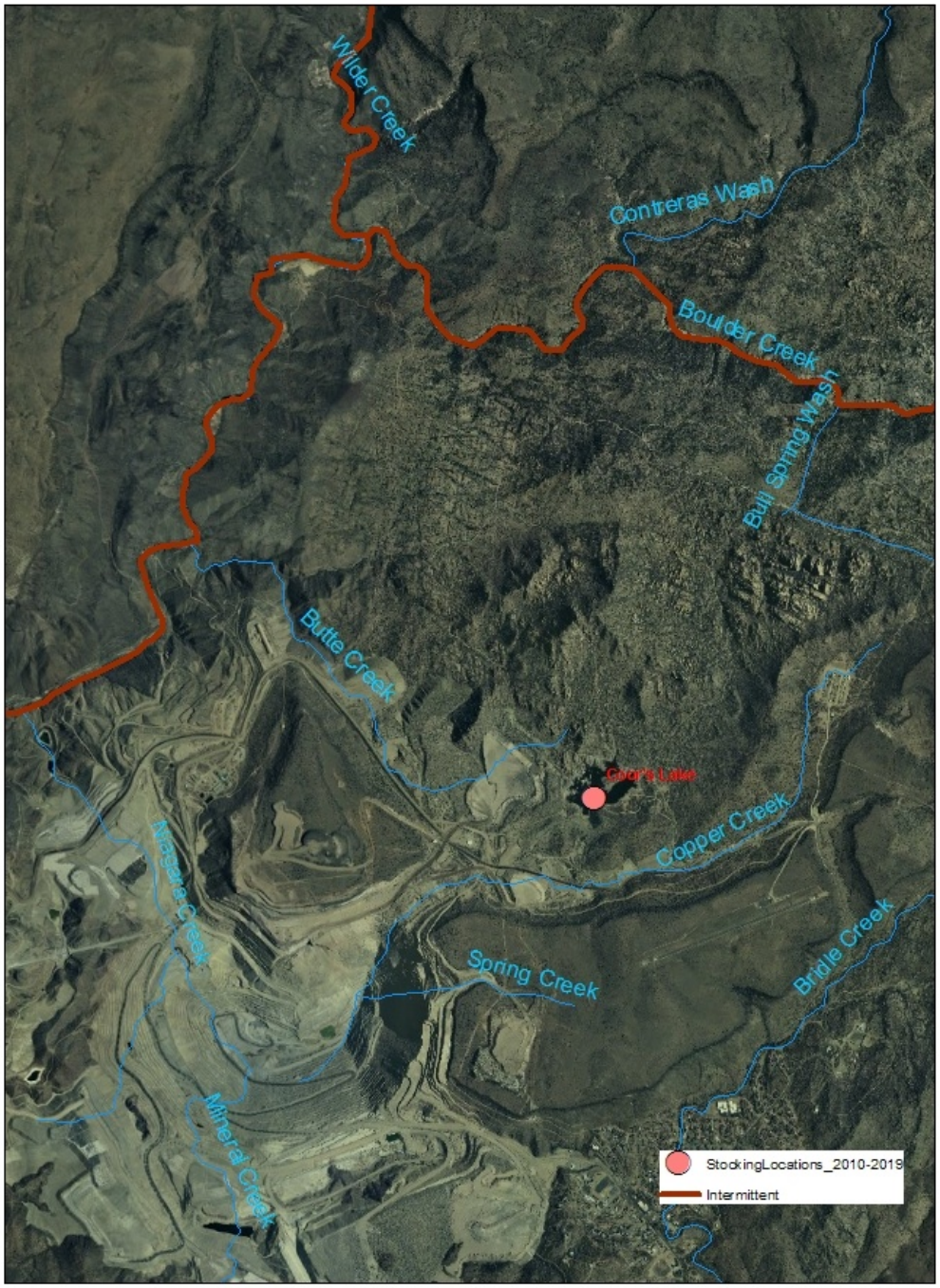

Wilder Creek
Contreras Wash
Boulder Creek
Bull Spring Wash
Butte Creek
Coor's Lake
Copper Creek
Niagara Creek
Spring Creek
Bridle Creek
Mineral Creek
StockingLocations_2010-2019
Intermittent

Figure 38. Coors Lake and ephemeral tributaries to Boulder Creek

Coor's Lake
StockingLocations_2010-2019

Figure 39. Cyprus Bagdad Mining Company operations near Coors Lake

Fish Movement
Coors Lake is a closed system. Conditions do not exist that allow natural fish movement out of the lake.

