ID # 17

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to NMFS No:
2008/06525

March 31, 2009

Kevin D. Martin
Forest Supervisor
Umatilla National Forest
2517 SW Hailey Avenue
Pendleton, Oregon 97801

Steve A. Ellis
Forest Supervisor
Wallowa-Whitman National Forest
P.O. Box 907
Baker City, Oregon 97814

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Umatilla and Wallowa-Whitman National Forests Invasive Plant Treatments Project, Baker, Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler Counties, Oregon; Asotin, Columbia, Garfield, and Walla Walla Counties, Washington; and Adams and Nez Perce Counties, Idaho (Fourth-field HUCs: 17050201, 17050202, 17050203, 17050116, 17050119, 17060101, 17060102, 17060103, 17060104, 17060105, 17060106, 17060107, 17070102, 17070103, 17070104, 17070202, 17070203, 17070204).

Dear Mr. Martin and Mr. Ellis:

The enclosed document contains a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the proposed treatment of invasive plants on the Umatilla and Wallowa-Whitman National Forests in Oregon and Washington for the duration of the Opinion (2009-2013).

In this Opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Snake River Spring/ Summer (SR) Chinook salmon, Snake River Fall Chinook Salmon, SR sockeye salmon, Snake River Basin (SRB) steelhead, or Middle Columbia River (MCR) steelhead, or result in the destruction or adverse modification of designated critical habitat for critical habitats for all the above-listed species.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the Opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the United States Forest Service (USFS), must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes six conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the USFS must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

If you have questions regarding this consultation, please contact Walt Wilson, Fisheries Biologist, Eastern Oregon Habitat Branch of the Oregon State Habitat Office, at 541.975.1835.

Sincerely,

Barry A. Thom
Acting Regional Administrator

cc: Alan Scott, Umatilla National Forest
Gene Yates, Wallowa-Whitman National Forest

ID # 17

Endangered Species Act – Section 7 Consultation Biological Opinion

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Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Umatilla and Wallowa-Whitman National Forests Invasive Plant Treatments Project
Baker, Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler Counties, Oregon
Asotin, Columbia, Garfield, and Walla Walla Counties, Washington; and Adams and Nez Perce Counties, Idaho
(Fourth-field HUCs: 17050201, 17050202, 17050203, 17050116, 17050119, 17060101, 17060102, 17060103, 17060104, 17060105, 17060106, 17060107, 17070102, 17070103, 17070104, 17070202, 17070203, 17070204)

Lead Action Agency: United States Department of Agriculture - Forest Service

Consultation Conducted By: National Marine Fisheries Service
Northwest Region

Date Issued: March 31, 2009

Issued by:

Barry A. Thom
Acting Regional Administrator

NMFS No.: **2008/06525**

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INTRODUCTION

This document contains a biological opinion (Opinion) and incidental take statement prepared in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531, *et seq*.), and implementing regulations at 50 CFR 402.[1] With respect to critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02. The National Marine Fisheries Service (NMFS) also completed an essential fish habitat (EFH) consultation, prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801, *et seq*.) and implementing regulations at 50 CFR 600.

The docket for this consultation is on file at the Eastern Oregon Habitat Branch in La Grande, Oregon.

Background and Consultation History

Invasive plant treatment actions on Umatilla National Forest (UNF) lands were originally covered under a 1995 record of decision (ROD). Snake River (SR) sockeye had been listed as "endangered" in 1991, and SR spring/summer and fall Chinook as "threatened" in 1992. Snake River Basin (SRB) and Middle Columbia River (MCR) steelhead were subsequently listed as "threatened", in 1997 and 1999, respectively. The 1995 invasive species treatments were bundled with on-going actions and included in geographic scale biological assessments (BAs). The consultation history for the Wallowa-Whitman National Forest (WWNF) is similar. Treatment actions were covered under decision notices for environmental assessments in 1992 and 1994, and invasive plant treatments were bundled with on-going actions and included in landscape scale BAs or consulted on as individual actions.

With the completion of the U.S. Forest Service (USFS) Region 6 final environmental impact statement (R6 FEIS) and ROD (R6 ROD) for invasive plants in 2005, additional herbicides, and specific goals and objectives for invasive plant management, were added to the UNF and WWNF Plans. The UNF/WWNF BA contains site specific analyses for activities proposed on the Forests, and is also tiered to the BA for the R6 FEIS, and the R6 ROD.

A primary focus of the site-specific analyses was development of project design features (PDF) to insure compliance with standards outlined in the R6 FEIS, as well as standards and guidelines in the UNF and WWNF land and resource management plans (LRMPs). Information used to design PDF to minimize effects from treatment included properties of herbicides from USFS risk assessments, properties of soils in relation to herbicide properties, proximity of treatment sites to streams, stream/road connectivity, and acres of proposed treatment for each fifth-field hydrologic unit code (HUC) watershed.

[1] This consultation was initiated prior to January 15, 2009, the effective date of amendments to 50 CFR section 402 described in 73 FR 76272 (Dec. 16, 2008). NMFS is issuing this document subsequent to that date. NMFS has considered whether the analysis or corresponding conclusions and incidental take statement would differ substantively depending on whether it applied the pre- or post-January 15 regulations, and has determined that they would not.

A draft BA was sent to NMFS in May, 2008. On July 16, 2008, representatives from NMFS, UNF, WWNF, and the U.S. Fish and Wildlife Service (USFWS) met to address comments and concerns from NMFS and the USFWS regarding the BA. Following the July meeting, discussions between the USFS, USFWS, and NMFS continued to address outstanding concerns by phone and e-mail. On September 15, 2008, the USFS requested by e-mail that NMFS address a concern with PDF H-14 by providing a term and condition in the biological opinion that would limit the extent of actions within the bankfull elevation of streams.

On September 26, 2008, NMFS received a letter and final BA requesting initiation of formal consultation under section 7(a)(2) of the ESA, and consultation on essential fish habitat pursuant to section 305(b) of the MSA.

Description of the Proposed Action

The proposed action is to control, contain, or eradicate invasive plants in known or newly discovered infestations, including new plant species that currently are not found on UNF or WWNF lands over the next 10 years (until invasive plant objectives are met or changed conditions or new information warrants the need for a new decision). Biological, manual, mechanical, mulching, thermal, and chemical treatment methods are proposed. Treatments are proposed for known or newly discovered infestations. The proposed UNF and WWNF invasive plant treatment programs are described in detail in the UNF Invasive Plant Treatment and WWNF Invasive Plant Treatment draft environmental impact statements, which are tiered to the R6 FEIS and R6 ROD. The PDF were developed to eliminate or minimize the effects of invasive plant treatments on human health and natural resources. Based on current invasive plant inventories, approximately 47,500 acres of treatment sites have been identified on UNF and WWNF lands (Tables 1 and 2). Site restoration to reestablish native vegetation would occur following invasive plant treatments. The proposed action description below is a summary of the primary components of the action, as described in the BA.

The UNF and WWNF will use an integrated mix of methods, as summarized in Tables 1 and 2, to treat infested areas. Infested areas will be treated with an initial prescription and retreated in subsequent years, as necessary. Herbicide application will likely be part of the treatment prescription for many sites. However, the USFS expects that the use of herbicides will decline in subsequent treatments, as the size of invasive plant infestations decrease. Mechanical and manual treatments would occur separately or concurrently with herbicide applications.

Table 1. Invasive plant treatment (acres) summary by ranger district, Umatilla National Forest.

Treatment Method	Umatilla National Forest Ranger District				
	Heppner	Pomeroy	North Fork John Day	Walla Walla	Total
Biological and Physical*	89	46	47	3736	3917
Chemical, Physical, and Biological - Upland	4699	3138	3933	5531	17301
Chemical, Physical and Biological - Riparian	839	1130	621	802	3392
Physical Only	2	6	24	6	39
Total	**5629**	**4320**	**4625**	**10075**	**24649**

* Physical methods are manual, mechanical, mulching, and thermal.

Table 2. Invasive plant treatment (acres) summary by ranger district, Wallowa-Whitman National Forest.

Treatment Method	Wallowa-Whitman National Forest Ranger Districts							
	Whitman* RD (Baker)	Whitman RD (Pine)	Whitman RD (Unity)	Wallowa Valley	HCNRA	Eagle Cap	La Grande	Total
Biological and Physical**	90	30	1,297	186	86	123	143	1,955
Chemical, Physical, and Biological - Upland	951	1,762	1,269	1,596	6,232	436	1,128	13,376
Chemical, Physical, and Biological - Riparian	628	725	403	555	4,031	300	758	7,400
Physical Only	1	18	7	10	70	2	3	111
Total	**1,670**	**2,535**	**2,976**	**2,347**	**10,419**	**861**	**2,032**	**22,842**

* The Baker, Pine, and Unity Ranger Districts have been consolidated into the Whitman Ranger District; however, to increase site-specificity, this separation was maintained in this table.

** Physical methods are manual, mechanical, mulching, and thermal.

The appropriate treatment method for each site will be determined by applying site information to the treatment decision tree (Figure 1). Up to about 4,000 acres of each national forest (Forest) may be treated annually with one or more of the treatment methods. Biological control methods are ongoing, and the number of acres managed using this type of control is likely to vary across the two Forests over time.

Once treatment methods have been determined, prioritization of infestation treatments will be conducted as follows. Generally, the highest priorities will be treatments of new invaders and early treatment of new infestations, followed in priority by containment, and then control of larger, established infestations.

Target species within each treatment site will be assigned one of the following treatment strategies:

- Eradicate - Totally eliminate an invasive plant species from a site. This objective generally applies to small infestations of aggressive species.
- Control - Reduce the size of the infestation over time; some level of infestation would be acceptable.
- Contain - Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories.

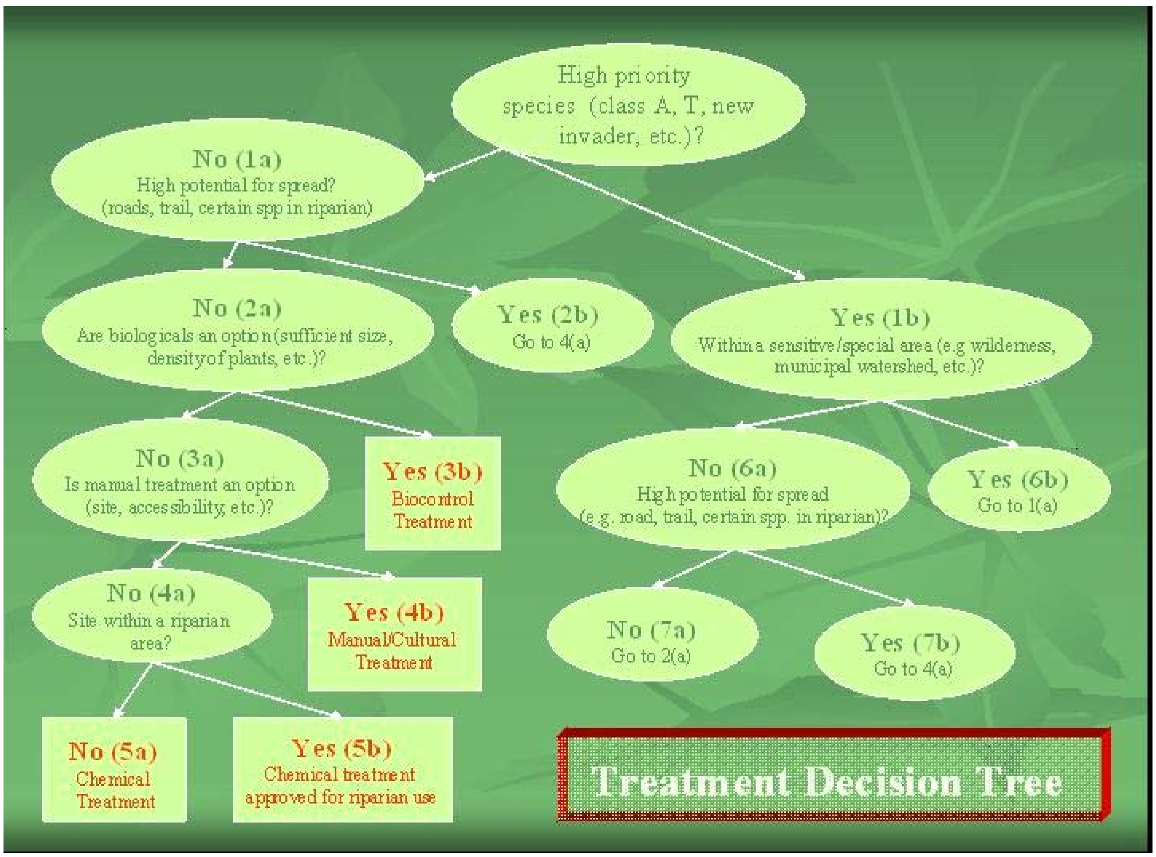

Figure 1. Invasive plant treatment decision tree.

The use of herbicides and surfactants would be conducted in accordance with USFS policies, regulations and LRMP standards, as well as product label requirements. Herbicides approved for use are listed in Table 3 and PDF F-1. Herbicide properties are described in detail in the R6 FEIS.

Ongoing monitoring of infestations at each site would provide the information needed to determine whether follow-up treatment methods were required. For sites treated with herbicides, follow-up treatment may include herbicide application and manual treatments. However, the intent of the USFS is to become progressively less dependent on herbicides and to use more of the alternative control methods for continued treatment.

Treatment methods, PDFs, and treatment priorities are described below.

Treatment Methods.

Biological methods. Biological control can be defined as the use of natural enemies to reduce the damage caused by invasive plant populations. Biological control is potentially useful where eradication is not possible, sites are too large to be sprayed with herbicides, invasive plants are so abundant that other methods would not be practical, or the biological control agent is effective on the target plant species and reduces or eliminates the need to use herbicides. Stem weevil biological control agents have proven very successful for Dalmation toadflax control on infested national forest and adjacent sites with other ownerships. Several biological control agents are available for yellow starthistle and diffuse knapweed, and effectiveness appears to be higher when bio-control agents work in concert. Biological control agents for control of purple loosestrife have been released on the Idaho side of the Snake River; however, fluctuating water levels have negatively affected the establishment of a productive biological control population, and effectiveness has been minimal.

Biological control agents previously released on private lands and established on the WWNF or UNF will continue to spread to other nearby invasive sites, potentially providing long-term control.

Manual and mechanical methods. Manual methods in the proposed action include hand pulling, clipping, stabbing, or digging out invasive plants with non-motorized hand tools. Manual methods include the use of hand-operated tools (e.g., axes, brush hooks, hoes, shovels, hand clippers) to dig up and remove invasive species (U.S. Department of Agriculture 2005). Mechanical methods involve chain saws, mowers, or other mechanized equipment, such as brush cutters, or other machinery with various types of blades to remove plants.

These techniques tend to minimize damage to desirable plants and animals, but they are generally labor and time intensive. Treatments must typically be administered several times per year over several years to prevent the weed from re-establishing. Manual and mechanical techniques are generally favored to treat small infestations in situations where a large pool of volunteer labor is available. They are often used in combination with other techniques.

Mulching. Mulching is an effective aid in controlling weeds, especially annual varieties. Mulching tools include the use of plastic, or sawdust, bark, compost, hay, or other organic materials to block sunlight. This both controls existing weeds and prevents seedlings from becoming established. Mulching also provides the additional benefits of conserving soil moisture, keeping the soil at a more uniform temperature and reducing erosion.

Thermal techniques. Thermal techniques may include radiant heating, spray of pressurized hot water, and spray of heated foam. A common radiant heat method consists of using a ceramic heating element to create extremely high temperatures (in the form of infrared radiation) to boil the moisture in plant cells, causing them to burst. Since cell proteins are damaged, photosynthesis stops and the plant dies. The use of pressurized hot water to treat invasive plants will be conducted by using a commercial pressure washer to inject steam into soils to kill rhizomes, and may also cause pressure damage to rhizomes. Heated foam treatments will consist of delivering hot water with a foam surfactant via a treatment wand attached to a foam generator. The superheated hot foam will be applied to the targeted vegetation at a precise temperature (approximately 200 degrees Fahrenheit) and pressure.

Herbicide treatment methods. The objective of herbicide treatments is often to either reduce the size of moderate to large infestations of invasive plants to a point at which manual or mechanical methods are effective, or to treat large areas where invasive plants thrive due to the nature of the site.

The 10 herbicides authorized by the R6 FEIS would be used, as appropriate, to treat invasive plants. These herbicides and their typical and maximum application rates are summarized in Table 3. Mixtures of up to three herbicides may be used, as an herbicide mixture may be more effective in the treatment of invasive plants at a given site. The herbicide, or mixture of herbicides, and application method(s) used at a specific site will depend on the invasive plant(s) present, the biology and ecology of the invasive plant species, site location, proximity to water, size of the infestation, and other factors.

Table 3. Herbicides and application rates.

Herbicide	Typical Application Rate (lb a.i./ac)*	Highest Application Rate (lb a.i./ac)
Chlorsulfuron	0.056	0.25
Clopyralid	0.35	0.5
Glyphosate	2.0	8.0
Imazapic	0.1	0.1875
Imazapyr	0.45	1.5
Metsulfuron	0.03	0.15
Picloram	0.35	1.0
Sethoxydim	0.3	0.45
Sulfometuron	0.045	0.38
Triclopyr	1.0	10.0

* lb a.i./ac = pounds of active ingredient per acre

Herbicide would be applied by hand/selective, spot spray, and broadcast spray methods. Several types of hand/selective application methods would be used, including wicking/wiping, basal bark, cut stump, stem injection, and hack and squirt. The details of these methods are summarized in Table 4. Hand/selective application methods are likely to be used in sensitive areas, such as near water, to reduce the risk of herbicide transfer to soils or water. Hand/selective application methods could be done under more variable conditions than spot spraying or broadcast spraying.