Community Description
The species assemblage in Coors Lake has been sampled periodically by electrofishing. Results can be found in (Table 33).

Table 33. Number, relative abundance, relative biomass and catch per unit effort by electrofishing at Coors Lake 1998-2007.

June 1998, Effort was 122 minutes of electrofishing						
Species	# Sampled	# Measured	% of Total	CPUE	Weight (g)	% of Total
Bluegill	123	123	50.6%	1.01	11,910	20%
Green Sunfish	5	5	2.1%	0.04	420	1%
Largemouth Bass	109	109	44.9%	0.89	36,780	62%
Black Crappie	4	4	1.7%	0.03	170	0%
Channel Catfish	2	2	0.8%	0.02	10,060	17%
May 2001, effort was 79 minutes of electrofishing.						
Species	# Sampled	# Measured	% of Total	CPUE	Weight (g)	% of Total
Bluegill	26	26	33.3%	0.33	3,488	12%
Green Sunfish	1	1	1.3%	0.01	88	0%
Largemouth Bass	51	51	65.4%	0.65	24,972	87%
September 2005, effort was 45 minutes of electrofishing.						
Species	# Sampled	# Measured	% of Total	CPUE	Weight (g)	% of Total
Mosquitofish	2	2	0.9%	0.04	2	0.1%
Bluegill	197	197	92.1%	4.38	1,634	80.7%
Black Crappie	15	15	7.0%	0.33	388	19.1%
June 2006, effort was 44 minutes of electrofishing.						
Species	# Sampled	# Measured	% of Total	CPUE	Weight (g)	% of Total
Bluegill	435.00	435.00	98.6%	9.89	4983	87%

Green Sunfish	1.00	1.00	0.2%	0.02	88	2%
Black Crappie	5.00	5.00	1.1%	0.11	660	12%
May 2007, effort was 45 minutes of electrofishing.						
Species	# Sampled	# Measured	% of Total	CPUE	Weight (g)	% of Total
Bluegill	415	415	90.0%	9.22	6132	47%
Green Sunfish	28	28	6.1%	0.62	3058	23%
Largemouth Bass	8	8	1.7%	0.18	2461	19%
Black Crappie	10	10	2.2%	0.22	1405	11%

Other species that have been recorded from the lake are red shiner, fathead minnow, and mosquitofish, presumably by anglers releasing unused bait. Red eared slider turtles have also been recorded from the site.

Consultation Species or Critical Habitat
Bald Eagle are discussed below. No aquatic species are known to be in the localized area. Roundtail chub are discussed in the Burro Creek Complex Analysis as they are found downstream within Burro Creek.

Bald Eagle
Burro Creek Breeding Area is approximately 14.7 miles from Coors Lake and is within the Sonoran Desert Bald Eagle DPS. The eagles were first observed at the breeding area in 2007 and were last observed at the breeding area in 2008. Nest watchers have not been present at the breeding area so the prey base specifics are largely unknown. Burro Creek Breeding Area productivity data shows that the nest failed in 2007, and was occupied in 2008 before the nest fell and has since not been rebuilt (McCarty pers. Comm.). The breeding area was unoccupied in 2009 (Jacobson et al. 2007; McCarty and Jacobson 2008, 2009) and in 2010.

Potential Impacts
Nesting bald eagles are known to occur in the vicinity of this stocking site all year. Human disturbance and monofilament line/fishing tackle disposal are issues for this site. It is unknown if Coors Lake has monofilament bins present

BURRO CREEK COMPLEX ANALYSIS
Water distribution and connectivity, fish movement and community descriptions were previously discussed for Carter, Antelope, Harmon #2, Bar 37, Little Antelope, McElhaney, Harmon,

Stubb's tanks and Coors Lake up to the point where they flow into Burro Creek. Downstream connectivity for Burro Creek into the Big Sandy River is discussed below.

Water Connectivity / Distribution

In summary, nearly all of the associated tributaries flowing into Burro Creek are ephemeral/intermittent in nature and are subject to flash flooding events that could potentially connect them for a short duration to Burro Creek. Conger Creek, Francis Creek and Pine Creek have short perennial reaches (Pine Creek with the confluence of Burro Creek and Middle Conger Creek).

Fish Movement

Fish movement out of the tanks within Pine Creek are not known nor documented to have occurred. Small and medium sized tanks often dry periodically, and none of the tanks have known barriers to downstream fish movement if spillage should occur. There is little to no opportunity for fishes to move upstream from the tanks as little or no riparian or aquatic habitat exists. In addition, there is at least one 80-feet drop exists between the proposed stocking sites on Pine Creek and Burro Creek (Figure 40).

No barriers to downstream fish movement are known below Little Antelope Tank or in Conger Creek. There is very little opportunity for fishes to move upstream out of Little Antelope Tank due to slope and lack of aquatic habitat upstream.

Within the Boulder Creek tanks, there would be very little opportunity for fishes to move upstream out of the tanks due to lack of aquatic habitat upstream. In addition, Connell Gulch runs through the headquarters of the Yolo Ranch. A privately owned pond exists at the headquarters that contains resident largemouth bass, bluegill and fathead minnow. The pond is not in the floodplain but is situated between two drainages feeding Connell Gulch in closer proximity to the drainage that could flow into Burro Creek, providing another source for non native fish if fish escaped during a spill event. It was known to spill in September 2004 (A. Clark pers. comm.)

In summary, these flash flooding conditions within the entire watershed, can create increased sediment loads, high turbidity, rapid currents, alteration of habitat conditions, increased stress levels of organisms in transport, altering of fish behavior and causing mortality limiting the ability of survival during transport.

Figure 40. Vertical Drop on Pine Creek UTM 12S 310728E 3858237N, June 2008.

Community Description

Fish assemblage information in the immediate complex area is generally sparse or lacking, but roundtail chub have been documented in Burro Creek about six miles downstream from the confluence of Pine and Burro creeks. The fishes documented from the Burro Creek watershed include longfin dace, brown bullhead, yellow bullhead, carp, red shiner, roundtail chub, green sunfish, bluegill, desert sucker, fathead minnow, black crappie and speckled dace. Bluegill and black crappie have only been documented from Coors Lake and not in any downstream systems. Largemouth bass and channel catfish have been stocked into the watershed in the past (1987-2006), but were never collected in any stream systems of the Burro Creek watershed (survey dates from 1966-2001). Green sunfish are known from Burro, Francis and Boulder creeks (1988-1995 surveys). There were also spot checks in 2003 and 2004 (Fong 2004[1]; Fong 2004[7]), 2007 (Cummins 2007[8]), and 2009 (Cummins 2009[1]) in Boulder Creek, and roundtail chub were located, but species proposed for stocking were not found. A summary of the findings follows.

> Fong 2004[1]; Sampled by electrofishing just below the San Luis Baca Float boundary. They found the following:

6 desert suckers
4 speckled dace
15 roundtail chub ranging from 65mm to 155mm.

Fong 2004(7): Seined in Apache Creek just below Forest Road 93 and found 18 speckled dace on 5/12/2004. They also seined in Upper Boulder Creek at Connell Gulch and pulled in 58 fathead minnows.

Cummins 2007 4/2-3/07: The sampling effort started approximately 3.5 miles upstream of the confluence of Francis and Burro Creeks at UTM 12S 0298635E 3851130N (NAD 27). Visual searching and netting was used. No native fish were netted but visual identification was made for two roundtail chubs. Non-native fish included yellow bullhead and green sunfish. The ending point was at UTM 12S 0299386E 3852262N. The total distance on the upper end of the creek covered 1.2 miles. The second day was spent electrofishing at the confluence of Burro and Francis Creeks. Non-native fish included yellow bullhead, green sunfish and one common carp.

Cummins 2009 4/13-14/09: They electrofish sampled at (UTM 12S 0297256 3834349 NAD 27) for 1,019 seconds and produced no fish. This site was downstream of the Hillside Mine. The second site was upstream from the Hillside Mine at (UTM 12S 0298039 3835112) and ended at (UTM 12S 0298038 3835239). The site used 1,215 seconds and produced:

3 roundtail chub with an average length of 173 mm
1 desert sucker
6 longfin dace
The third (UTM 12S 0313126 3841741) and fourth (UTM 12S 0308392 385929) electrofishing sites produced only fathead minnows.

4/13/09: Nets were set in three positions (UTM 12S 0308319 3836132) (UTM 12S 03313349 3842261) (UTM 12S 0313109 3841898). The nets were set in the late afternoon and pulled in the morning and produced no fish. Small bodied fish, possibly longfin dace were present at site two but too small to be caught. One mosquito fish was observed at site three.