The herbicides proposed for use often include inert compounds including adjuvants or surfactants. Inert compounds (inerts) are substances that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicide's activity. Inerts are added to a formulation to facilitate its handling, stability, or mixing. Adjuvants are compounds added to a formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (utility modifier).

Surfactants are utility modifier adjuvants that make herbicides more effective by increasing absorption into the plant. Inerts and adjuvants, including surfactants, are not under the same registration guidelines as pesticides. These compounds are classified into four categories based on the available toxicity information.

Other inert ingredients may include carriers, surfactants, spray adjuvants, preservatives, dyes, and anti-foaming agents, among other chemicals. Because many manufacturers consider inert ingredients in herbicide formulations to be proprietary, they do not list specific chemicals.

Several types of surfactants or additives proposed for use been reviewed in risk assessments or reviews and thus meet standard 18 in the R6 FEIS and R6 ROD ("Use only adjuvants (e.g., surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA 1997a, 1997b; Bakke 2002"). Table 5 contains several examples of typical herbicide-surfactant combinations that are likely to be used in the proposed action.

Table 4. Herbicide application methods.

Application Method	Description
Hand/Selective	a. Wicking and Wiping - Involves using a sponge or wick on a long handle to wipe herbicide onto foliage and stems. Use of a wick eliminates the possibility of spray drift or droplets falling on non-target plants. Herbicide can drip or dribble from some wicks. An adjuvant or surfactant is often needed to enable the herbicide to penetrate the plant cuticle, a thick, waxy layer present on leaves and stems of most plants. b. Basal Bark - This method applies a 6 to 12 inch band of herbicide around the circumference of the trunk of the target plant, approximately 1 foot above ground. The width of the sprayed band depends on the size of the plant and the species' susceptibility to the herbicide. The herbicide can be applied with a backpack sprayer, hand-held bottle, or wick. c. Frill or Hack and Squirt - The frill method, also called the "hack and squirt" treatment, is often used to treat woody species with large, thick trunks. The tree is cut using a sharp knife, saw, or ax, or drilled with a power drill or other device. Herbicide is then immediately applied to the cut with a backpack sprayer, squirt bottle, syringe, or similar equipment. d. Stem Injection - Herbicides can be injected into herbaceous stems using a needle and syringe. Herbicide pellets can also be injected into the trunk of a tree using a specialized tool. e. Cut-stump - This method is often used on woody species that normally re-sprout after being cut. The tree or shrub is cut down, and herbicide is immediately applied to the exposed cambium (living inner bark) of the stump. The cut stump treatment allows for a great deal of control over the site of herbicide application, and therefore, has a low probability of affecting non-target species or contaminating the environment. It also requires only a small amount of herbicide to be effective.
Spot Spraying	Herbicide is sprayed directly onto small patches or individual target plants. These applicators range from motorized vehicles with spray hoses, to backpack sprayers, to hand-pumped spray or squirt bottles. Hand-pumped spray and squirt bottles can target very small plants or parts of plants.
Broadcast Spraying	A boom (a long horizontal tube with multiple spray heads) is mounted or attached to a helicopter, airplane, tractor, ATV (all terrain vehicle), or other vehicle. The boom is then positioned above the target plants while spraying herbicide, allowing large areas to be treated rapidly with each sweep of the boom. The herbicide is carried in a tank and reaches the nozzles via tubing. All herbicides are metered out from the nozzles in a controlled manner. The nozzle controls the droplet size and the area (or cone) being covered by the herbicide, and can be turned on/off with ease. Some nozzles could rotate. This flexibility permits the operator to carefully apply herbicide at specific rates over specific areas. Wind and other weather data, and application rates would be recorded for all broadcast applications. Flight paths and altitude would be recorded for aerial applications. Not all broadcast methods employ a boom; boom-less nozzles that can reduce the risk of non-target effects may be used. Backpack sprayers may also be used as a broadcast tool.

Table 5. Herbicide-surfactant combinations likely to be used.

Clopyralid
- Transline™ (Dow AgroSciences): 0.25-0.5% non-ionic, or use surfactant manufacturer's label (also crop oils can be used)

Glyphosate
- Glyphosate VMF (DuPont): 0.5-2.5% nonionic
- Accord® Concentrate (Monsanto): 0.5-2.5% nonionic
- Glypro™ (Dow AgroSciences): ≥0.5% nonionic with >50% a.i.
- Roundup® Original (Monsanto): none needed (contains polyethoxylated tallow amine-based surfactant)
- Accord® SP (Monsanto): none needed (contains surfactant – not identified)

Imazapic
- Plateau® (BASF): seed oil 1.5-2 pints/acre; post-emergence ≥0.25% nonionic with >60% ai; silicone-based, as per surfactant manufacturer's label; silicone/oil blends as per surfactant manufacturer's label

Imazapyr
- Arsenal® (American Cyanamid): hack/squirt – none needed; foliar, 0.25-1% non-ionic
- Chopper® (American Cyanamid): foliar, 12-50% seed oil or crop oil or silicone/oil blends as per surfactant manufacturer's label; hack/squirt – none needed; thin line basal or low volume basal, 100% crop oil or diesel fuel

Metsulfuron methyl
- Escort® (DuPont): 0.25% minimum or surfactant manufacturer's rate (non-ionic with >80% ai); don't use products with acetic acid (LI-700); seed oils or seed oil/silicone blends as per surfactant manufacturer's label.

Picloram
- Tordon® 22K (DuPont): none needed, but can add as per surfactant manufacturer's label

Sulfometuron methyl
- Oust®, Oust® XP (DuPont): 0.25% non-ionic if needed

Triclopyr
- Garlon™ 3A (Dow AgroSciences): for foliar, use surfactant manufacturer's label
- Garlon™ 4 (Dow AgroSciences): foliar, 1-2 qts/ac or none; basal 95-99% oil or 8-16% Mor-Act; low volume basal, 70-80% oil; thinline, 25-50% oil; contains kerosene as surfactant.
- Pathfinder™ II (Dow AgroSciences): none needed, includes a crop oil surfactant.

Early Detection, Rapid Response Treatment Strategy. For new infestations and current, but undiscovered, infestations, the UNF and WWNF would use the "early detection, rapid response" (EDRR) program, consisting of the treatment methods described above, as constrained by the PDF described below. The EDRR approach enables a more efficient response to infestations than has occurred in the past. A treatment plan would be developed for new infestations, based on goals, objectives, and standards described in the R6 FEIS.

Project Design Features. The following PDFs are intended by the UNF and WWNF to minimize the potential impacts of invasive plant treatment. The PDFs are specific Forest-level measures designed to minimize project effects and provide sideboards for EDRR in accordance with R6 ROD Standards 19 and 20. The PDFs were developed to address site-specific resource conditions within treatment areas, including (but not limited to) the current invasive plant inventory, the presence of special interest species and their habitats, potential for herbicide delivery to water, and the social environment. Implementation of the PDFs will be mandatory to ensure that treatments would have effects within the scope of those disclosed in the BA. The buffers would be implemented as horizontal (map) distances. Details of the PDFs are given below.

A. Pre-Project Planning

A-1: Prior to treatment, confirm species/habitats of local interest, watershed and aquatic resources of concern (e.g., hydric soils, streams, lakes, roadside treatment areas with higher potential to deliver herbicide to water, municipal watersheds, domestic water sources), places where people gather, and range allotment conditions. Apply appropriate PDF described below.

For EDRR sites follow the decision tree (Figure 1) to determine the type and method of treatment and apply applicable PDF.

B. Coordination with Other Landowners and Agencies

B-1: Work with owners and managers of neighboring lands to respond to invasive plants that straddle multiple ownerships. Coordinate treatments within appropriate distances based on invasive plant species reproductive characteristics and current use of area.

C. To Prevent the Spread of Invasive Plants during Treatment Activities

C-1: Ensure vehicles and equipment (including personal protective clothing) do not transport invasive plant materials.

D. Wilderness Areas

D-1: For EDRR in wilderness, invasive plants may be treated using non-mechanical hand methods or herbicides. Herbicide treatments may use application methods such as wicking, stem injection, spray bottle, hand pressurized pumps, battery or solar powered pumps and propellant based systems such as those that use pressurized carbon dioxide.

E. Non-herbicide Treatment Methods

E-1: Limit the numbers of workers on any one site at any one time while treating areas within 150 feet of creeks.

E-2: Fueling of gas-powered equipment with tanks larger than 5 gallons would not occur inside the riparian habitat conservation area[2] (RHCA) unless there is no other alternative.

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[2] Riparian habitat conservation areas are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines.

F. Herbicide Application

F-1: Herbicides will be used in accordance with label instructions, except where more restrictive measures are required as described below. Herbicide applications will only treat the minimum area necessary to meet site objectives. Herbicide formulations will be limited to those containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Herbicide application methods include wicking, wiping, injection, spot, and broadcast, as permitted by the product label and these PDFs. The use of triclopyr is limited to spot and hand/selective methods. Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

F-2: Herbicide use will comply with standards in the Forest Plans as amended by the R6 2005 ROD, including standards on herbicide selection, restrictions on broadcast use, tank mixing, licensed applicators, and use of adjuvants, surfactants and other additives.

F-3: POEA surfactants, urea ammonium nitrate or ammonium sulfate will not be used in applications within 150 feet of surface water or wetlands, or on roadside treatment areas with ditches having high potential to deliver chemicals to streams.

F-4: Lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates. NPE surfactant will not be broadcast at a rate greater than 0.5 lbs. a.i./ac (pounds of active ingredient per acre). Favor other classes of surfactants wherever they are expected to be effective.

F-5: Herbicide applications will occur when wind velocity is between two and eight miles per hour to reduce the chance of drift. During application, weather conditions will be monitored periodically by trained personnel.

F-6: To minimize herbicide application drift during broadcast operations, use low nozzle pressure; apply as a coarse spray, and use nozzles designed for herbicide application that do not produce a fine droplet spray (e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns).

F-7: Use of sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl, and metsulfuron methyl), will require soils to be mapped prior to treatment. Treatment of powdery, ashy dry soil, or light sandy soil can only be treated if rainfall is expected within 24 hrs of treatment.

F-8: Additional design features specific to aerial application corresponding to BA Appendix F-Aerial Spray Guidelines:

F-8a: Application of herbicide aerially will not be used for treatment of EDRR sites.

F-8b: Chlorsulfuron, metsulfuron methyl, sulfometuron methyl and triclopyr will not be applied aerially.

F-8c: Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners).

F-8d: Prohibit aerial application of herbicides within congressionally designated municipal watersheds.

F-8e: Effectiveness Monitoring required for "a representative sample" of the spray area in a project involving aerial application of herbicide to ensure impacts to non-target species are within tolerance.

F-8f: All aviation activities shall be in accordance with FSM 5700 (Aviation Management), FSH 5709.16 (Flight Operations Handbook) FSM 2150 (Pesticide Use Management and Coordination), FSH 2109.14, 50 (Quality Control Monitoring and Post-Treatment Evaluation).

F-8g: Buffers for herbicide use and application methods are proposed for perennial and wet intermittent streams, dry streams and lakes and wetlands. These buffers are displayed below in Tables 6, 7, and 8.

F-8h: Buffer distances for federally listed species of local interest (SOLI) will follow Recovery Plan recommendations. No aerial application will occur within 300 feet of non-federally listed SOLIs. Spray cards to monitor drift can be used in conjunction with monitoring and adaptive management to adjust buffers if needed.

F-8i: Aerial spraying of invasive species will not occur in areas with 30% or more live tree canopy cover. For live tree canopy cover between 10 to 29% an on-site decision whether or not to aerial spray would be based on factors such as target invasive species, herbicides (specificity) proposed for treatment, and potential impacts to non-target tree species present.

F-8j: Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) will be ground-checked, flagged and marked using GPS prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system will be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Plastic spray cards will be placed out to 350 feet from and perpendicular to perennial creeks to monitor herbicide presence.

F-8k: Press releases will be submitted to local newspapers indicating potential windows of treatment for specific areas. Signing and on site layout will be performed 1 to 2 weeks prior to actual aerial treatment.

F-8l: Grazing permittees will be notified at annual permittee meeting that aerial application will be conducted. Permittees will also be notified of specific time frames in which treatment will occur to ensure grazing animals are removed from the area.

F-8m: Enforceable temporary area, trail, and road closures will be used to ensure public safety during aerial spray operations.

F-8n: Constant communications will be maintained between the helicopter and the project leader during spraying operations. Ground observers will have communication with the project leader. Observers will be located at various locations adjacent to the treatment area to monitor wind direction and speed as well as to visually monitor drift and deposition of herbicide.

F-8o: Aerial swath displacement buffers will be applied as needed as described in BA Appendix F, Table F-2.

F-8p: Aerial application rates for picloram will not exceed (0.25lb/a.i./acre), and clopyralid will not exceed typical application rates (0.35lb a.i./acre).

G. Herbicide Transportation and Handling Safety/Spill Prevention and Containment

G-1: A herbicide transportation and handling safety/spill response plan will be the responsibility of the herbicide applicator (Forest Service applicator or contractor, as applicable). At a minimum the plan will:

G-1a: Address spill prevention and containment.

G-1b: Estimate and limit the daily quantity of herbicides to be transported to treatment sites.

G-1c: Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.

G-1d: Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent).

G-1e: Outline reporting procedures, including reporting spills to the appropriate regulatory agency.

G-1f: Ensure applicators are trained in safe handling and transportation procedures and spill cleanup.

G-1g: Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition.

G-1h: Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible.

G-1i: Specify conditions under which guide vehicles would be required.

G-1j: Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters.

G-1k: Require that spray tanks be mixed or washed further than 150 feet of surface water.

G-1l: Ensure safe disposal of herbicide containers.

G-1m: Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft (See H14).

H. Soils, Water and Aquatic Ecosystems:

H-1: Herbicide buffers have been established by herbicide and application method for perennial and wet intermittent steams; dry streams; and lakes and wetlands. These buffers are displayed in Tables 6, 7, and 8. The largest buffer for an individual ingredient will apply to tank mixtures.

H-2: No broadcast of high aquatic risk herbicides on roads that have a high risk of delivery to water (generally roads in RHCAs). These herbicides are picloram, non-aquatic triclopyr (Garlon 4), non-aquatic glyphosate, and sethoxydim.

H-3: In riparian and aquatic settings, vehicles (including all terrain vehicles) used to access invasive plant sites, apply foam, or for broadcast spraying would remain on roadways, trails, parking areas to prevent damage to riparian vegetation, soil, water quality and aquatic habitat.

H-4: Avoid use of clopyralid on high-porosity soils (coarser than loamy sand).

H-5: Avoid use of chlorsulfuron on soils with high clay content (finer than loam).

H-6: Avoid use of picloram on shallow or coarse soils (coarser than loam.) according to herbicide labels. No more than one application of picloram would be made within a two-year period.

H-7: Avoid use of sulfometuron methyl on shallow or coarse soils (coarser than loam). No more than one application of sulfometuron methyl would be made within a 1-year period.

H-8: Lakes and Ponds – No more than half the perimeter or 50% of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond will be treated with herbicides in any 30-day period. This limits area treated within riparian areas[3] to keep refugia habitat for reptiles and amphibians.

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[3] The term "riparian areas" refers to "riparian habitat conservation areas" as defined in the 1995 Record of Ddecision record for the Environmental Assessment for the Interim Strategies for Managing Fish-producing Watershed in Eastern Oregon and Washington, Idaho, and Portions of California. U.S. Forest Service and Bureau of Land Management, Washington, D.C.

H-9: Wetlands – Wetlands will be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or 50% individual wetland areas will be treated in any 30-day period.

H-10: Foaming will only be used on invasive plants that are further than 150 feet from streams and other water bodies.

H-11: Herbicide use will not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.

H-12: When chemicals need to be carried over water by boat, raft or other watercraft, herbicides will be carried in water tight, floatable containers of 1 gallon or less.

H-13: Aerial applications will not exceed typical application rates.

H-14: Treatments above bankfull, within riparian areas, will not exceed 10 acres per year along any 1.6 mile reach of a stream.

I. Vascular and Non-Vascular Plant and Fungi Species of Local Interest (SOLI)

I-1: Botanical surveys may be necessary prior to treatment applications to identify vascular and non-vascular SOLI occurrence in or near areas proposed for invasive plant treatments. Consultation with the district or forest botanist will be done prior to invasive plant treatments to evaluate survey needs. If suitable habitat is present and surveys are needed, they will be conducted by qualified personnel and surveys around proposed invasive plant treatments will be as follows: 300 to1,000 feet of planned aerial treatments (see I7), 100 feet of planned broadcast treatments, 10 feet of planned spot treatments and/or 5 feet of planned hand/selective herbicide treatments.

I-2: In absence of botanical surveys: no aerial herbicide treatment will occur within 300 to 1000 feet of SOLI habitat (see section I6), and no ground based broadcast, spot, or hand/selective treatments will occur within 100 feet of SOLI habitat.

I-3: Buffer distances for known botanical SOLI's occurrences are:

I-4: Picloram will not be used within 50 feet of the threatened plant species *Silene spaldingii* and *Mirabilis macfarlanei*.

I-5: In the vicinity of *S. spaldingii*, *M. mcfarlaneis* and all other SOLI, restoration and cultural treatments, including seeding or use of fertilizer, will be under the direct supervision of the district or forest botanist to ensure that plant communities are restored to their desired condition without negative impacts to existing SOLI populations or individuals. The vicinity areas will be evaluated on a case by case basis.

I-6: When vascular or non-vascular SOLI plant species are within 10 feet of saturated or wet soils at the time of herbicide application, only hand/selective methods (wiping, stem injection, etc.) will be used. Avoid the use of picloram and imazapyr in this situation, and use aquatic triclopyr with caution as typical application rates can result in concentrations greater than estimated or measured "no observable effect concentration" to aquatic plants (R6 FEIS, Table 4-47).