Though drainages such as Boulder and Francis have historically held viable native fish populations, recent investigations of these creeks found much less water and more dominance by non-native fish species (Fong 2004 (2), Cummins 2007(8)). Within the drainage complex, non-native fish species are present including green sunfish, yellow bullhead, common carp, red shiner, fathead minnow and mosquitofish. Conger Creek maintains an all native species assemblage in the middle reaches. Pine Creek does not provide adequate aquatic habitats and has not been known to harbor fishes historically.

All the proposed waters have been in existence a minimum of 20 years with some having stocking and/or survey records dating back 25 years while others were only recently stocked

according to Department records. It would not be unusual for other undocumented stockings to have occurred in tanks prior to the 1970's, though. The exception is redear sunfish which is a new proposed species in the Burro Creek Complex. General persistence of fish species proposed for this stocking period have been documented in each of the proposed waters, with occasional extirpations due to drying/drought.

Consultation Species or Critical Habitat
Roundtail chub are downstream within Burro Creek and the Santa Maria River and are discussed below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Roundtail Chub
There are collection records of roundtail chub in Burro Creek and the Santa Maria River, however, the current status of roundtail chub in the Santa Maria River is unknown (See Santa Maria Complex).

Roundtail chub is currently the only fish species of concern in these two systems. Roundtail chub tend to do well in desert stream systems in which they evolved, provided periodic flooding occurs to ensure habitat for their young (Rinne 1996). Burro Creek shows frequent high flow events suggesting roundtail chub may persist better in this creek when compared to others in the Complex (Table 34). Burro Creek also has the most perennial and ephemeral/interrupted perennial areas in the Bill Williams system that would allow fish to survive. Fish surveys in Burro Creek will be performed every other year over 6 years for a total of 3 surveys. If largemouth bass, bluegill or redear sunfish are discovered in these streams, stockings would be halted and consultation re-initiated.

Table 34. Peak stream flow for USGS 09424447 Burro Creek at old US 93 bridge near Bagdad, Az.

Water Year	Date	Stream-flow (cfs)
1980	Feb. 14, 1980	47,400

1981	Sep. 05, 1981	728
1982	Feb. 11, 1982	5,400
1983	Mar. 03, 1983	30,600
1984	Aug. 24, 1984	3,950
1985	Dec. 27, 1984	12,400
1986	Nov. 30, 1985	6,210
1987	Mar. 05, 1987	565
1988	Aug. 27, 1988	6,410
1989	Jan. 05, 1989	798
1990	Sep. 18, 1990	1,410
1991	Mar. 01, 1991	29,900
1992	Feb. 13, 1992	12,300
1993	Feb. 08, 1993	55,300
2004	Sep. 19, 2004	21,200
2005	Feb. 11, 2005	44,600
2006	Sep. 09, 2006	1,510
2007	Sep. 22, 2007	5,700

Potential Impacts

Largemouth bass, channel catfish, bluegill and redear sunfish are proposed to be stocked over a 10-year period in waters within the Burro Creek Complex. Of the four species, largemouth bass and channel catfish would be the two species that have the potential to negatively impact native fish populations in downstream portions of the Complex. Three of the four proposed species (excluding redear sunfish) have been present in both drainages since at least 1988 when records of species occurrence in area tanks began. To date, data collections from these drainages have recorded one occurrence of largemouth bass, one confirmed bluegill and one suspect bluegill in the neighboring Santa Maria River (See Santa Maria Complex discussion) and no largemouth bass or bluegill have been documented within the Burro Creek drainage stream channels (Kansas Aquatic GAP database spanning 1947-2003 and 478 species/location combinations). Channel catfish and redear have not been sampled in either Burro Creek or the Santa Maria River (Kansas Aquatic GAP accessed 2009). Largemouth bass characteristically become most abundant in lentic waters, i.e. lakes, ponds, reservoirs, and in slow–moving, downstream portions of larger streams (Minckley 1973). Burro Creek cannot be classified as a slow-moving, larger river. Burro is a “flashy” type desert stream prone to prolonged dry periods followed by extreme high water events that transport large amounts of sedimentary materials (Kepner 1980). These events are believed to remove suitable habitats for all the proposed species. It is possible that largemouth bass could find refuge in permanent pools in the river if they were not swept downstream beyond

the pool habitat during flashy events. However, because largemouth bass have not been found in Burro Creek, it appears that this has not been the case.