I-7: Aerial herbicide applications will follow Recovery Plan recommendations for listed species (FWS). Presently, two federally listed species (*Silene spaldingii* and *Mirabilis macfarlanei*) are documented on the forest. Recovery plan recommend no aerial herbicide within 1,000 feet of occurrence for *S. spaldingii* and not adjacent to *M. macfarlanei*. A 1,000 foot buffer for aerial application will be used for both species. For non-federally listed SOLI, no aerial herbicide applications will occur within 300 feet of known location of SOLI and spray cards to monitor drift will be used to monitor drift and adjust buffers if needed.

I-8: A USDA Forest Service botanist will use monitoring results to refine buffers in order to adequately protect vascular and nonvascular plant species of local interest.

I-9: The impacts of herbicide use on plant SOLI are uncertain, especially regarding lichen and bryophytes. The potential for variances in aerial drift due to uncontrolled weather conditions during treatment may also be uncertain. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to vascular and non-vascular plant SOLI's would be monitored. Non-target vegetation within 1,000 feet of aerial treatment sites, 500 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand/selective treatment sites will be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Treatment buffers will be expanded if damage is found as indicated by: (1) Decrease in the size of the SOLI plant population; (2) Leaf discoloration or chlorophyll change.

I-10: Compliance monitoring will occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate PDF. This will be done via a pre-work review.

I-11: Implementation monitoring will occur during implementation to ensure PDFs are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments, and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook (FSH 2109.14). The reports required by the Forest Service Health Pesticide Use Handbook will be submitted to the Level I teams annually.

I-12: Effectiveness monitoring will occur before, during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially native vascular and non-vascular species of local interest, is adequately protected.

L. Special Forest Products

L-1: Triclopyr will not be applied to foliage in areas of known special forest products or other wild food collection areas.

L-2: Special forest product gathering areas may be closed for a period of time to ensure that no inadvertent public contact with herbicide occurs.

L-3: Popular berry and mushroom picking areas will be posted, marked on the ground or otherwise posted.

L-4: Special forest product gatherers will be notified about herbicide treatment areas when applying for their permits. Flyers indicating treatment areas may be included with the permits, in multi-lingual formats if necessary.

O. Human Health (See R6 FEIS, Appendix Q for more information)

O-1 Worker Health

O-1a: Backpack Application - Triclopyr application rate will not exceed 1.0 lbs a.i./ac.

O-1b: Backpack Application - Sulfometuron methyl application rate will not exceed 0.2 lb a.i./ac.

O-1c: Backpack Application - NPE surfactant will not exceed 1.67 lb a.i./ac.

O-1d: Ground Boom Application - Picloram application rate will not exceed 0.5 lb a.i./ac.

O-1e: Ground Boom Application - Sulfometuron methyl application rate will not exceed 0.12 lb a.i./ac.

O-2 Public Health

O-2a: Triclopyr application rate will not exceed 1.0 lbs a.i./ac. Use selective spray techniques to further reduce dermal exposure. Favor other herbicides wherever they are likely to be effective.

O-2b: Those PDF developed for water quality and protection of aquatic organisms will provide reduction in potential doses of herbicides in drinking water.

P. Restoration

P-1: Long-term site strategy for highly disturbed areas that are highly susceptible to invasion, such as old fields or old homesteads, follow guidelines and techniques outlined in

Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest.

P-2: On dry grassland habitat below 3,000 feet in the Hells Canyon National Recreation Area and other highly disturbed areas where live vegetative groundcover will be reduced by 70% of existing vegetation by herbicide treatment, restoration or revegetation will occur following Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest and R6 FEIS standards.

P-3: In areas where broadcast herbicide is used to treat highly infested areas, evaluation of potential re-infestation by new or nearby invasive plants will be considered and restoration and/or revegetation measures will be implemented to ensure protection of native vegetation and soils.

Herbicide Use Buffers (for PDF H-1). Herbicide application methods would become more restrictive as they occur closer to water. The PDF and herbicide use buffers within the riparian areas were developed based on label advisories, SERA risk assessments, the Berg (2005) BMP effectiveness review, and various studies of drift and runoff to streams. Tables 6, 7, and 8 specify buffers according to treatment methods, herbicides used, and type of aquatic zone.

Table 6. Herbicide use buffers for perennial and wet intermittent streams.

Herbicide	Buffer by Application Method (feet)			
	Aerial	Broadcast	Spot	Hand/Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	300	100	15	Bankfull elevation
Clopyralid	300	100	15	Bankfull elevation
Metsulfuron Methyl	None Allowed	100	15	Bankfull elevation
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	Bankfull elevation
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	Bankfull elevation
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) by Syracuse Environmental Research Associates is completed for inert ingredients and additives.

Table 7. Herbicide use buffers for dry intermittent streams. (See Table 6 for buffer distances when flowing, or pools present, but water not flowing.)

Herbicide	**Buffer by Application Method (feet)**			
	Aerial	**Broadcast**	**Spot**	**Hand/Select**
Aquatic Labeled Herbicides				
Aquatic Glyphosate	100	50	0	0
Aquatic Triclopyr-TEA	None Allowed	None Allowed	0	0
Aquatic Imazapyr*	100	50	0	0
Low Risk to Aquatic Organisms				
Imazapic	100	50	0	0
Clopyralid	100	50	0	0
Metsulfuron Methyl	None Allowed	50	0	0
Moderate Risk to Aquatic Organisms				
Imazapyr	100	50	15	Bankfull elevation
Sulfometuron Methyl	None Allowed	50	15	Bankfull elevation
Chlorsulfuron	None Allowed	50	15	Bankfull elevation
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	100	100	50	50
Sethoxydim	100	100	50	50
Glyphosate	100	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) by Syracuse Environmental Research Associates is completed for inert ingredients and additives.

Table 8. Herbicide use buffers for wetlands.

Herbicide	Buffer by Application Method (feet)			
	Aerial	**Broadcast**	**Spot**	**Hand/Select**
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100**	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100**	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	300	100	15	high water mark
Clopyralid	300	100	15	high water mark
Metsulfuron Methyl	300	100	15	high water mark
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	high water mark
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	high water mark
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) by Syracuse Environmental Research Associates is completed for inert ingredients and additives.
** If wetland, pond, or lake is dry, there is no buffer.

In addition to the monitoring already required under various LRMPs, an inventory and monitoring plan framework is part of the proposed action as a result of tiering to the R6 FEIS and R6 ROD. The approach included in the framework was developed via interagency discussions with NMFS and FWS personnel during ESA consultations for the R6 FEIS. A measure included within the monitoring framework that will improve the USFS's ability to detect and respond rapidly to new infestations is the requirement to maintaining an invasive plant inventory consistent with nationally accepted (*e.g.*, the USFS Natural Resource Information System[4]) protocols. Additionally, the monitoring framework outlines the criteria for prioritizing monitoring of projects that may pose more risk to Federally-listed species. Details of the inventory and monitoring plan framework can be found in Appendix J of the BA.

Treatment Priorities. Prioritization of infestation treatments will be based on the following decision pathway. Highest priority treatments will be focused on new invaders and early treatment of new infestations, followed in priority by containment, then control of larger established infestations. Moody and Mack (1988) demonstrated in a simple geometric model that small, new outbreaks of invasive plants eventually would occupy an area larger than the source population. Control efforts that focus on the large, main population rather than the new small satellites reduced the chances of overall success. The ability to detect and destroy the new,

[4] See: http://www.fs.fed.us/emc/nris/

small infestation was crucial to control of invasive species. A maintenance strategy focused on control also may be more economically feasible than attempting to eradicate large populations.

The methods and factors for prioritizing invasive plant sites for treatments on the national forests in Region Six generally follow a similar decision-making model. Treatment priorities are displayed in Table 9, and are based on a USFS guide on site prioritization and selection of treatment methods (USDA Forest Service 2001).

The NMFS relied on the foregoing description of the proposed action, including all stated minimization measures, to complete this consultation. To ensure that this consultation remains valid, NMFS requests that the action agency keep NMFS informed of any changes to the proposed action

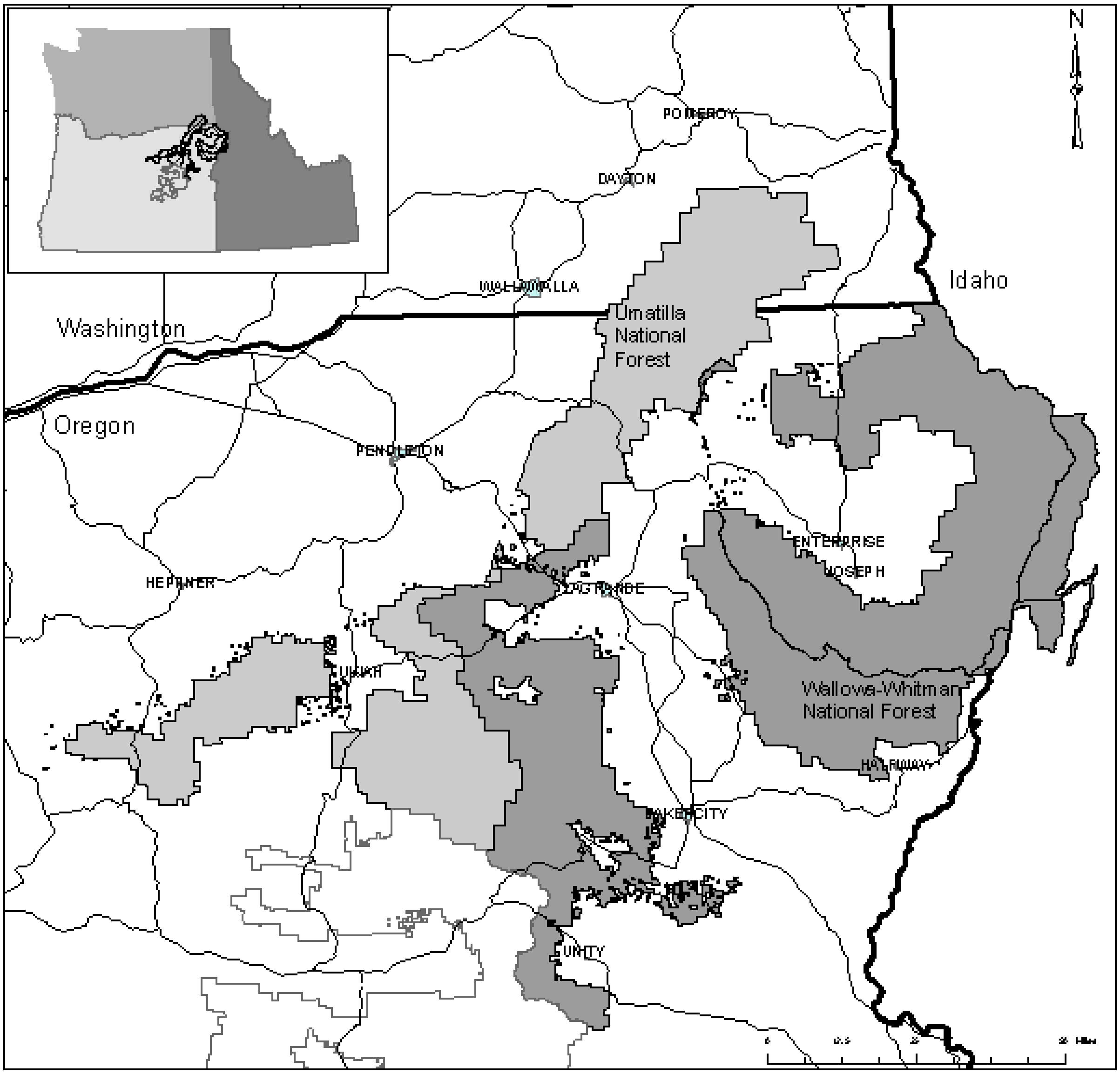
Table 9. Priorities for treatment and selection of treatment methods.

Priority	Description	Treatment – choice based on site-specific conditions
Highest Priority for Treatment	* Eradication of new species (focus on aggressive species with potential for significant ecological impact including but not limited to state-listed high priority noxious weeds) * New infestations (e.g. populations in areas not yet infested; "spot fires"; any state or Forest priority species). * Areas of concern such as: Areas of high traffic and sources of infestation (e.g. parking lots, trailheads, horse camps, gravel pits) Areas of special concerns: (e.g. botanical areas, wilderness, research natural areas, adjacent boundaries/access with national parks) Riparian corridors where high threat species such as knotweeds occur.	1. Manual/mechanical - isolated plants or small populations. 2. Herbicide treatment if manual/mechanical is known to be ineffective or population too large. 3. Remove seed heads. This is an interim measure if cost/staff is an issue. 4. Seed to restore treated areas; use native species when possible.
Second Priority for Treatment	* Containment of existing large infestations (e.g. focus on state-listed highest priority species or Forest priority species) – focus on boundaries of infestation. * Roadsides – focus first on access points leading to areas of concern.	1. Manual/mechanical - isolated plants or small populations in spread zones. 2. Herbicide treatment for larger populations along perimeter. 3. Seed to restore treated areas to create a buffer from spread; use native species when possible.
Third Priority for Treatment	* Control of existing large infestations (e.g. state-listed and Forest second-priority species)	1. Disperse bio-control agents on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide application
Fourth Priority for Treatment	* Suppression of existing large infestations when eradication/control or containment is not possible.	1. Bio-control on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide application along perimeters

Action Area

'Action area' means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area consists of all fourth-field HUC watersheds containing lands managed by the UNF and WWNF. The action areas are within the UNF and WWNF and no applications will occur, nor will herbicides travel outside the boundaries of the national forests. The location of the approximately 3.7 million acres managed by the UNF and WWNF is displayed in Figure 2.

Figure 2. Action Area.



The UNF and WWNF are located in the Blue Mountains of northeast Oregon and southeast Washington, and west central Idaho. The UNF manages approximately 1.4 million acres, and the WWNF approximately 2.3 million acres, for a total of approximately 3.7 million acres. The action area contains diverse plant communities located in mountainous terrain, V-shaped valleys separated by narrow ridges or plateaus, and canyon lands. The landscape also includes heavily timbered slopes, grassland ridges and benches, and basalt outcroppings. Elevation ranges from 875 feet on the Snake River in Hell's Canyon National Recreation Area to 9,845 feet in the Eagle Cap Wilderness of the Blue Mountains. Interstate Highway 84 divides the UNF roughly in half.

The action area is bordered by the Malheur National Forest to the west, the Salmon River to the east, the Columbia River to the north, and high desert to the south.

The action area is contained within the 18 fourth-field HUC sub-basins displayed in Table 10.

Table 10. Fourth-field HUC sub-basins containing the action area.

Fourth Field HUC Name	Fourth Field HUC #	Listed Anadromous Species Presence	Umatilla NF	Wallowa-Whitman NF
Upper Malheur	17050116	N		Y
Willow (Snake)	17050119	N		Y
Brownlee Reservoir	17050201	N		Y
Burnt River	17050202	N		Y
Powder River	17050203	N		Y
Hell's Canyon	17060101	Y		Y
Imnaha River	17060102	Y		Y
Lower Snake - Asotin	17060103	Y	Y	Y
Upper Grande Ronde River	17060104	Y	Y	Y
Wallowa River	17060105	Y		Y
Lower Grande Ronde	17060106	Y	Y	Y
Lower Snake - Tucannon	17060107	Y	Y	
Walla Walla	17070102	Y	Y	
Umatilla	17070103	Y	Y	
Willow (Columbia)	17070104	Y	Y	
North Fork John Day	17070202	Y	Y	Y
Middle Fork John Day	17070203	Y	Y	
Lower John Day	17070204	Y	Y	

The project area includes five fourth-field HUC sub-basins (Upper Malheur, Willow (Snake), Brownlee Reservoir, Burnt River, and Powder River) that do not contain listed aquatic species. Listed anadromous species present in the action area are displayed in Table 11.

Within the action area, treatment areas will be located in fish- and non-fish-bearing streams, riparian areas, and uplands that have a direct link to ESA and MSA listed fish and their habitats. Chinook salmon are the only species with habitat covered by the MSA in the action area.

Table 11. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Snake River Spring/Summer Chinook Salmon	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Snake River Fall Chinook Salmon	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Sockeye salmon (*O. nerka*)			
Snake River Sockeye Salmon	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

ENDANGERED SPECIES ACT

Section 7(a)(2) of the ESA requires Federal agencies to consult with NMFS to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The biological opinion (Opinion) that follows records the results of the interagency consultation for this proposed action. An incidental take statement (ITS) is provided after the Opinion that specifies the impact of any taking of threatened or endangered species that will be incidental to the proposed action, reasonable and prudent measures that NMFS considers necessary and appropriate to minimize such impact, and nondiscretionary terms and conditions (including, but not limited to, reporting requirements) that must be complied with by the Federal agency to carry out the reasonable and prudent measures.

Biological Opinion

To complete the jeopardy analysis presented in this Opinion, NMFS reviewed the status of each listed species[5] of Pacific salmon and steelhead considered in this consultation, the environmental baseline in the action area, the effects of the action, and cumulative effects (50 CFR 402.14(g)). From this analysis, NMFS determined whether effects of the action were likely, in view of existing risks, to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

For the critical habitat adverse modification analysis, NMFS considered the status of the entire designated area of the critical habitat considered in this consultation, the environmental baseline in the action area, the likely effects of the action on the function and conservation role of the affected critical habitat, and cumulative effects. NMFS used this assessment to determine

[5] An "evolutionarily significant unit" (ESU) of Pacific salmon (Waples 1991) and a "distinct population segment" (DPS) of steelhead (71 FR 834; January 5, 2006) are both "species" as defined in section 3 of the ESA.

whether, with implementation of the proposed action, critical habitat would remain functional, or retain the current ability for the primary constituent elements (PCEs) to become functionally established, to serve the intended conservation role for the species (Hogarth 2005).

Status of the Species and Critical Habitat

Status of the Species. Natural variations in freshwater and marine environments have substantial effects on the abundance of Pacific salmon and steelhead. Pacific salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation probably contributes to significant natural mortality, although the levels of predation are largely unknown. In general, Pacific salmon and steelhead are eaten by pelagic fishes, birds, and marine mammals.