The likelihood of any of the aforementioned tanks transporting live stocked fish into tributaries feeding into Burro Creek is low. In the event of a spill with live fish transport from these tanks, if overlap with roundtail chub occurs, potential impacts would include predation and/or competition. Channel catfish are the hardiest of the species proposed for stocking in Carter tank, Coors Lake, Antelope Tank, Bar 37 Tank, Harman Tank and Swale Tank and would be the most likely of any of the stocked species to have a chance to persist in the system should they wash out of any of the tanks (except for Coors as it is a closed system). Channel catfish have been stocked in the drainage since 1974, but have not been surveyed in Burro Creek, making it unlikely that they have escaped the tanks and/or established in Burro Creek or elsewhere. In addition, samples taken at three separate sites in Burro Creek during "fall fish count" efforts, 1991-1993 (Young 1994) and spot check surveys in Burro Creek and Francis Creek in 2003, 2004, and 2007 did not yield channel catfish. Predation and/or competition from sunfish would be considered unlikely due to the low level of piscivory by nature they exhibit (refer to the species interactions information in Chapter 4) and differential use in habitat.

Prolonged overlap of proposed species with roundtail chub is not likely to occur due to conditions created during flash flooding events and differential use/preference of habitat for the proposed stocked species. Although no surveys have detected bass, bass might find temporary refuge in pools also inhabited by suckers, sunfish, bullhead and carp as well as roundtail chub; however they likely would be flushed out of the system reducing the time of exposure.

Angling pressure at the proposed tanks would most likely increase in the period of this consultation. However, this rise would be considered minimal, due to the remoteness of the proposed waters and the rough roads leading to them. Waters on the Prescott National Forest would be evaluated for use periodically by the Forest. Waters on private lands would be monitored by the owners and closures can be expected if use patterns or litter grow to unreasonable levels. Tanks closest to Bagdad are expected to have the most significant increase in angler use in the next 10 years. Conservation actions are being planned or implemented in both drainages to benefit roundtail chub under the Range Wide Six Species Conservation Agreement for roundtail chub. This would include construction of a fish barrier and removal of non-native species mainly in Burro Creek above the mouth of Francis Creek. Stocking of roundtail chub is also planned for some stock tanks in the area to both increase chub populations as well as continue to provide unique sport fishing opportunities. This is part of a future action and not part of the proposed action for this consultation. Given the habitat loss in the Santa Maria drainage due to groundwater pumping, the greatest opportunities for roundtail chub conservation occur within areas of Burro Creek.

BILL WILLIAMS RIVER WATERSHED ANALYSIS

Water distribution and connectivity, fish movement and community descriptions were previously discussed for the Santa Maria and Burro complexes above Alamo Lake. Downstream connectivity and potential for impacts below Alamo Dam are discussed below.

Water Connectivity / Distribution

Proposed stocking sites in the watershed above Alamo Lake have the potential to contribute stocked fishes into the stream systems and for potential transport into Alamo Lake.

The intake elevation for the outlet works of Alamo Dam is located at 990 feet. The bottom of spillway is located at 1235 feet. Alamo Dam has never reached the spillway level (Figure 41). All releases have occurred through the three tandem slide gates (max discharge of 8715 cfs) or the low-flow bypass butterfly valve (max discharge of 112 cfs). That releases from Alamo Dam have never occurred through the spillway is supported by USGS gauge data from below Alamo Dam that show a discharge maximum at 7230 cfs in 2005 (Figure 42).

Between Alamo Dam and Lake Havasu, the Bill Williams is usually an interrupted perennial stream, containing dry reaches through the summers of many years. After wet winters with high releases from Alamo Dam, Planet Valley alluvium becomes saturated and the channel may remain wetted throughout the summer.