Over the past few decades, the size and distribution of the salmon and steelhead populations considered in this Opinion generally have declined because of natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Predation by terns, seals, and sea lions in the Pacific Northwest has reduced the survival of some Pacific salmon and steelhead populations. Climate change is likely to play an increasingly important role in determining the abundance of salmon and steelhead by exacerbating long-term problems related to temperature, stream flow, habitat access, predation, and marine productivity (Climate Impacts Group 2004, Scheuerell and Williams 2005, Zabel *et al.* 2006, Independent Scientific Advisory Board 2007).

The status of populations of each listed species occurring in the action area is described below.

Interior Columbia (IC) Recovery Domain. The Interior Columbia Technical Recovery Team (IC-TRT) recommended viability criteria that follow the viable salmonid population (VSP) framework (McElhany *et al*. 2006). These criteria provide biological or physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period (IC-TRT 2007, National Research Council 1995).

SR spring/summer run Chinook salmon. This species includes all naturally-spawned populations of spring/summer run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 31 historical populations of SR spring/summer run Chinook salmon, and aggregated these into major population groups (IC-TRT 2003, McClure *et al*. 2005). This species includes those fish that spawn in the Snake River basin and its major tributaries, including the Grande Ronde River and the Salmon River, and that complete their adult, upstream migration past Bonneville Dam between March and July. Of the 31 historical populations of SR spring/summer run Chinook salmon identified by the IC-TRT, eight occur within the action area. Seven occur in Oregon and are part of the Grande Ronde/Imnaha major group, and one population occurs in Washington and is part of the Lower Snake River major group (Table 12). All of these populations face a high risk of extinction (IC-TRT 2006).

The major factors limiting recovery of SR spring/summer run Chinook salmon include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, and hydropower system mortality (NMFS 2006).

Table 12. SR spring/summer run Chinook salmon populations in the action area. For overall viability risk; "high" means greater than 25% risk of extinction in 100 years, "moderate" means 5 to 25% risk of extinction with 100 years, "low" means 1 to 5% risk of extinction in 100 years, and "very low" means less than 1% risk of extinction in 100 years.

Major Group	Spawning Populations in Oregon and Washington (Watershed)	Viability Ratings		
		Abundance and Productivity Risk	Spatial Diversity Risk	Overall Viability Risk
Grande Ronde and Imnaha Rivers	Wenaha River	High	Moderate	High
	Wallowa-Lostine River	High	Moderate	High
	Minam River	High	Moderate	High
	Catherine Creek	High	Moderate	High
	Upper Grande Ronde	High	High	High
	Imnaha River mainstem	High	Moderate	High
	Big Sheep Creek	High	Moderate	High
Lower Snake River	Tucannon River	High	Moderate	High

SR fall-run Chinook salmon. This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon Rivers (IC-TRT 2003, McClure *et al.* 2005). The lower mainstem population spawns in the Columbia River mainstem, including the river reach that is adjacent to Oregon. All adult and juvenile individuals of this species must pass through part of the action area. The IC-TRT has not completed a viability assessment of this species. The major factors limiting recovery of SR fall-run Chinook salmon are reduced spawning/rearing habitat, degraded water quality, hydropower system mortality, and harvest impacts (NMFS 2006).

SR sockeye salmon. This species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. The IC-TRT identified historical sockeye production in at least five Stanley Basin lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (e.g., Wallowa and Payette Lakes), although current returns of SR sockeye are extremely low and are limited to Redfish Lake (IC-TRT 2007). SR sockeye salmon do not spawn in Oregon, but all adult and juvenile individuals of this species must pass through part of the action area. The IC-TRT has not completed a viability assessment of this species. The major factors limiting recovery of SR sockeye salmon are altered channel morphology and flood plain, reduced streamflow, impaired passage, and hydropower system mortality (NMFS 2006).

MCR steelhead. This species includes all naturally-spawned steelhead populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River basin, and the progeny of seven artificial propagation programs. The IC-TRT identified 20 historical populations of MCR steelhead in major groups (IC-TRT 2003, McClure *et al*. 2005). Seven populations of MCR steelhead occur in the action area, divided among three major groups (Table 13).

Table 13. MCR steelhead populations in the action area.

Major Group	Population (Watershed)
John Day River	Lower Mainstem John Day River
	North Fork John Day River
	Middle Fork John Day River
	South Fork John Day River
	Upper Mainstem John Day River
Walla Walla and Umatilla Rivers	Umatilla River
	Walla Walla River

Of the 20 historical populations of MCR steelhead identified by the IC-TRT, only the North Fork John Day population currently meets viability criteria, and none of the major groups or the species are considered viable (IC-TRT 2006). The strength of the North Fork John Day population is due to a combination of high abundance and productivity, and good spatial structure and diversity, although the genetic effects of the large number of out-of-species strays and of natural spawners that are hatchery strays are still significant long-term concerns. The major factors limiting recovery of MCR steelhead are altered channel morphology and floodplain, excessive sediment, degraded water quality, reduced streamflow, impaired passage, and hydropower system mortality (NMFS 2006).

SRB steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, and the progeny of six artificial propagation programs. The IC-TRT identified 24 populations in five major groups (IC-TRT 2003, McClure *et al*. 2005). Of those, seven populations belonging to four major groups spawn in Oregon and Washington (Table 14). The IC-TRT has not completed a viability assessment of this species. The major factors limiting recovery of SRB steelhead include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, hydropower system mortality, harvest impacts, and hatchery impacts (NMFS 2006).

Table 14. SRB steelhead populations in the action area.

Major Group	Population (Watershed)
Grande Ronde	Lower Grande Ronde
	Joseph Creek
	Wallowa River
	Upper Grande Ronde
Imnaha River	Imnaha River
Hells Canyon Tributaries	Hells Canyon Tributaries
Tucannon River	Tucannon River

Status of Critical Habitat. The ESA requires the federal government to designate critical habitat for any species it lists under the ESA; in this case, salmon and steelhead. Critical habitat is defined as: (1) Specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and whether those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

To assist in the designation of critical habitat in 2005, NMFS convened several Critical Habitat Analytical Review Teams (CHARTs) organized by major geographic areas that roughly correspond to salmon recovery planning domains. The CHARTs consisted of Federal biologists and habitat specialists from NMFS, the U.S. Fish and Wildlife Service, FS, and Bureau of Land Management, with demonstrated expertise regarding salmonid habitat and related protective efforts within the domain.

The CHARTs were tasked with assessing biological information pertaining to areas under consideration for designation as critical habitat. Specifically, CHARTs: (1) Determined if occupied areas contained PCEs essential for conservation; (2) determined whether there were any unoccupied areas within the historical range of the listed salmon and steelhead that may be essential for conservation; (3) scored each habitat area based on several factors related to the quantity and quality of the physical and biological features; (4) rated each habitat area as having a ‘‘high,’’ ‘‘medium,’’ or ‘‘low’’ conservation value; and (5) identified management actions that could affect salmonid habitat in given areas.

The ESA gives the Secretary of Commerce discretion to exclude areas from designation if the Secretary determines that the benefits of exclusion outweigh the benefits of designation. Considering economic factors and information from CHARTs, NMFS excluded areas in the following categories during its 2005 critical habitat designations:

1. Military areas. All military areas were excluded because of the current national priority on military readiness, and in recognition of conservation activities covered by military integrated natural resource management plans.
2. Tribal lands. Native American lands were excluded because of the unique trust relationship between tribes and the federal government, the federal emphasis on respect for tribal sovereignty and self governance, and the importance of tribal participation in numerous activities aimed at conserving salmon.
3. Habitat Conservation Plans. Some lands covered by habitat conservation plans were excluded because NMFS had evidence that exclusion would benefit our relationship with the landowner, the protections secured through these plans outweigh the protections that are likely through critical habitat designation, and exclusion of these lands may provide an incentive for other landowners to seek similar voluntary conservation plans.
4. Economic impacts. NMFS excluded areas where the conservation benefit to the species is relatively low compared to the economic impacts.

When NMFS designated critical habitat in 2005 for the salmon and steelhead considered in this consultation, NMFS used the watershed or 5th field hydrologic unit code (HUC) to organize critical habitat information systematically and at a scale that is applicable to the spatial distribution of salmon. Organizing information at this scale is especially relevant to salmonids, since their innate homing ability allows them to return to the watersheds where they were born. Such site fidelity results in spatial aggregations of salmonid populations that generally correspond to the area encompassed by 5th field watersheds (Washington Department of Fisheries *et al.*, 1992; Kostow, 1995; McElhany *et al.*, 2000). For prior critical habitat designations, spatial data for 5th field watersheds was widely not available, and NMFS used the subbasin or 4th field HUC to organize critical habitat information. Older critical habitat for SR sockeye salmon, SR fall-run Chinook salmon, and SR spring/summer run Chinook salmon was designated at the 4th field subbasin scale.

The NMFS reviews the status of critical habitat affected by the proposed action by examining the condition and trends of PCEs throughout the designated area. PCEs consist of the physical and biological elements identified as essential to the conservation of the species in the documents identifying critical habitat (Table 15).

Table 15. PCEs of critical habitats designated within the action area for SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, MCR and SRB steelhead, and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook) Spawning gravel Water quality Water temperature (sockeye) Water quantity	Adult spawning Embryo incubation Alevin development Fry emergence Fry/parr growth and development Fry/parr smoltification Smolt growth and development
Juvenile migration corridors	Cover/shelter Food Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Fry/parr seaward migration Smolt growth and development Smolt seaward migration
Adult migration corridors	Cover/shelter Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult "reverse smoltification" Adult upstream migration Kelt (steelhead) seaward migration

Status of Critical Habitat in the Interior Columbia Basin. Critical habitat has been designated in the Interior Columbia Basin (including the Snake River basin) for SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, MCR steelhead, and SRB steelhead. Major tributary river basins in the Interior Columbia Basin include: the Klickitat, Deschutes, Yakima, John Day, Umatilla, Walla Walla, Methow, Entiat, Wenatchee, Grande Ronde, Tucannon, Imnaha, Clearwater, and Salmon.

Migratory habitat quality in this area has been severely affected by the development and operation of the Federal Columbia River Power System (FCRPS) dams in the mainstem Columbia River and privately-owned dams in the Snake and Upper Columbia river basins.

Hydroelectric development has modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmonids, and delayed migration time for both adult and juvenile salmonids. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles. Construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005). Grande Coulee and Chief Joseph dams on the Upper Columbia River completely block anadromous fish passage on the upper mainstem Columbia River.

In addition to the development and operation of the dams in the mainstem rivers, development and operation of extensive irrigation systems and hydroelectric dams for water withdrawal and storage in tributaries have drastically altered hydrological cycles, causing a variety of adverse impacts to salmon and steelhead spawning and rearing habitat. A series of large regulating dams on the middle and upper Deschutes River impact flow, block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope MPG (ICBTRT 2003). Pelton Round Butte Dam, for instance, blocked 32 miles of MCR steelhead habitat in the mainstem Deschutes below Big Falls, and removed the historically important tributaries of the Metolius River and Squaw Creek from production. Similarly, Condit Dam on the White Salmon River has extirpated another population from the Cascades Eastern Slope MPG. In the Umatilla subbasin, the Bureau of Reclamation developed the Umatilla Project in 1906, effectively eliminating over 108 miles of historically highly productive tributary habitat for MCR steelhead in upper McKay Creek due to construction of the McKay Dam and Reservoir in 1927. A flood control and irrigation dam on Willow Creek was also built near river mile 5, completely blocking MCR steelhead access to productive habitat upstream in this subbasin. Construction of Lewiston Dam, completed in 1927, eliminated access for Snake River basin steelhead and salmon to a major portion of the Clearwater basin.

Habitat quality in tributary streams in the Interior Columbia Basin varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (Overton *et al.* 1995; Wissmar *et al.* 1994; and McIntosh *et al.* 1994). Lack of summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas. Critical habitat throughout the Interior Columbia River basin has been degraded by several management activities, including intense agriculture, alteration of stream morphology (*i.e.*, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, timber harvest, mining, and urbanization (Lee *et al.* 1997). Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common symptoms of ecosystem decline in areas of critical habitat.

Many stream reaches designated as critical habitat in the Interior Columbia Basin are overallocated under state water law, with more allocated water rights than existing streamflow conditions can support. Irrigated agriculture is common throughout this region and withdrawal of water increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Continued operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have disrupted the entire riverine ecosystem. Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this area except SR fall-run Chinook salmon (NMFS 2005b).

Impaired water quality is a problem in many tributaries of the Columbia and Snake rivers. Summer stream temperature is the primary water quality problem for this area, with many stream reaches designated as critical habitat listed on the Clean Water Act (CWA) 303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevate stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste are common in some areas of critical habitat.

Environmental Baseline for the Action Area

National forest lands now contain much of the highest quality salmon and steelhead habitat remaining in Oregon and Washington. National forest lands are generally forested and located in the upper portions of subbasins. While there has been substantial habitat degradation across all land ownerships, including national forests, habitat in many headwater stream segments is generally in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al.* 1993, Frissell 1993, Henjum *et al.* 1994). However, the environmental baseline on national forests varies widely throughout the analysis area. National forest management activities such as timber harvest, road construction, livestock grazing, mining, and public recreation have degraded riparian areas. Separately and cumulatively, these activities have reduced stream shading, altered riparian vegetation and function, increased sedimentation, reduced instream large woody debris, reduced pool frequencies, and created migration barriers (Spence *et al*. 1996).

Aquatic habitat conditions across the UNF and WWNF vary depending on the location, past land management activities, and natural events such as floods, fire, and debris torrents. In general, streams that have experienced little to no land management are in good condition, even though forest plan standards (pools per mile, pieces of wood per mile, etc.) are not always met. Some streams have been affected by natural events, such as floods or wildfires. Fish habitat conditions vary by stream segment within watersheds where land management activities have occurred. Conditions range from poor to good, depending on the type and scale of disturbance, proximity to streams, and duration of the disturbance.

The action area can be divided into three geographic sections for describing baseline conditions; the John Day River, Columbia River tributaries, and Snake River tributaries. Information for each section is described below.

John Day River. The John Day River section of the action area contains portions of three 4^{th} field HUC subbasins; the North Fork John Day, Middle Fork John Day, and Lower John Day.

Listed fish habitat (LFH[6]) on UNF lands in the North Fork John Day subbasin has been degraded by logging, wildfire, livestock grazing, and mining. The CHART conservation value ratings for fifth-field watersheds containing UNF lands were "high".

LFH on UNF lands in the Middle Fork John Day subbasin has been degraded by logging, wildfire, mining, and livestock grazing. The CHART conservation value ratings for fifth-field watersheds containing UNF lands were "high".

LFH on UNF lands in the Lower John Day subbasin has been degraded by logging, wildfire, and livestock grazing. The CHART conservation value ratings for fifth-field watersheds containing UNF lands were "high".

Columbia River Tributaries. The Columbia River tributaries section of the action area contains portions of three 4th field HUC subbasins; the Walla Walla, Umatilla, and Willow-Columbia.

LFH on UNF lands in the Walla Walla subbasin has been degraded by logging, wildfire, livestock grazing, and recreational activities. The Critical Habitat Analytical Review Team (CHART) conservation value ratings for fifth-field watersheds containing UNF lands were "high" (NMFS 2005). The CHART reports contain biological assessments supporting NMFS designation of critical habitat for 12 species of listed salmon and steelhead.

LFH on UNF lands in the Umatilla subbasin has been degraded by logging, wildfire, livestock grazing, and recreational activities. The CHART conservation value ratings for fifth-field watersheds containing UNF lands were "high".

UNF lands in the Willow-Columbia subbasin have likely been degraded by logging and livestock grazing. The UNF lands are in the upper elevations of the subbasin, and do not contain LFH. Some habitat in the lower reaches of the subbasin is utilized by non-listed Chinook salmon.

Snake River Tributaries. The Snake River tributaries section of the action area contains portions of seven 4th field HUC subbasins; the Upper Grande Ronde, Lower Grande Ronde, Wallowa, Imnaha, Hell's Canyon, Lower Snake-Asotin, and Lower Snake-Tucannon.

LFH on WWNF and UNF lands in the Upper and Lower Grande Ronde subbasins has been degraded by channel modifications, logging, livestock grazing, mining, and road construction. The CHART conservation value ratings for fifth-field watersheds containing WWNF lands were generally "high".

LFH on WWNF lands in the Wallowa subbasin has been degraded by channel modifications, logging, livestock grazing, and mining. The CHART conservation value ratings for fifth-field watersheds containing WWNF lands were generally "high".

LFH on WWNF lands in the Imnaha subbasin has been degraded by logging, livestock grazing, recreational activities, and irrigation impoundments and water withdrawals. Some of the

[6] Listed fish habitat is defined as habitat used by ESA-listed fish, or designated as critical habitat.

headwater portions of the Imnaha River subbasin are in the Eagle Cap wilderness area, and some are in the Hell's Canyon National Recreation Area, so they are likely to be primarily degraded by livestock grazing. The CHART conservation value ratings for all fifth-field watersheds in the subbasin were "high".

LFH on USFS lands in the Hell's Canyon subbasin has been degraded by livestock grazing, with minor additional impacts from recreational rafting and boating on the Snake River mainstem. All of the WWNF lands within this section of the action area are in the Hell's Canyon National Recreation Area or Hell's Canyon wilderness area. The CHART conservation value ratings for all fifth-field watersheds in the subbasin were "high".

LFH on WWNF and UNF lands in the Lower Snake-Asotin subbasin has been degraded by logging, livestock grazing, and irrigation impoundments and water withdrawals. LFH on WWNF lands in the Lower Snake-Asotin subbasin has been degraded by livestock grazing, with introduction of exotic fish species and minor additional impacts from recreational rafting and boating on the Snake River mainstem. The CHART conservation value ratings for all fifth-field watersheds in the subbasin were "high".

LFH on UNF lands in the Lower Snake-Tucannon subbasin has been degraded by logging and livestock grazing. The CHART conservation value ratings for fifth-field watersheds containing UNF lands were generally "high".

In conclusion, the combined long-term effects of activities such as livestock grazing, timber harvest, and mining have degraded the watersheds in the action area, but the conservation value of the migration, rearing, and spawning PCEs for ESA-listed species remains high.

Effects of the Action

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, which will be added to the environmental baseline (50 CFR 402.02). The USFS or NMFS did not identify any interrelated or interdependent actions during consultation.

The invasive plant treatment activities addressed by this Opinion that may alter LFH in a way that affects ESA-listed fish (Snake River Spring/ Summer (SR) Chinook salmon, Snake River Fall Chinook Salmon, SR sockeye salmon, Snake River Basin (SRB) steelhead, or Middle Columbia River (MCR) steelhead) are manual, mechanical, and herbicide treatment of both known infestation sites, and of infestations sites discovered in the future and treated under the EDRR program. Potential pathways of effects on LFH are summarized in Table 16. Each pathway is examined below.

Table 16. Potential pathways of effects of treatment methods on ESA-listed fish.

	Pathways of Effects							
Treatment Methods	**Disturbance***	**Chemical toxicity**	**Dissolved oxygen and nutrients**	**Water temperature**	**Fine sediment and turbidity**	**Instream habitat structure**	**Forage**	**Riparian and emergent vegetation**
Manual	X					X	X	X
Mechanical	X			X	X		X	X
Biological				X	X			
Herbicides		X	X	X	X	X	X	X

*Stepping on redds, displacing fish, interrupting fish feeding, or disturbing banks.

The number of significant exposures, as described below, is likely to vary from year to year, and will depend on the number and nature of the riparian and in-channel sites treated, the amount of time elapsed between manual, mechanical, and herbicide treatments and rainfall, and the intensity of rainfall.

Biological Treatments. Biological controls work slowly, typically over several years, and are designed to work only on the target species. As treated invasive plants die, native plants are likely to become reestablished at each site, and they will prevent a loss in soil and bank stabilization from root systems, or a loss of stream shade. Therefore, adverse effects to LFH from biological treatments are not likely to occur and are not discussed further.

Manual and Mechanical Treatments. Manual and mechanical treatments (including mulching and thermal techniques) of streamside and instream vegetation are likely to adversely affect LFH under some circumstances. Riparian vegetation creates and supports fish habitat in important ways. The roots of riparian vegetation stabilize banks, reduce soil erosion, and help to create overhanging banks. Thus, riparian vegetation minimizes turbidity and instream fine sediment deposition, maintains stream channel pattern and profile, and creates hiding cover. Riparian vegetation also provides shade, helping to maintain water temperature by limiting solar exposure. Manual and mechanical treatments can affect individual fish or eggs, water temperatures, sediment delivery to streams, instream habitat structure, and juvenile forage.

Summer water temperatures are likely to be increased by manual or mechanical treatments if substantial removal of shading streamside vegetation occurs. These circumstances are likely to occur on the UNF and WWNF only in rare circumstances (e.g., treatment of an invasive plant monoculture encompassing a small “E” or “C” type (Rosgen 1996) stream channel). The magnitude of temperature increase would likely be minor, but would depend on site characteristics such as aspect, elevation, and amount of topographic shading. Temperature increases would likely occur in July and August, and would occur annually for a few years while native shading vegetation was reestablished.

Mechanical treatments that increase the delivery of fine sediment to surface waters increase turbidity, and deposition of fine sediment in LFH. The amount of sediment delivery to LFH would vary with proximity to the treatment area, and the type, extent, and intensity of the mechanical treatment. The magnitude and duration of sediment delivery increases, as well as the existing stream conditions, in LFH would determine whether adverse effects to LFH were likely to result. For the most intensive mechanical treatments, NMFS estimates that the PDF are likely to limit significant exposures to minor increases in turbidity and deposited sediment that extend no more than 500 feet downstream from treatment sites.

Instream habitat structure is likely to be simplified as a result of hand-pulling of invasive plants located within the bankfull elevation of streams containing LFH. Emergent aquatic vegetation can provide hiding cover or refuge for fish and other aquatic organisms. Based on the treatment summary provided in Tables 1 and 2, very little hand-pulling within LFH is likely to occur.

Juvenile forage adjacent to treated streamside vegetation is likely to be temporarily decreased by reduced inputs of leaf and other organic material, and associated insects. The magnitude of the effect will be proportional to the extent of streamside vegetation treated. Reestablishment of native vegetation will offset these effects.

While some adverse effects to LFH from manual and mechanical treatments are likely to occur, as discussed above, the extent of adverse effects is likely to be low. As displayed in Table II-1 of the BA, approximately 12,000 acres of riparian treatments (combined herbicide, physical, and biological) are currently proposed of a total estimated 185,000 riparian acres within the action area. This equates to proposed treatment of approximately 6.5% of the total estimated riparian acres in the action area. Treatment will occur over several years, only about one third of riparian areas are likely to be adjacent to LFH, and only some treatment activities will be likely to affect ESA-listed fish. Additional acres are likely to be treated under the EDRR program, but the total treatment will not exceed the limitations set in PDF H-14 and agreements between the USFS and NMFS described on page 1. The net effect of PDF H-14 and the agreements is that no more than 10 acres of riparian treatment, and no more than 2 acres of in-channel treatment, would occur per sixth-field HUC, per year.

Herbicide Treatments. The NMFS identified three herbicide application scenarios inherent to the proposed action that are likely to result in exposure of ESA-listed fish. The scenarios are: (1) Runoff from riparian application; (2) application within perennial stream channels; and (3) runoff from intermittent stream channels and ditches. Appendices H and I of the BA document numerous riparian invasive plant treatment sites with planned herbicide treatments that are adjacent to streams.

Chronic Effects

The chronic exposure risk for the ten herbicides in the proposed action was analyzed in the BA for the R6 FEIS for riparian applications, and that analysis is incorporated by reference, and is summarized below. No chronic exposure analysis has been conducted for applications within perennial channels or intermittent stream channels or ditches, because these applications result only in short-term exposures.

The chronic effects analysis for riparian applications concluded that an insufficient amount of the proposed herbicides would be applied in the 10 acre/small stream scenario to result in exposure of fish and aquatic invertebrates to chronic effect threshold concentrations for the standard test durations (90 days for fish, 21 days for aquatic invertebrates). The analysis also concluded that chronic effects on algae (21 days) from herbicides other than sulfometuron are not possible from the action. The analysis concluded that chronic effects on aquatic macrophytes (21 days) were: not possible from use of clopyralid, glyphosate, and sethoxydim; not likely to occur from use of imazapyr, metsulfuron, and sulfometuron; and likely to occur from use of chlorsulfuron under some conditions. The chronic exposure analysis determined that adverse effects on aquatic macrophytes are likely for chlorsulfuron when 10 or more streamside acres are treated at application rates greater than about 0.08 pounds active ingredient/acre (0.056 pounds/acre is the typical rate, and 0.25 pounds/acre is the maximum rate).

Acute Effects

The risk of acute adverse effects on ESA-listed and other aquatic organisms in their habitat was evaluated in terms of hazard quotient (HQ) values. Hazard quotient values are calculated by dividing the estimated environmental concentration (EEC) by the effect threshold concentration. For ESA-listed fish, the effect threshold was the estimated or measured no-observed-effect concentration (NOEC). The NOEC values were determined by using the lowest measured acute or chronic NOEC available in literature, or estimated using 1/20th of the lowest fish LC_{50} value (the concentration lethal to 50% of individuals, typically over 96 hours), whichever was lower. Since the NOEC represents the threshold of effects, when the HQ value is greater than 1, then adverse effects are likely to occur.

Hazard quotient values were also calculated by NMFS for aquatic invertebrates, algae, and aquatic macrophytes. Threshold concentrations at which herbicides are likely to adversely affect aquatic invertebrates, algae, and aquatic macrophytes that were used were either the LC_{50} or the EC_{50} (the concentration resulting in an observable effect to 50% of individuals) values. The LC_{50} values were used for aquatic invertebrates and some algal species, and EC_{50} values were used for the remaining species of algae and aquatic macrophytes.

The LC_{50} values for listed fish (salmonids, or representative fish species when no salmonid data available) were obtained from the risk assessments conducted by Syracuse Environment Research Associates (SERA) for the USFS[7], research literature, peer-reviewed journals, and product registration data. The values recommended in the risk assessments for “sensitive” species within each species group were used. If an HQ value exceeded 1 for algae or aquatic macrophytes, an adverse effect to habitat was considered to occur.

Exposure estimates from analyses are expressed as numerical point estimates. However, the numbers are far from exact, and considerable variability and uncertainty are inherent in the estimates. Variability reflects the understanding that some analysis data input values would change under environmental situations not accounted for by the analysis process; that some circumstances affecting exposure cannot be predicted, and the inherent randomness in data input value estimates. Uncertainty reflects lack of knowledge. For example, LC_{50} values, by definition based on a lethality endpoint, are frequently used to estimate a NOEC for acute

[7] The SERA risk assessments are available at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

sublethal effects due to a lack of data on known sublethal endpoints and an incomplete understanding of which biological metric(s) should be measured to determine the most relevant NOEC.

The BA states (p. III-67) that applying herbicides by spot and hand/select methods (rather than by the broadcast method) within riparian buffers will limit the amount of herbicide available for runoff, even though higher application rates are allowed within the buffers. However, the BA does not adequately explain or document why using spot and hand/select methods will account for the majority of the variability and uncertainty in the "water contamination rates" (WCR) supplied in the SERA risk assessments, and significantly reduce exposure. The WCR values are the peak exposure levels predicted in the SERA risk assessments to result from 10 acre herbicide applications adjacent to a small stream (1.8 cfs[8]). The exposure estimates made in the SERA risk assessments are point estimates, and are not presented in terms of significant digits with statistical confidence intervals. Therefore, NMFS uses the WCR values provided in the SERA risk assessments as the best available estimates of exposure from riparian herbicide application at specified application rates in its analysis, but does not discount the WCR values for spot and hand/select application methods.

Acute Exposure of ESA-listed Fish

As previously discussed, NMFS agrees with the chronic exposure analysis conducted by the USFS. Therefore, this section focuses on acute exposure for the three exposure scenarios.

Exposure from Riparian Applications. This section addresses direct exposure risks to ESA-listed fish in both small streams and on the margins of larger streams from runoff and percolation resulting from herbicide application in riparian areas. The analysis was conducted by comparing the WCR values for the small stream scenario analysis in the SERA risk assessments to sublethal effect thresholds agreed upon between NMFS and the USFS.

Stream margins often provide shallow, low-flow conditions, may have a slow mixing rate with mainstem waters, and may also be the site at which subsurface runoff is introduced. Early-stage juvenile salmon and steelhead, particularly recently emerged fry, often utilize low-flow areas along stream margins (Johnson *et al*. 1992, Quinn 2005). As juveniles grow, they migrate away from margins, occupying habitats of progressively higher velocity (Lister and Genoe 1970, Everest and Chapman 1972). Weber and Fausch (2004) found that wild Chinook salmon reared near the river margin until reaching about 60 mm in length. Stream margins are utilized by salmonids for a variety of reasons, including nocturnal resting (Roussel and Bardonnet 1999, Polacek and James 2003), summer and winter thermal refuge, predator avoidance (Roussel and Bardonnet 1999), and flow refuge (Roussel and Bardonnet 1999). Since several relevant parameters of margin habitat in larger streams are analogous to the modeled small stream scenario, and the small stream analysis results are representative of stream margin habitat in larger streams.

The NMFS agrees with the spray drift analysis in Appendices E and F of the BA, which concludes that the PDF buffers for perennial streams are likely to protect ESA-listed fish from

[8] cfs = cubic feet per second of stream flow

exposures to herbicide drift that exceed effect thresholds. However, herbicide exposure from riparian applications is likely to occur via runoff, when rainfall mobilizes herbicides and associated compounds through dissolution into surface and subsurface runoff. Soil erosion can also deliver herbicides from riparian applications.

The results of the acute exposure analysis of riparian applications for ESA-listed fish are displayed in Table 17. The WCR values used in this analysis were the modeled values reported in the SERA risk assessments. Typical and maximum herbicide application rates, WCR values for annual rainfall rates of 15 and 50 inches per year, three representative soil types, and NOEC values were used in the small stream exposure analysis to calculate HQ values for ESA-listed fish. The annual rainfall rates were selected as representative of the lower and upper levels occurring within the action area.

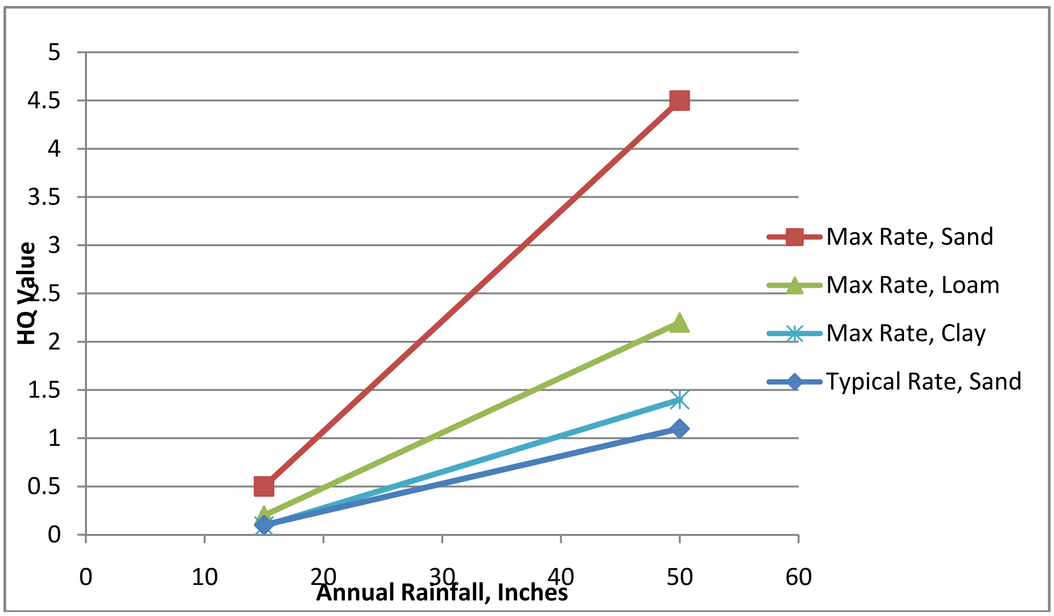
Table 17 shows that at typical application rates, only glyphosate had an HQ value exceeding 1. At maximum application rates, glyphosate, picloram, and triclopyr had HQ values exceeding 1, and sethoxydim had an HQ value equal to 1.

Table 17. Summary of HQ values for ESA-listed fish for 10 herbicides to be applied in riparian areas. HQ values greater than 1 are shaded.

		Typical Application Rate			Maximum Application Rate		
		Clay	Loam	Sand	Clay	Loam	Sand
Herbicide	Annual Rainfall (inches)	HQ Value	HQ Value	HQ Value	HQ Value	HQ Value	HQ Value
Chlorsulfuron	15	0.000	0.000	0.000	0.002	0.000	0.000
	50	0.003	0.000	0.000	0.01	0.000	0.002
Clopyralid	15	0.000	0.000	0.000	0.001	0.000	0.000
	50	0.001	0.000	0.000	0.001	0.001	0.002
Glyphosate	15	0.02	0.05	0.1	0.09	0.2	0.5
	50	0.4	0.6	1.1	1.4	2.2	4.5
Imazapic	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Imazapyr	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Metsulfuron	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Picloram	15	0.09	0.000	0.2	0.3	0.000	0.5
	50	0.9	0.1	0.4	2.5	0.3	1.2
Sethoxydim	15	0.02	0.007	0.1	0.03	0.01	0.1
	50	0.3	0.6	0.5	0.4	1.0	0.7
Sulfometuron	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Triclopyr	15	0.06	0.06	0.06	0.6	0.7	0.6
	50	0.5	0.2	0.2	4.8	3.6	2.1

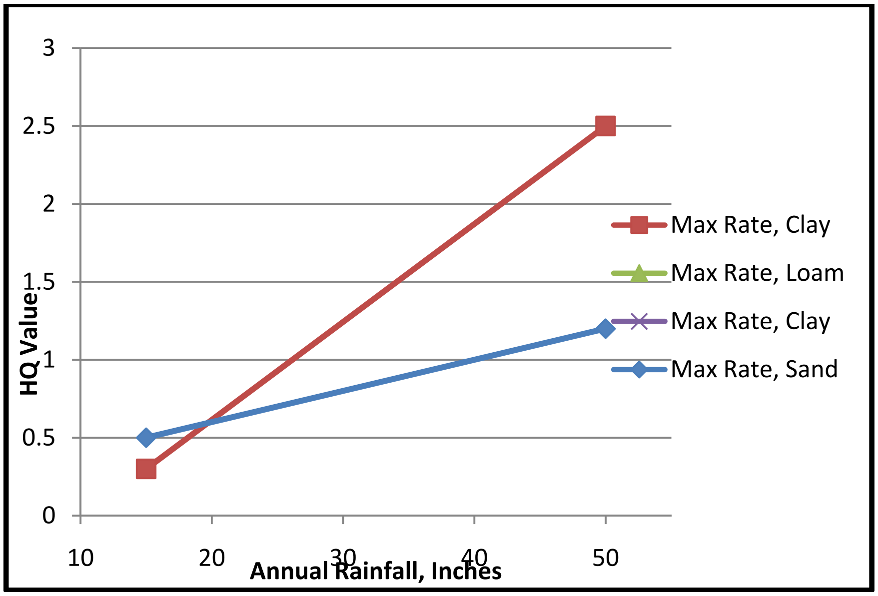
Glyphosate HQ values exceeding 1 occurred at rainfall rates of 15 and 50 inches per year. At the typical application rate (2 pounds/acre), the HQ value of 1.1 occurred at a rainfall rate of 50 inches per year on sandy soil. Given that the effect threshold was exceeded (HQ value >1) at the highest rainfall rate on sandy soil (which represents runoff percolation with minimal soil interaction), and few treatment sites and little LFH are likely to be located in areas of highest rainfall, the risk of exceeding the effect threshold for ESA-listed fish resulting from riparian glyphosate application at typical rates is low. At the maximum application rate (8 pounds/acre), the effect threshold was exceeded on all soil types at 50 inches per year of rainfall, with HQ values ranging from 1.4 to 4.5. As displayed in Figure 3, riparian application of glyphosate at higher application rates on sandy soils is likely to result in concentrations that exceed the effect threshold for ESA-listed fish when site precipitation is about 20 inches per year or higher. At the lowest application rates, application on sandy soils is not likely to result in concentrations that exceed the effect threshold for ESA-listed fish unless site precipitation rate is about 45 inches per year. At higher application rates on loam and clay soils, riparian application of glyphosate at higher application rates is likely to result in concentrations that exceed the effect threshold for ESA-listed fish when site precipitation is about 30 inches per year for loam, and 40 inches per year for clay.