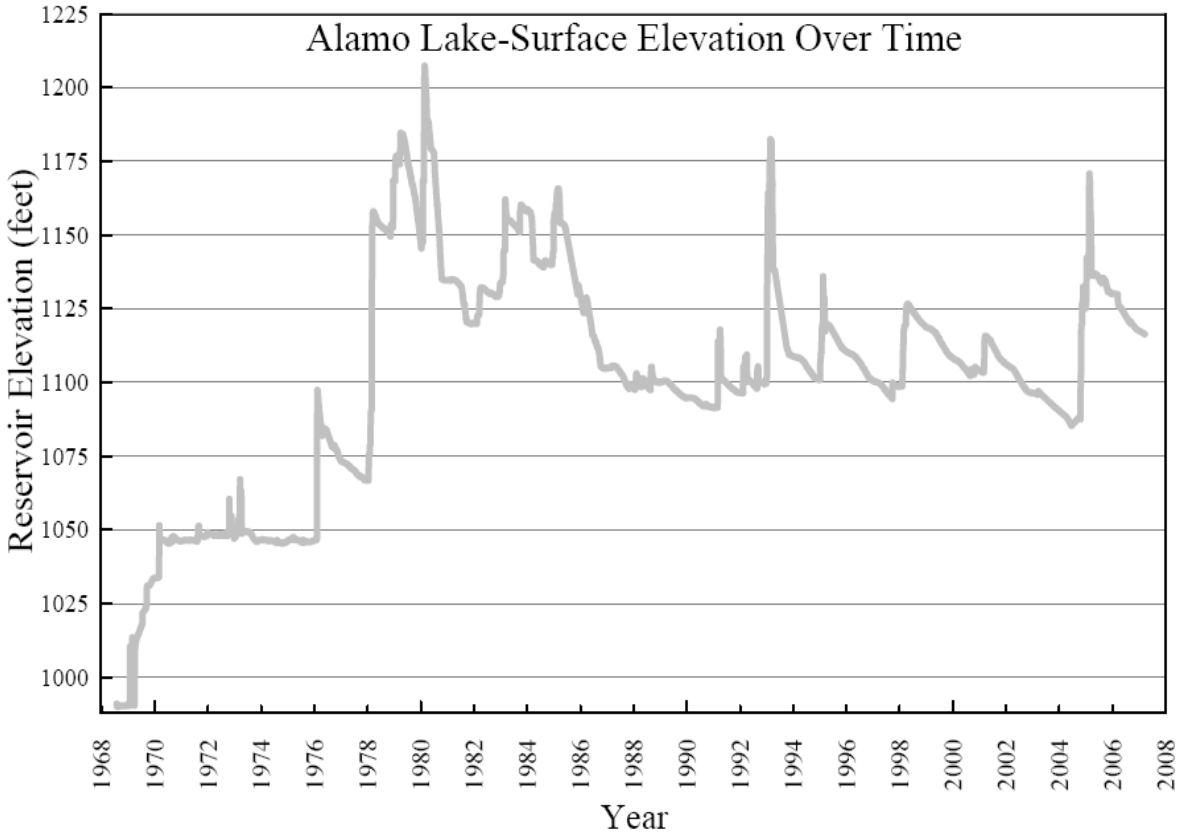


Figure 41. Surface elevation of Alamo Lake over time, 1968 to present (Brown and Jacobson 2007a).

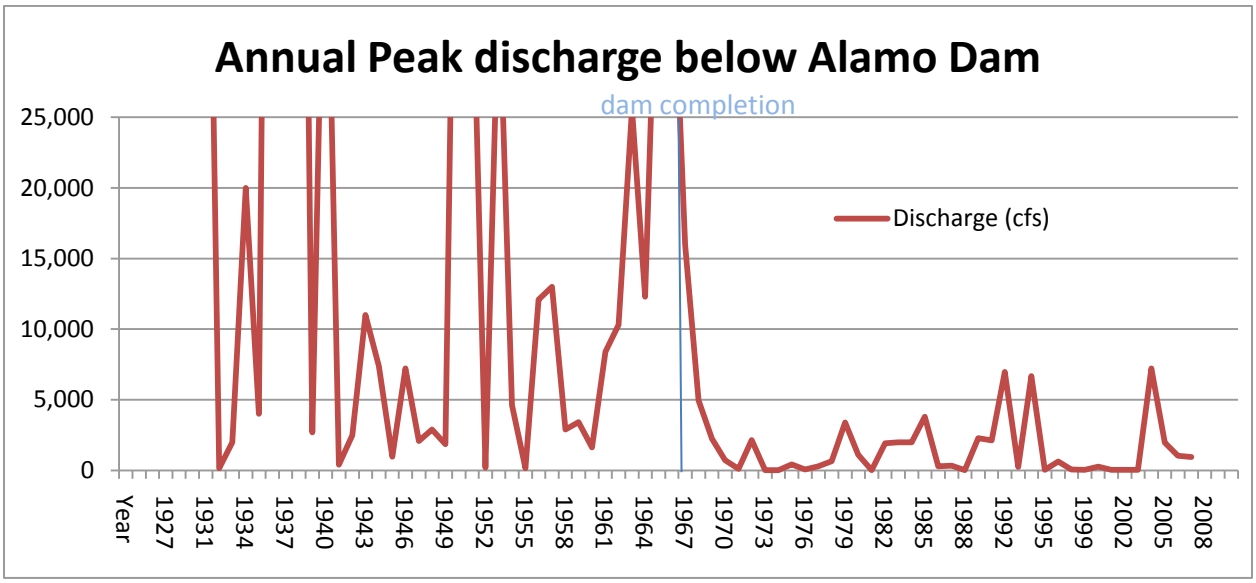


Figure 42. USGS gauge data for peak discharge below Alamo Dam before and after dam construction completed in July 1968.