Figure 3. HQ values for riparian application of glyphosate on sand, loam, and clay soils at 15 and 50 inches per year of rainfall.



For the picloram HQ values displayed in Table 17, values exceeding 1 occurred only at 50 inches of precipitation per year. At the maximum application rate (1 pound/acre), the effect threshold was exceeded on clay and sandy soil types, with HQ values of 2.5 and 1.2, respectively. As displayed in Figure 4, riparian application of picloram at higher application rates on clay soils is likely to result in concentrations that exceed the effect threshold for ESA-listed fish when site precipitation is about 25 inches per year or higher, and on sandy soils when site precipitation is about 40 inches or higher.

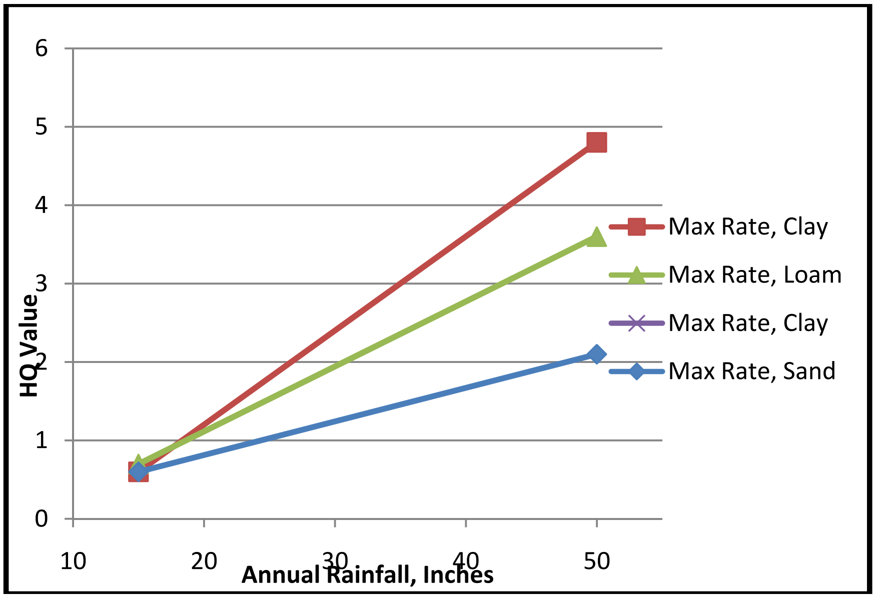
Figure 4. HQ values for riparian application of picloram on sand and clay soils at 15 and 50 inches per year of rainfall.



The HQ values for sethoxydim were calculated using the toxicity data for the Poast formulation, and incorporates the toxicity of naphtha solvent. The toxicity of sethoxydim alone for fish and aquatic invertebrates is much less than that of the formulated product (about 30 times less toxic for invertebrates, and about 100 times less toxic for fish). Since the naphtha solvent tends to volatilize or adsorb to sediments, using Poast formulation data to predict indirect aquatic effects from runoff leaching is likely to overestimate adverse effects (SERA 2001). Application buffers specified in the PDF sharply reduce the risk of naphtha solvent occurring in percolation runoff reaching streams. Therefore, the HQ value of 1.0 displayed in Table 17 for riparian sethoxydim application overstates the risk of effects to ESA-listed fish.

Triclopyr HQ values exceeded 1 at a rainfall rate of 50 inches per year for all soil types. At the maximum application rate (10 pounds/acre), the effect threshold was exceeded on clay, loam, and sand soil types, with HQ values of 4.8, 3.6, and 2.1, respectively. As displayed in Figure 5, riparian application of triclopyr at higher application rates on clay and loam soils is likely to result in concentrations that exceed the effect threshold for ESA-listed fish when site precipitation is about 18 inches per year or higher, and on sandy soils when site precipitation is about 25 inches or higher.

Figure 5. HQ values for riparian application of triclopyr on sand, loam, and clay soils at 15 and 50 inches per year of rainfall.



Exposure from Applications in Intermittent Stream Channels and Ditches. Based on data presented in Appendix E of the BA, a total of 150 miles of currently inventoried roadside treatments are located within 100 feet of fish-bearing streams on UNF, and 57 miles of currently inventoried roadside treatments are within 100 feet of fish-bearing streams on WWNF. The BA does not state how much of this treatment area occurs within roadside or water conveyance ditches. Many of the associated fish-bearing streams are likely to contain ESA-listed fish. Additional roadside treatments are likely to occur under the EDRR component of the proposed action.

Herbicides applied within ditches and intermittent stream channels may be delivered to LFH by dissolving directly into ditch or stream channel flow following rainfall, and by erosion of exposed soil. The contribution from erosion is likely to vary considerably among sites and herbicides. Spot spray and hand/selective application of clopyralid, glyphosate (aquatic formulation), imazapic, imazapyr (aquatic formulation), metsulfuron methyl, and triclopyr (aquatic formulation) are proposed within ditches and intermittent stream channels. All six herbicides can be applied up to their maximum application rate. The primary determinants of exposure risk from ditch or intermittent stream channel treatments are herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to LFH.

Monitoring of storm runoff has documented that the highest concentrations of pollutants occur during the first storm following treatment (Caltrans 2005, USGS 2001). More specifically, the highest pollutant concentrations generally occur early in the storm runoff period (Caltrans 2005). The discharge of ditch or intermittent stream channel runoff in the early stages of the storm runoff period is generally low, but early runoff is exposed to the greatest amount of pollutants available for dissolution. Runoff later in the runoff period occurs at a higher discharge, and dissolved pollutant concentrations are lower, even though mass movement of pollutants can be greater. Therefore, exposure of ESA-listed fish and their critical habitat elements to the highest concentrations of herbicides resulting from application to ditches and intermittent stream channels is likely to occur early in a storm runoff period. The most significant exposure locations are likely to be at or near confluences with perennial streams.

As discussed above, the effects on pollutant concentration of the first flush of water in previously dry channels are well understood. In contrast, little monitoring data is available regarding specific concentrations of herbicides likely to occur in runoff from treated ditches. An algorithm based on the USGS (2001) monitoring report on sulfometuron and glyphosate in runoff from treated roadside plots into ditches in western Oregon has been used in previous biological opinions for USFS invasive plant projects (NMFS 2008, NMFS 2008a) to estimate potential maximum concentrations in runoff from treated ditches and intermittent stream channels. The development of the algorithm is explained in detail in the Appendix of this Opinion.

The potential exposure concentrations from application of clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, and triclopyr triethylamine (TEA) in intermittent stream channels and ditches are summarized in Table 18.

Table 18. Herbicide concentrations and HQ values for ESA-listed fish from herbicide application within intermittent stream channels and ditches. *

	Typical Application Rate		Maximum Application Rate	
Herbicide	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value
Clopyralid	0.3	0.06	0.4	0.09
Glyphosate	0.5	4.8	1.9	19
Imazapic	0.09	0.0009	0.2	0.002
Imazapyr	0.4	0.08	1.3	0.3
Metsulfuron	0.03	0.01	0.1	0.03
Triclopyr	0.9	3.3	8.7	33

* Shaded cells highlight HQ values > 1.

Based on the HQ values displayed in Table 18, glyphosate and triclopyr applied to intermittent stream channels and ditches that are tributary to LFH are likely to result in concentrations that exceed effect thresholds for ESA-listed fish if rainfall occurs 24 hours after application. The HQ values for glyphosate range from 4.8 for application at the typical rate (2 pounds/acre) to 19 for application at the maximum labeled rate (8 pounds/acre). The HQ values for triclopyr TEA range from 3.3 for application at the typical rate (1 pound/acre) to 33 for application at the maximum labeled rate (10 pounds/acre). Actual exposure concentrations, and associated HQ values, may be lower when incomplete treatment of the intermittent stream channel or ditch occurs, only short sections are treated, or when rainfall occurs more than 24 hours after application.

As discussed above, the exposure estimates contain significant uncertainty, and actual exposures under the conditions modeled may be higher or lower.

Exposure from Applications within Perennial Stream Channels. Under the proposed action, glyphosate, imazapyr, and triclopyr TEA can be applied within the bankfull elevation of perennial streams, up to the water's edge. All three herbicides can be applied up to the maximum application rates by spot spray or hand/selective methods.

Exposure from application within stream channels could occur from overspray, foliar rinse by rainfall, erosion, leaching, and site inundation. Juvenile and fry life stages are likely to be at the highest risk of exposure. Exposure of juveniles in stream margin habitat could result from overspray, inundation of treatment sites due to upstream storms, delivery of herbicide to stream margins via percolation or surface runoff due to rainfall at the treatment sites, or a combination of these factors.

Table 19 displays the potential HQ values for the three herbicides proposed for application within perennial streams. The HQ values were derived for two exposure scenarios: 1) dilution of rainfall rinse of treated foliage (75% of the amount applied, multiplied by herbicide wash-off fraction) into 1 cubic foot of water, (the SERA risk assessments state the wash-off fractions as 0.5 for glyphosate, 0.9 for imazapyr, and 0.95 for triclopyr), and 2) dilution of overspray into 1 foot of water (an assumed 25% overspray rate). The effect threshold was exceeded for glyphosate at both typical and maximum application rates for both scenarios, and effect threshold was exceeded for triclopyr at typical and maximum application rates for both scenarios, except overspray at the typical rate. The effect threshold was not exceeded for imazapyr.

Table 19. Herbicide concentrations and HQ values for ESA-listed fish from herbicide application within perennial stream channels.*

	Typical Application Rate				Maximum Application Rate			
Herbicide	Conc in 1' water from foliar rinse	HQ Value	Conc in 1' water from overspray	HQ Value	Conc in 1' water from foliar rinse	HQ Value	Conc in 1' water from overspray	HQ Value
Glyphosate	0.3	2.8	0.2	1.8	1.1	11	0.7	7.4
Imazapyr	0.1	0.02	0.04	0.01	0.4	0.07	0.1	0.03
Triclopyr	0.3	1.0	0.1	0.4	2.6	10	0.9	3.5

* Shaded cells highlight HQ values > 1.

Numerous factors influence the actual concentration in stream margins associated with an instream application site. These include application rate, herbicide properties, rainfall proximity and intensity, time since application, soil permeability, and water turbulence and flow rate. Glyphosate is strongly sorbed by most soils (Yu and Zhou 2005), so exposure to glyphosate is likely to be attenuated when the channel substrate contains substantial fine sediment.

Label instructions for the Aquamaster aquatic glyphosate formulation recommend to "always use the higher rate of this product per acre within the recommended range when weed growth is heavy or dense or weeds are growing in an undisturbed (noncultivated) area." The product label allows an application rate up to 8 pounds/acre. Therefore, NMFS assumes that application at or near the label maximum is likely to be necessary in some situations for invasive plant control on gravel bars and other below bankfull sites, and some exposures are likely to be at or near the higher levels displayed in Table 19.

Acute Exposure of Critical Habitat PCEs

The results of the exposure analysis for algae and aquatic plants from herbicide application in riparian areas, within ditches, intermittent stream channels, and perennial stream channels are discussed below. Exposure analysis for aquatic invertebrates did not reveal any effect threshold exceedences, so herbicide effects to aquatic invertebrates are not discussed further.

Exposure from Riparian Applications. The results of the acute exposure analysis of riparian herbicide applications for algae and aquatic plants are displayed in Table 20. Shaded cells highlight HQ values greater than or equal to 1. Exposures exceeding the effect threshold from riparian application occurred for chlorsulfuron only.

Table 20. HQ values for algae and aquatic plants from riparian herbicide application.*

Herbicide	Rainfall Rate	Typical Application Rate: Clay, Algae HQ Value	Typical: Clay, Macrophyte HQ Value	Typical: Loam, Algae HQ Value	Typical: Loam, Macrophyte HQ Value	Typical: Sand, Algae HQ Value	Typical: Sand, Macrophyte HQ Value	Maximum Application Rate: Clay, Algae HQ Value	Maximum: Clay, Macrophyte HQ Value	Maximum: Loam, Algae HQ Value	Maximum: Loam, Macrophyte HQ Value	Maximum: Sand, Algae HQ Value	Maximum: Sand, Macrophyte HQ Value
Chlorsulfuron	15 inches	0.07	1.0	0.0000	0.0000	0.0000	0.0000	0.3	4.5	0.0000	0.0000	0.0000	0.0001
	50 inches	0.6	9.0	0.002	0.03	0.07	1.0	2.8	40	0.01	0.1	0.3	4.6
Clopyralid	15 inches	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000
	50 inches	0.0005	0.0005	0.0004	0.0004	0.0009	0.0009	0.0008	0.0008	0.0005	0.0005	0.001	0.001
Glyphosate	15 inches	0.001	0.0000	0.002	0.0001	0.006	0.0003	0.004	0.0002	0.009	0.0004	0.03	0.001
	50 inches	0.02	0.0007	0.03	0.001	0.05	0.002	0.07	0.003	0.1	0.005	0.2	0.009
Imazapic	15 inches	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	50 inches	0.001	0.008	0.0000	0.0001	0.0002	0.001	0.002	0.02	0.0000	0.0002	0.0003	0.003
Imazapyr	15 inches	0.0001	0.001	0.0000	0.0000	0.0000	0.0000	0.0004	0.004	0.0000	0.0000	0.0000	0.0001
	50 inches	0.001	0.01	0.0000	0.0001	0.0004	0.003	0.005	0.04	0.0000	0.0002	0.001	0.01
Metsulfuron	15 inches	0.0000	0.02	0.0000	0.0000	0.0000	0.002	0.0000	0.09	0.0000	0.0000	0.0000	0.01
	50 inches	0.0000	0.2	0.0000	0.007	0.0000	0.04	0.0002	0.8	0.0000	0.04	0.0001	0.2
Picloram	15 inches	0.004	0.0000	0.0000	0.0000	0.007	0.0000	0.01	0.0001	0.0000	0.0000	0.02	0.0001
	50 inches	0.04	0.0002	0.004	0.0000	0.02	0.0001	0.1	0.0006	0.01	0.0001	0.05	0.0003
Sethoxydim	15 inches	0.006	0.006	0.002	0.002	0.02	0.02	0.008	0.008	0.003	0.003	0.04	0.04
	50 inches	0.07	0.07	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Sulfometuron	15 inches	0.0007	0.0004	0.0000	0.0000	0.0000	0.0000	0.006	0.004	0.0000	0.0000	0.0000	0.0000
	50 inches	0.008	0.005	0.0000	0.0000	0.0012	0.0007	0.07	0.04	0.0001	0.0001	0.0000	0.006
Triclopyr	15 inches	0.003	0.002	0.003	0.002	0.003	0.002	0.03	0.02	0.03	0.02	0.03	0.02
	50 inches	0.02	0.01	0.02	0.01	0.009	0.006	0.2	0.1	0.2	0.1	0.09	0.06

* Shaded cells highlight HQ values > 1.

The effect threshold for aquatic plants was exceeded for chlorsulfuron only on clay and sand soil types. On clay soils, the effect threshold was exceeded for aquatic plants at the both the typical (0.056 pounds/acre) and maximum (0.25 pounds/acre) application rates, and at the 15 and 50 inch-per-year rainfall levels. Since the proposed action allows application of chlorsulfuron at up to the maximum labeled rate to the bankfull elevation of perennial and intermittent streams, adverse effects to aquatic plants are likely to result from riparian application of chlorsulfuron between 0.056 and 0.25 pounds/acre on clay-dominated soils at all rainfall levels occurring in the action area. On sandy soils, the effect threshold was exceeded for aquatic plants at both the typical and maximum rates at the 50 inch-per-year rainfall level, with HQ values of 1.0 and 4.6, respectively. Therefore, adverse effects to aquatic plants are likely to occur from riparian application of chlorsulfuron at high application rates on sandy soils, but only at sites with high rainfall levels.

The effect threshold value for algae was exceeded (HQ = 2.8) only at the maximum rate, on clay soils, at the 50 inch-per-year rainfall level.

<u>Exposure from Applications in Dry Intermittent Stream Channels, Ditches, and Perennial Stream Channels</u>. The results of the acute exposure analysis of herbicide applications in intermittent stream channels, ditches, and perennial stream channels are displayed in Table 21. Shaded cells highlight HQ values greater than or equal to 1. For herbicide application in ditches and intermittent stream channels, imazapic and imazapyr exposure exceeded the effect thresholds for algae and aquatic macrophytes at both the typical and maximum application rates, metsulfuron exposure exceeded the effect threshold for aquatic macrophytes at the typical and maximum application rates, and triclopyr exposure exceeded the effect thresholds for algae and aquatic macrophytes at the maximum application rate.

Table 21. HQ values for algae and aquatic plants from herbicide application in intermittent stream channels, ditches, and perennial channels. *

	Ditches and Intermittent Stream Channels				Application in Perennial Streams							
	Algae		Aquatic Macrophytes		Typical Application Rate				Maximum Application Rate			
Herbicide	Typical Rate	Maximum Rate	Typical Rate	Maximum Rate	HQ value for 1' deep water – foliar rinse		HQ value for 1' deep water - overspray		HQ value for 1' deep water – foliar rinse		HQ value for 1' deep water - overspray	
	HQ Value	HQ Value	HQ Value	HQ Value	Algae	Aquatic Macrophytes	Algae	Aquatic Macrophytes	Algae	Aquatic Macrophytes	Algae	Aquatic Macrophytes
Clopyralid	0.04	0.06	0.04	0.06								
Glyphosate	0.2	0.9	0.0	0.0	0.1	0.006	0.09	0.004	0.5	0.02	0.4	0.02
Imazapic	1.7	3.3	14	27								
Imazapyr	2.0	6.5	17	57	0.6	4.9	0.2	1.8	1.9	16	0.7	6.0
Metsulfuron	0.03	0.2	130	652								
Triclopyr	0.1	1.5	0.1	1.0	0.04	0.03	0.02	0.01	0.4	0.3	0.2	0.1

* Shaded cells highlight HQ values > 1.

For herbicide application in perennial channels, the effect threshold for aquatic macrophytes was exceeded for imazapyr at both the typical and maximum application rates, for both the "foliar rinse" and "overspray" scenarios, and the effect threshold for algae was exceeded at the maximum application rate for the "foliar rinse" scenario.

Due to the high HQ values for aquatic macrophytes, the duration of exposure to significant concentrations of imazapic, imazapyr, and metsulfuron from treatments in ditches and dry channels is likely to be longer than the duration for fish or algae.

Effects on Listed Species

Manual and Mechanical Treatments. Although fine sediment may be transported great distances before depositing in areas of reduced transport potential, measurable effects are likely to be limited to about 500 feet downstream from treatment sites. The likelihood of measurable amounts of fine sediment entering streams as a result of herbicide application or manual invasive species removal is minimal. Both activities generally occur early in the growing season providing native plants ample opportunity to quickly inhabit bare soils. The distance over which measurable effects that may occur will vary due to existing turbidity and bedload sediment levels, stream velocity, channel configuration, and other factors. Suttle *et al*. (2004) demonstrated a linear effect of increasing fine sediment deposition decreasing juvenile steelhead growth. The authors concluded that the linear effect of fine sediment deposition on growth, even at low levels, suggests that there is no threshold below which adverse effects from sediment deposition do not occur. The growth declines were associated with lower prey availability, and higher activity, aggression, and risk of injury.

In some circumstances, manual and mechanical treatments are likely to be conducted by workers standing in the water. For example, some emergent invasive plants may be hand-pulled, and it may be necessary to cut some streamside invasive plants by using string trimmers (e.g., weedeater) or chainsaws while standing in streams. This would likely result in direct adverse effects to any ESA-listed fish present through disturbance of some individuals to the point of harassment, or injury by stepping on redds or fry. The extent and intensity of these effects would depend on the fish life stages present, the area of stream accessed, and the amount of time spent in the water.

Based on the above exposure analysis and the discussion on page 37, NMFS estimates that the fish response period per occurrence of increased suspended sediment and turbidity usually would be limited to no more than a few days. In some circumstances, fish responses to sediment delivery and turbidity could last up to a week. Some fish are likely to be displaced due to avoidance of turbidity plumes, increasing the risk of predation (Quigley 2003). Fish that are not displaced are likely be harmed through increased stress, hormone concentration, and increased metabolic costs (Quigley 2003); gill irritation or abrasion (which can reduce respiratory efficiency or lead to infection) (Berg and Northcote 1985); and a reduction in juvenile feeding efficiency due to reduced visibility (Noggle 1978). Compromised gill function is likely to increase juvenile mortality. Reduced feeding efficiency is likely to lower growth rate. In some circumstances, individuals may find increased feeding opportunities along the sediment plume fringe as suspended fauna are transported downstream with the sediment. No effects on fish are expected as a result of temperature change from near shore riparian treatments because invasive treatment is geared toward very small groups of emergent plants which have no effect of shading and subsequent cooling of the watercourse.

Herbicide Treatments. ESA-listed salmon and steelhead are likely to be present in the action area in LFH where significant herbicide concentrations (those exceeding effect thresholds and causing adverse effects) will occur. The likelihood of significant exposures will be greatest in small streams (those with flow less than about 5 cfs), along the margins of larger streams near treatment areas, and at the confluences of perennial streams with treated intermittent stream channels and ditches.

NMFS estimates that significant exposure periods per occurrence are likely to last 24 hours or less for those resulting from riparian applications, 2 hours or less for those resulting from applications in perennial stream channels, and 4 hours or less for those resulting from applications in intermittent stream channels and ditches. Exposures from all herbicide application scenarios are not likely to adversely affect listed fish at distances greater than 500 feet downstream from application sites. These estimates are based on NMFS's understanding of the herbicide delivery pathways and instream processes.

Rearing and migrating juvenile salmon and steelhead present in small streams, along stream margins, and near the confluences of perennial streams with intermittent stream channels and ditches would be the most likely to experience significant exposures. Adults are also likely to be present in the action area, but less likely to be present in small streams and stream margins where significant exposures would be likely to occur. Adults would be most likely to experience significant exposures at the confluences of perennial streams with intermittent stream channels and ditches. Incubating salmon and steelhead eggs and pre-emergent fry are most likely to experience significant exposures where redds are located along stream margins or in small streams where subsurface runoff percolates into spawning gravels.

Estimated exposure concentrations resulting from the proposed action are likely to exceed NOEC values for some herbicides. Therefore, sublethal effects that alter behaviors, impair swimming or olfactory functions, diminish the ability to find food, navigate, or escape from predators, are likely to occur, and may ultimately result in death. Compromised olfaction in listed fish from glyphosate exposure, as was recently documented by Tierney *et al*. (2006), is likely to result from the proposed action, and the authors noted that olfaction is tantamount to survival for anadromous salmonid fishes. Some sublethal effects are rapidly reversible or diminish with time, and may result in little or no long-term consequences. In addition, individual fish may exhibit different responses to the same concentration of toxicant.

Program Scale Effects. In total, a small number of individuals from each ESA-listed species are likely to experience exposures to significant concentrations of herbicides, turbidity, fine sediment deposition, and increased water temperatures that exceed effect thresholds and result in harm as described above. These exposures are likely to be minor in magnitude (generally sublethal) and extent (generally less than 500 feet of stream per treatment site), and occur infrequently over the proposed 10-year program duration. The amount of riparian (i.e., above bankfull elevation) treatment per 1.6 miles of stream is limited to 10 acres by the proposed action. NMFS expects treatment below bankfull elevation in intermittent and perennial streams and ditches to be very limited in scope, based on the current infestation maps in Appendix H and I of the BA. The need for future incidental applications below bankfull elevation to address emergent infestations is likewise expected to be quite limited because treatment is directed at small newly emergent invasive populations of plants and designed to eliminate large infestations before they become uncontrollable. Small scale control of emergent outbreaks of invasive species via herbicide treatment will have insignificant effects on listed species of fish.

The number of listed fish affected is likely to vary from year to year, and will depend on the number and nature of the riparian and in-channel sites treated; the amount of time elapsed between manual, mechanical, and herbicide treatments and rainfall; and the intensity of rainfall. On rare occasions, juveniles, fry, or eggs may be injured or killed by workers walking or standing in stream channels.

Due to the low magnitude and extent of effects resulting from implementation of the proposed action, the abundance, productivity, spatial structure, and diversity of populations of individual listed species will not be appreciably affected. The BA states that only about 8,000 acres are likely to be treated annually, therefore only a few of the 257 sixth-field HUC subwatersheds in the action area (Table 22) are likely to be affected each year.

Table 22. Number of sixth-field HUCs in the action area.

Fourth-Field HUC Name	Fourth-Field HUC Number	Number of Sixth-Field HUCs in Action Area
Hell's Canyon	17060101	18
Imnaha River	17060102	21
Lower Snake - Asotin	17060103	8
Upper Grande Ronde River	17060104	27
Wallowa River	17060105	17
Lower Grande Ronde	17060106	49
Lower Snake - Tucannon	17060107	7
Walla Walla	17070102	14
Umatilla	17070103	21
Willow (Columbia)	17070104	4
North Fork John Day	17070202	54
Middle Fork John Day	17070203	8
Lower John Day	17070204	9
		Total = 257

Effects on Critical Habitat

Designated critical habitat within the action area includes three PCEs and their essential physical and biological features as listed and discussed below. The essential features of the PCEs potentially affected include water quality, substrate, cover, and forage.

<u>Freshwater spawning sites</u>
Water quantity – The proposed action is not likely to measurably affect water quantity or flows.

Water quality – Short-term adverse effects on water quality are likely to occur when invasive plant treatments occur adjacent to streams or within stream channels, and ground disturbance or areas of bare ground greater than about ¼ acre result. Minor increased turbidity resulting from treatment is likely to last for a few hours to a maximum of a few days. Minor increases in water temperatures from decreased shade are not likely to last more than one summer. Inputs of herbicides as described in the exposure analysis are likely to degrade water quality for up to 24 hours. In the long term (2 or more years, depending on the site), the removal of invasive plants and the planting of riparian areas with native vegetation in place of invasive plants is likely to ultimately increase shade and reduce summer stream temperatures.

Substrate – Localized (stream reach), minor increases in substrate embeddedness resulting from fine sediment inputs are likely to last for a few days to a few weeks. Increased embeddedness would reduce spawning habitat quality in affected areas.

<u>Freshwater rearing sites</u>
Water quantity – The proposed action is not likely to measurable affect water quantity or flows.
Floodplain connectivity – The proposed action is not likely to measurable affect floodplain connectivity.

Water quality – Same as described above for freshwater spawning sites.

Forage – The herbicide exposure analysis earlier in this Opinion documented that adverse effects to algae and aquatic macrophytes causing reductions in primary production are likely to occur. Fine sediment deposition is likely to result in short-term reductions in the abundance of aquatic invertebrate forage organisms. While these effects (from sediment and herbicides) are not likely to extend more than a few hundred feet below treatment sites, and these areas are likely to be recolonized by primary producers and aquatic invertebrates within a few months, the short-term effect is likely to be a minor decrease in available forage at affected sites.

Natural cover – Minor, short-term reductions in natural cover for juveniles are likely to occur from increases in substrate embeddedness and losses of aquatic macrophytes. Effects from substrate embeddedness are not likely to last more than a few weeks. The amount of sediment delivery to LFH would vary with proximity to the treatment area, and the type, extent, and intensity of the mechanical treatment. The magnitude and duration of sediment delivery increases, as well as the existing stream conditions, in LFH would determine whether adverse effects to LFH were likely to result. Effects from herbicides are not likely to last more than a few months.

<u>Freshwater migration corridors</u>
Free passage – The proposed action is not likely to affect free passage.

Water quantity – The proposed action is not likely to measurable affect water quantity or flows.

Water quality – Same as described above for freshwater spawning sites.

Natural cover – Same as described above for freshwater rearing sites.

Due to the site-scale nature of effects resulting from implementation of the proposed action, the designated critical habitat of individual listed species will not be appreciably affected. Critical habitat in only a few sixth-field HUC subwatersheds in the action area are likely to be affected each year, out of a total of 257, therefore, the implementation of the proposed action is not likely to affect critical habitat at the scale of designation.

Cumulative Effects

Cumulative effects are those effects of future state or private activities, 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). Cumulative effects that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

Watershed conditions in the action area will continue to be influenced by a variety of land-uses including recreation, agriculture and livestock grazing, forest management, private land development, and road construction, use, and maintenance, and the results of recovery plan implementation. Detailed information on these activities and their influence in the action area are not specifically available. Based on patterns of growth and land use in the vicinity of the action area, current levels of these uses are likely to persist or grow. The Snake River sub-domain recovery plan[9] and the Mid-Columbia sub-domain[10] recovery plans are under development, and, when completed, will provide cumulative effects discussions at the sub-domain scale. The broad-scale environmental effects of land uses include water quality issues such as pollutants and pesticides, turbidity, temperature increase, altered hydrology, increased sediment deposition and turbidity, as well as reduced habitat access due to physical barriers.

Private lands are predominately located downstream from the action area, although there are some intermingled lands in both the UNF and WWNF. Herbicide use occurs, and is likely to continue, on tribal, state, county, and private forestry lands, and utility corridors, road rights-of-way, and private property. Only restricted use herbicides have a mandatory reporting requirement to the states. Therefore, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable.

The NMFS is not aware of any additional specific non-Federal actions, beyond those discussed above, planned within the action area.

Conclusion

After reviewing the status of the affected species and their designated critical habitats, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, NMFS concludes that the action as proposed is not likely to jeopardize the continued existence of SR Chinook salmon, SR sockeye salmon, SRB steelhead, and MCR steelhead, and is not likely to destroy or adversely modify their designated critical habitat.

The environmental baseline for the subject action covers two national forests, so it is highly variable in quality, but generally includes some of the best remaining habitat within the affected watersheds, as well as areas that have been degraded by land management actions. The analysis

[9] For information see: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Snake/Index.cfm
[10] For information see: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Mid-Columbia/Index.cfm

of effects in this Opinion demonstrated that the proposed action will slightly degrade the environmental baseline at the site scale in treated areas, the effects will not persist beyond a few years, and the removal of invasive plants and restoration of native species are likely to improve riparian functions at many of these sites over the long term. The action area is likely to experience cumulative effects or state or private actions at intensities that are similar to recent years, and NMFS is not aware of any specific proposals for any specific non-Federal actions that are planned within the action area. Because of these habitat factors, and because direct and indirect injury and mortality among ESA-listed species from proposed activities will be low, the effects analysis demonstrated that the proposed action will not affect the abundance, productivity, distribution, or genetic diversity of any listed species at the population scale. Therefore, the proposed action is not likely to appreciably reduce the survival and recovery of any of the listed species. The effects analysis also demonstrated that the adverse effects of the proposed action on critical habitat PCEs will be brief and limited to the site scale, so that critical habitat PCEs will retain their current ability to become functionally established as necessary to serve the intended conservation role for the species at the scale of the designation. Therefore, the proposed action will not destroy or adversely modify designated critical habitat.

Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. The following recommendations are discretionary measures that are consistent with this obligation and therefore should be carried out by the USFS:

1. The NMFS encourages the UNF and WWNF to consider the recommended actions and prioritization plans found in draft and final recovery plans for the subject species when planning invasive plant treatment projects on the UNF and WWNF.
2. The applicator should only use surfactants or adjuvants in riparian areas when the effects of the ingredients have been tested on salmonid fishes and have been found to be of low toxicity, and when the products do not contain any ingredients on EPA's List 1 or 2.
3. The USFS should use herbicides with the least toxicity to listed fish and other non-target organisms whenever practicable.

Please notify NMFS if the USFS carries out any of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that has an effect to the listed species or designated critical habitat that was not considered in the biological opinion; or (d) if a new species is listed or critical habitat is designated that may be affected by the identified action (50 CFR 402.16).

To reinitiate consultation, contact the Oregon State Habitat Office of NMFS, and refer to NMFS Number 2008/06525.

Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by Fish and Wildlife Service as an intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Amount or Extent of Take

The proposed action is reasonably certain to cause incidental take of juvenile SR Chinook salmon, SR sockeye salmon, SRB steelhead, and MCR steelhead. The action area provides spawning, rearing, and migration habitat for these species. Habitat conditions are variable throughout the action area, but UNF and WWNF lands contain some of the highest quality and potentially restorable habitat.

Incidental take caused by implementing the proposed action will include the following:
(1) Harm of juveniles due to impairment of essential behavioral patterns (*i.e*., feeding and predator avoidance), which will cause injuries or deaths, from exposure to herbicides applied in riparian areas, perennial streams, intermittent stream channels, and ditches; (2) harassment due to significant disruption of normal behavioral patterns (*i.e*., use of olfaction to migrate, sheltering from predators, feeding) of juveniles resulting from increased suspended sediment, turbidity and fine sediment deposition; and (3) deaths or injuries due to workers standing or walking on redds or fry in stream channels while conducting treatments.

Despite the use of the best scientific and commercial data available, NMFS cannot quantify the specific number of fish, incubating eggs, or fry that may be taken by the proposed action. The number of animals exposed to herbicide concentrations sufficient to change their behavior, or injure or kill them, depends on several variables. These variables include the specific times and locations that invasive plant treatments will occur, rainfall amount and timing, wind, soil composition and depth, site slope, and proximity of treatment sites to individual fish or redds.

There are currently no meaningful measureable metrics that can be utilized instream to determine quantifiable levels of take, and data collection of parameters expected to show physical or chemical change would be so infinitesimally small that take could not be reliably determined against natural background fluctuations in these parameters. For these reasons the only way to quantify take is relative to the extent of habitat modification. For this action, the only meaningful way to quantify the extent of habitat modification is by the geographic extent and location of the expected mechanical, manual, and herbicide treatments, and the extent of any downstream effects.

The proposed action is to treat up to 10 acres of riparian infestation per 1.6 miles of stream channel, per year, and take from suspended sediment is likely to extend up to an additional 500 feet downstream. In addition, treatments below bankfull elevation in intermittent and perennial streams and ditches are expected to be conducted on 2 acres or less per year, per 6th field HUC subwatershed. Therefore, the extent of incidental take exempted in this incidental take statement is the extent of habitat modified by treatment of up to 10 acres along any 1.6 mile reach of stream channel plus 500 feet, per year, plus up to 2 acres of streams and/or ditches below bankfull elevation (per watershed). As displayed in Table 22, a total of 257 sixth-field HUCs are present in the action area.