Fish Movement

The potential exists for fish to move through the watershed above Alamo Lake and enter the lake. However, because of the similarity between the species present in both areas, it is not possible to determine the frequency or magnitude of that potential movement. Information previously presented in the Burro Creek and Santa Maria complex chapters indicates that the movement of stocked species within the watersheds may be minimal. Transport of fishes through the outlet works of Alamo Dam is possible through the low-flow and tandem gates. There are no turbines present in the outlet works.

Community Description

Sport fish management at Alamo Lake focuses on those species most sought after by anglers; primarily channel catfish, largemouth bass, and black crappie (Brown and Jacobson 2007a and Table 35). Other species present include yellow bullhead, common carp, bluegill, redear sunfish, green sunfish and tilapia spp. Threadfin shad is the primary forage species in the lake. Alamo Lake has supported populations of all species proposed for stocking in the upper watershed. Redear sunfish were not counted but were caught consistently during all surveys (Brown and Jacobson 2007a). Downstream of Alamo Lake, the Bill Williams River flows for about 45 miles from Alamo Dam into Lake Havasu. Lake Havasu contains a fishery assemblage very similar to that of Alamo Lake, with the additional presence of striped bass. Lake Havasu is also the site of conservation actions for razorback sucker and bonytail chub, which are the subject of this analysis.

Table 35. Species composition, by number and percent, and mean catch per unit effort (CPUE) of fish sampled in Alamo Lake on spring and fall surveys from 2003 through spring 2007 (Brown and Jacobson 2007a).

Year/Season	Species	Number sampled	Percent of Total (%)	CPUE	No. of stations sampled
2003/Spring	Largemouth bass	73	78	6.6	11
	Channel catfish	21	22	1.9	
2003/Fall	Largemouth bass	64	83	10.7	6
	Black crappie	4	5	0.7	
	Channel catfish	2	3	0.3	
	Yellow bullhead	7	9	1.2	
2004/Spring	Largemouth bass	209	85	13.1	16
	Black crappie	15	6	0.9	
	Channel catfish	22	9	1.4	
2004/Fall	Largemouth bass	257	91	21.4	11
	Black crappie	3	1	0.3	

Year/Season	Species	Number sampled	Percent of Total (%)	CPUE	No. of stations sampled
	Channel catfish	21	7	1.8	
2005/Spring	Largemouth bass	114	71	10.4	11
	Black crappie	42	26	3.8	
	Channel catfish	4	3	0.4	
2005/Fall	Largemouth bass	139	91	13.9	10
	Black crappie	6	4	0.6	
	Channel catfish	7	5	0.7	
2006/Spring	Largemouth bass	252	81	21.0	12
	Black crappie	40	13	3.3	
	Channel catfish	21	7	1.8	
2006/Fall	Largemouth bass	268	96	14.9	18
	Black crappie	1	0	0.1	
	Channel catfish	7	3	0.4	
	Yellow bullhead	3	1	0.2	
2007/Spring	Largemouth bass	272	82	20.9	13
	Black crappie	20	6	1.5	
	Channel catfish	40	12	3.1	
	Yellow bullhead	1	0	0.1	

Data available indicate the following species have been collected in the river below Alamo Dam since its construction: longfin dace, yellow bullhead, carp, red shiner, mosquitofish, roundtail chub, channel catfish, green sunfish, bluegill, redear sunfish and largemouth bass (AGFD data and Kansas State GAP data). However, roundtail chub and longfin dace have not been collected since before 1980.

Lake Havasu has produced the following species during past surveys according to the Kansas State Aquatic GAP database: brown bullhead, yellow bullhead, carp, threadfin shad, mosquitofish, bonytail, channel catfish, green sunfish, bluegill, redear sunfish, smallmouth bass, largemouth bass, striped bass, rainbow trout, white crappie, black crappie, Colorado pikeminnow (now extirpated), flathead catfish and razorback sucker. Brown and Jacobson (2007b; Table 36) provide more recent information on electrofishing surveys in Lake Havasu.

Table 36. Species composition, by number and percent, and mean catch per unit effort (CPUE), of fish sampled by electrofishing in Lake Havasu from fall 2003 through fall 2006. One unit of effort is 900 seconds of electrofishing (Brown and Jacobson 2007b).

Season-Year	Species	Number sampled	Percent of Total (%)	CPUE	No. of stations sampled
Fall-2003	Largemouth bass	94	86	7.8	12

Season-Year	Species	Number sampled	Percent of Total (%)	CPUE	No. of stations sampled
	Smallmouth bass	13	12	1.9	
	Bonytail chub	2	2	0.1	
Spring-2005	Largemouth bass	156	10	2.9	54
	Bluegill	390	24	7.2	
	Redear sunfish	403	25	7.5	
	Green sunfish	282	17	5.2	
	Warmouth	3	0	0.1	
	Channel catfish	17	1	0.3	
	Flathead catfish	13	1	0.2	
	Striped bass	187	12	3.5	
	Carp	89	6	1.6	
	Goldfish	8	0	0.1	
	Yellow bullhead	3	0	0.1	
	Smallmouth bass	64	4	1.2	
Fall-2005	Largemouth bass	139	37	3.9	36 (Striped bass collected at only 18 stations)
	Channel catfish	28	7	0.8	
	Flathead catfish	1	0	0.03	
	Striped bass	128	34	7.1	
	Smallmouth bass	82	22	2.3	
Spring -2006	Channel catfish	2	12	0.2	10
	Flathead catfish	15	88	1.5	
Fall-2006	Largemouth bass	141	20	3.9	36
	Black crappie	1	0	0.03	
	Channel catfish	11	2	0.3	
	Flathead catfish	9	1	0.3	
	Striped bass	492	70	13.7	
	Smallmouth bass	52	7	1.4	

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Razorback sucker

Razorback sucker are currently stocked directly into Lake Havasu as part of the Lower Colorado River MSCP. They are found periodically throughout the reservoir, including the Bill Williams River arm and inflow area.

Potential Impacts

If fishes stocked in the watershed upstream of Alamo Lake are able to traverse (in one flow event or through periodic and episodic events) the distance to Alamo Lake, they become indistinguishable from the existing populations of those species resident in the lake. Their incremental addition to the assemblage is not likely to contribute to the existing assemblage in any meaningful way because the warm water assemblage that exists in Alamo Lake is already self sustaining and not dependent upon the addition of fish from upstream.

If water releases through the outlet works of Alamo Dam allow stocked fish or their progeny to pass through, they could traverse the 45 miles of river channel into Lake Havasu, where they would be indistinguishable from the existing populations of those species resident in that lake . The incremental increase to the already present assemblage would not have a meaningful impact because the warm water assemblage that exists in Lake Havasu is already self sustaining and not dependent upon the addition of fish from upstream. The Bill Williams River is not perennial between the dam and Lake Havasu, generally drying in the Planet Valley most summers. The stocking of razorback sucker into Lake Havasu is an ongoing conservation action taken with the fore-knowledge that it is occupied by a diverse, abundant and thriving community of non-native predatory and competitor fishes. Any potential impact from stocking in the upstream watershed would not be measurable or meaningfully detectable.

Bonytail chub

Bonytail chub are currently stocked directly into Lake Havasu as part of the Lower Colorado River MSCP. They are found periodically throughout the reservoir, including the Bill Williams arm and inflow area.

Potential Impacts

If fishes stocked in the watershed upstream of Alamo Lake are able to traverse (in one flow event or through periodic and episodic events) the distance to Alamo Lake, they become indistinguishable from the existing populations of those species resident in the lake and their incremental addition to the assemblage is not likely to contribute to the existing assemblage in any meaningful way because the warm water assemblage that exists in Alamo Lake is already self sustaining and not dependent upon the addition of fish from upstream.

If water releases through the outlet works of Alamo Dam allow stocked fish or their progeny to pass through, they could traverse the 45 miles of river channel into Lake Havasu, where they

would be indistinguishable from the existing populations of those species resident in that lake . The incremental increase to the already present assemblage would not have a meaningful impact because the warm water assemblage that exists in Lake Havasu is already self sustaining and not dependent upon the addition of fish from upstream. The Bill Williams River is not perennial between the dam and Lake Havasu, generally drying in the Planet Valley most summers. The stocking of bonytail chub into Lake Havasu is an ongoing conservation action taken with the fore-knowledge that it is occupied by a diverse, abundant and thriving community of non-native predatory and competitor fishes. Any potential impact from stocking in the upstream watershed would not be measurable or meaningfully detectable.