The estimated extent of take is based on assumptions in the exposure analysis in the SERA risk assessments and in this Opinion that herbicide application would not occur less than 24 hours before rainfall. Conducting treatments outside of these conditions may result in a greater extent of than is authorized in this incidental take statement.

Reasonable and Prudent Measures

The following measures are necessary and appropriate to minimize the impact of incidental take of listed species from the proposed action:

The USFS shall:

1. Minimize incidental take by following the proposed PDFs described in the BA.
2. Minimize incidental take by avoiding and minimizing adverse effects to aquatic and riparian habitats.
3 Minimize incidental take by ensuring completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

Terms and Conditions

The measures described below are non-discretionary, and must be undertaken by the USFS for the exemption in section 7(o)(2) to apply. The USFS has a continuing duty to regulate the activity covered by this incidental take statement. If the USFS (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the USFS or applicant must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement.

1. To implement reasonable and prudent measure #1, the USFS shall:

    a. Follow all PDFs for each programmatic category provided in the proposed action section of the BA and this Opinion.

2. To implement reasonable and prudent measure #2, the USFS shall:

    a. Complete work within the active channel of streams occupied by ESA-listed fish during the ODFW or WDFW preferred in-water work period, as appropriate for the action area (ODFW 2008, U.S. Army Corps of Engineers 2008). Exceptions must receive NMFS' concurrence in writing prior to work being performed.
    b. Do not apply herbicides in riparian areas, perennial streams, intermittent stream channels, or ditches when rainfall is likely to occur within 24 hours.
    c. Limit treatments within stream channels to 2 acres or less per year, per 6^{th} field HUC subwatershed for the duration of this Opinion (2009-2013).

3. To implement reasonable and prudent measure #3, the USFS shall:

    a. Prior to the CIRS becoming available, the UNF and WWNF shall provide the following information in paper form to the NMFS Oregon State Habitat Office (OSHO) for all herbicide projects by May 1, prior to each annual spray season.
        i. Location: 5^{th} or 6^{th} field HUC (depending on site resolution), 10-12 digit code, and name.
        ii. Maps of proposed treatment areas.
        iii. Anticipated treatment start and end dates
        iv. Proposed herbicide treatments and mixtures, and any changes from mixtures identified in the EIS and BA for this action.
        v. Number of treatment acres by 6^{th} field HUC, number of treatment acres in riparian reserves, number of ditch miles to be treated, and number of stream miles to be treated.
        vi. By 5^{th} or 6^{th} field watershed, identify ESA-listed fish distribution, critical habitat, and EFH.
    b. Use the NMFS Public Consultation Tracking System - Consultation Initiation and Reporting System (CIRS) (http://www.nmfs.noaa.gov/pcts), when this online system becomes available, and UNF and WWNF staff have been trained to use it, to enter the information described in 3(a) above.
    c. Require that site-specific information be recorded by each applicator for treatment sites that may affect ESA-listed fish, including the following information:
        i. Location of treatment areas in riparian areas, streams, and ditches that may affect ESA-listed fish species, critical habitat, and or EFH.
        ii. The number of acres treated within riparian areas.
        iii. The number of acres treated within perennial stream channels.

iv. The number of feet of wet or dry intermittent stream channels and ditches treated with herbicide.
v. The location and size of emergent plant treatment areas.
vi. Names of 5th or 6th field HUC(s), as applicable, that are treated.
vii. The product names and herbicide formulations, including mixtures, adjuvants and surfactants used.
viii. The herbicide application rate.
ix. The herbicide application method.
x. Estimated wind speed at time of application.
xi. Description of meteorological conditions.

d. Provide the monitoring records to NMFS for review annually by January 31.
e. Annually report to NMFS by February 28, following the end of each spray season for the duration of this Opinion (2009 to 2013 spray seasons), the results of the reporting requirements described in term and condition 3, and the following information:
   i. A list of herbicide applications conducted over the reporting period, including information requested in 3(c) above.
   ii. The results of the previous years' monitoring program.
   iii. The annual report shall be sent to:

National Marine Fisheries Service
Oregon State Habitat Office
Attn: 2008/06525
1201 NE Lloyd Blvd., Suite 1100
Portland, OR 97232

f. Comply with the requirements of the USFS Region 6 invasive plant monitoring plan, once that plan has been finalized. The USFS should conduct a data review of the pesticides that are proposed for use, or may be used, on the UNF and WWNF each year. The review should include:
   i. New scientific data regarding non-target fish species effects or environmental fate, including peer-reviewed studies and other forms of scientific evidence that may be relevant to Pacific salmon and steelhead.
   ii. Changes to EPA-approved labels (ESA-related and other).
   iii. Legal findings relevant to the use of pesticides.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for Chinook salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction of this document. The action area includes areas designated as EFH for various life-history stages of Chinook salmon.

The proposed action area includes freshwater habitat which has been designated as EFH for Chinook salmon. Estuarine and ocean habitat will not be affected by the proposed action. Therefore, there would be no effect to EFH of groundfish or coastal pelagic species.
Based on information provided in the BA, and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for Chinook salmon:

1. Short-term adverse effects on water quality when invasive plant treatments occur adjacent to streams or within stream channels, and ground disturbance or areas of bare ground greater than about ¼ acre result. Minor increased turbidity resulting from treatment is likely to last for a few hours to a maximum of a few days. Minor increases in water temperatures from decreased shade are not likely to last more than one summer. Inputs of herbicides as described in the exposure analysis are likely to degrade water quality for up to 24 hours. In the long term (two or more years, depending on the site), the removal of invasive plants and the planting of riparian areas with native vegetation in place of invasive plants is likely to ultimately increase shade and reduce summer stream temperatures.
2. Localized (stream reach), minor increases in substrate embeddedness resulting from fine sediment inputs are likely to last for a few days to a few weeks. Increased embeddedness would reduce spawning habitat quality in affected areas.
3. Adverse effects to algae and aquatic macrophytes from herbicide application, causing reductions in primary production, are likely to occur. Fine sediment deposition is likely to result in short-term reductions in the abundance of aquatic invertebrate forage organisms. While these effects (from sediment and herbicides) are not likely to extend more than a few hundred feet below treatment sites, and these areas are likely to be recolonized by primary producers and aquatic invertebrates within a few months, the short-term effect is likely to be a minor decrease in available forage at affected sites.
4. Minor, short-term reductions in natural cover for juveniles are likely to occur from increases in substrate embeddedness and losses of aquatic macrophytes.

Effects from substrate embeddedness are not likely to last more than a few weeks. The amount of sediment delivery to LFH would vary with proximity to the treatment area, and the type, extent, and intensity of the mechanical treatment. The magnitude and duration of sediment delivery increases, as well as the existing stream conditions, in LFH would determine whether adverse effects to LFH were likely to result. Effects from herbicides are not likely to last more than a few months.

EFH Conservation Recommendations

The three conservation recommendations presented above in the Conservation Recommendations section of this document, in addition to terms and conditions1 through 3, are applicable to designated Pacific salmon EFH. Therefore, NMFS recommends that they be adopted as EFH conservation measures. Should the USFS adopt and implement these recommendations, potential adverse impacts to EFH would be minimized.

Statutory Response Requirement

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations [50 CFR 600.920(j) (1)]. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse affects of the activity on EFH. If the response is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations. The reasons must include the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your response to the EFH portion of this consultation, you clearly identify the number of conservation recommendations adopted.

Supplemental Consultation

The USFS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations [50 CFR 600.920(k)].

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users.

This ESA consultation concludes that the proposed UNF and WWNF Invasive Plant Treatments Project will not jeopardize the affected listed species. Therefore, the USFS can carry out this action in accordance with its authority. The intended users are the UNF and WWNF.

Individual copies were provided to the above-listed entities. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01, *et seq.*, and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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APPENDIX

RUNOFF FROM TREATED DITCHES AND DRY INTERMITTENT STREAMS.

Herbicides applied within ditches and intermittent stream channels are delivered primarily by leaching, dissolving directly into ditch or stream channel flow, and erosion. The contribution from erosion is likely to vary considerably among sites. The primary determinants of exposure risk from ditch/intermittent stream channel treatments are herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to habitat for listed salmonids.

Monitoring of storm runoff has documented that the highest concentrations of pollutants occur during the first storm following treatment (Caltrans 2005, USGS 2001). More specifically, the highest pollutant concentrations generally occur during the early part of storm runoff, relative to concentrations later in the runoff event (Caltrans 2005). The discharge of ditch/intermittent stream channel runoff in the early stages of the storm hydrograph is generally low, but is exposed to the greatest amount of pollutants available for dissolution. The ratio of low discharge to highest amount of available pollutant results in early runoff solute concentrations that are high relative to those occurring later in the runoff event. Runoff later in the hydrograph occurs at a higher discharge, and dissolved pollutant concentrations are lower, even though mass movement of pollutants can be greater. Therefore, exposure of listed salmonids and their critical habitat elements to the highest concentrations of herbicides resulting from application to ditches and intermittent stream channels is likely to occur early in storm runoff. The most significant exposure locations are at or near confluences with perennial streams.

In contrast to the well established understanding of the "first flush" effect on pollutant concentrations, little monitoring data is available regarding specific concentrations of herbicides likely to occur in runoff from treated ditches. The USGS (2001) monitoring report cited above provides data for concentrations of sulfometuron and glyphosate in runoff from treated roadside plots into ditches in western Oregon. Sulfometuron was applied at a rate of 0.23 pounds/acre, and resulted in runoff concentrations of 0.119 to 0.253 mg/l (corresponding to about 3 to 7% of amount applied) from simulated rainfall 24 hours following application. Glyphosate was applied at a rate of about 2 pounds/acre, and resulted in runoff concentrations of 0.323 – 0.736 mg/l (corresponding to about 1 to 2% of amount applied) from simulated rainfall 24 hours following application. The samples were collected in the initial 15 liters of runoff from simulated rainfall at a rate of 0.3 inches per hour, and lasting 0.5 to 1.4 hours. Given this sampling scenario, these concentrations are the best estimates available for what would occur in 24-hour, post-application runoff from ditch/intermittent stream applications from "first flush" events for these herbicides (per amount applied, per unit area).

The runoff concentrations likely for the herbicides in the activity description for which runoff data is not available (clopyralid, imazapyr, metsulfuron, chlorsulfuron, and sethoxydim) can be estimated from the USGS (2001) data. Ramwell *et al.* (2002) and Huang *et al.* (2004) found that herbicides with high solubility and low K_{oc} produced the highest peak concentrations and highest total yield of herbicides in roadside runoff. Krutz *et al.* (2005) stated that herbicide concentrations observed at vegetative filter strip outflows correlate positively with increasing solubility. If solubility and K_{oc} values are reasonable predictors of herbicide yield in ditch runoff, with high solubility and low K_{oc} increasing runoff risk, then it is reasonable to assume that herbicides with solubility values greater than, and K_{oc} values less than or equal to, sulfometuron are likely to be present in runoff at concentrations at least equal to that for sulfometuron. The shortest soil half-life of any of the herbicides is 5 days for sethoxydim, and the others are considerably longer, so it is reasonable to ignore half-life for estimating 24-hour post-application runoff concentrations.

Table 1 summarizes herbicide soil mobility factors (solubility and K_{oc} ratios) and application rates for seven herbicides as an example. Five example herbicides for which ditch runoff data is not available (chlorsulfuron, clopyralid, imazapyr, metsulfuron, and sethoxydim) all have K_{oc} values similar to or less than sulfometuron, and much higher solubility. Sulfometuron solubility is low (70 mg/l) relative to the other five herbicides, but a substantial portion of the amount applied appears in the initial runoff. Due to the relatively low application rate of 0.23 pounds/acre, the initial runoff only needs to reach 0.6% saturation to remove 10% of sulfometuron applied. Under circumstances where the ratio of water volume to a low-solubility organic chemical is very large, dissolution is seldom limited by solubility (Lyman 1995). Thus, at low herbicide application rates, solubility of the seven herbicides in the activity description is likely to be less important than K_{oc} as a predictor of runoff risk. It is therefore reasonable to assume that the runoff efficiency of those five herbicides will occur at a rate at least equal to that of sulfometuron following a rainstorm occurring 24 hours post-application. This assumption is consistent with groundwater movement ratings from Vogue *et al.* (1994). In addition, foliar wash-off fractions of these five herbicides were also higher than for sulfometuron (Knisel 2000), indicating that an amount greater than or equal to sulfometuron will be available for dissolution.

Table 1. Summary of herbicide soil mobility factors and application rates.

Herbicide	Solubility[1,2] (mg/l)	K_{oc}[2]	Maximum Application Rate (lbs/acre)[3]
Clopyralid	300,000	6	0.5
Imazapyr	500,000	100	1.5
Metsulfuron	9,500	35	0.15
Chlorsulfuron	7,000	40	0.25
Sethoxydim	4,390	100	0.45
Sulfometuron	70	78	0.38
Glyphosate	900,000	24,000	8

[1] Solubility values are for salts, if salts are typically the ingredient in commercial formulations
[2] From Vogue *et al*. (1994), located at http://npic.orst.edu/ppdmove.htm
[3] From product labels

The average sulfometuron 24-hour post-application concentration reported by USGS (2001) was used to extrapolate likely concentrations of the five herbicides for which comparable monitoring data was unavailable, predict exposure risk to listed salmonids and their habitat, and calculate HQ values. The equation for extrapolation of the USGS (2001) sulfometuron data to chlorsulfuron, clopyralid, imazapyr, metsulfuron, and sethoxydim was derived by treating application rate as the independent variable (x), runoff concentration as the dependent variable (y), and solving for the slope of the line intersecting y = 0, x = 0 (no herbicide was considered to be in runoff if none was applied). The average sulfometuron runoff concentration of the 24-hour simulated rainfall plots was 0.2 mg/l, and the application rate was 0.23 lbs/acre. The resulting estimate of runoff concentration is in mg/l. Thus, where m = slope and b = y intercept:

$$y = mx + b$$
$$y = (\text{runoff concentration/application rate}) * x + 0$$
$$y = (0.2 \text{ mg/l})/0.23 \text{ lbs/acre}) * x + 0$$
$$\text{mg/l in runoff} = 0.87 \text{ mg/l per lb/acre} * \text{application rate in lbs/acre}$$

The results of the extrapolation and resulting HQ values are summarized in Table 13. Runoff rates in Table 13 for sulfometuron and glyphosate are those published in USGS (2001).

The HQ values presented in Table 2 are based on the assumption of application to several hundred feet of ditch/intermittent stream channel adjacent to a perennial stream with occupied or critical habitat present. Herbicide treatments approaching the maximum rates for ditch/channel lengths greater than a few hundred feet are likely to occur within the project area. However, due to the generally patchy distribution of invasive plant infestations in ditches and intermittent stream channels, and use of conservative herbicide application methods, treatment of such large, contiguous areas near the maximum application rate is expected to be rare. Treatments of ditch/channel lengths greater than a few hundred feet at the typical rate are likely to be infrequent. Therefore, the estimated herbicide runoff concentrations and consequent HQ values displayed in Table 13 are likely to occur on a rare (for maximum HQ values) to infrequent (for typical HQ values) basis within the project area.

Based on the example analysis results presented in Table 2, the summary of the likely adverse effects to listed salmonids and their habitat from 24-hour post-application storm at ditch/intermittent stream channel confluences with perennial streams is:

- Glyphosate would cause sublethal effects to listed salmonids, generally reducing their fitness and cause adverse effects to their habitat by reducing algae production.

- Sethoxydim would cause sublethal effects to listed salmonids, generally reducing their fitness and adverse effects by reducing production of aquatic invertebrates, algae, and aquatic macrophytes.

- Chlorsulfuron, imazapyr, metsulfuron, and sulfometuron would be likely to cause adverse effects to salmonids habitat by reducing production of algae and aquatic macrophytes.

Actual exposure concentrations and durations at or near confluences with perennial streams will depend on a variety of factors, including the extent of the herbicide application within the ditch/intermittent stream, application rate, extent of riparian applications, and rainfall timing, intensity, and amount.

Riparian applications adjacent to ditch/intermittent stream channels may contribute additional herbicide, exacerbating exposures at confluences with perennial streams. However, due to a greater transport lag time through soils, peak herbicide exposures from riparian applications delivered via ditches and intermittent streams are likely to arrive at perennial stream confluences at a later time than the "first flush" peak. This would likely extend exposure time, but would be unlikely to increase peak exposure level.

The projected runoff concentrations and HQ values displayed in Table 2 should be interpreted with an understanding of the precision and accuracy of the USGS (2001) data upon which they are based. Although the USGS (2001) results were based on relatively ambitious quality assurance, "it is important to recognize that all of the data presented are semiquantitative in nature and that interpretations should take this into account. These data can be relied on only for order-of-magnitude representations of concentrations, and possibly for trends." Thus, the runoff concentrations and HQ values in Table 2 should be considered as estimates that may vary by an order of magnitude lower or higher. However, the runoff concentrations projected in Table 2 for clopyralid are reasonably consistent (within an order of magnitude) with roadside ditch runoff data for clopyralid reported by Huang *et al.* (2004), and collected under similar conditions.

Table 2. Projected runoff concentrations at typical and maximum application rates, and resulting HQ values

Herbicide	Typical Application Rate (pounds/acre)	Expected Typ. Runoff Concentration (mg/l)	Maximum Application Rate (pounds/acre)	Expected Max. Runoff Concentration (mg/l)	Species Group	Effect Threshold Concentration (mg/l)	Typ Application Rate HQ values	Max Application Rate HQ values
Chlorsulfuron	0.056	0.05	0.25	0.22	Fish	2	0.02	0.11
					Aq. Invertebrates	10	0.005	0.02
					Algae	0.01	5	22
					Aq. Macrophytes	0.000047	1,036	4,625
Clopyralid	0.35	0.30	0.5	0.43	Fish	5	0.06	0.1
					Aq. Invertebrates	21	0.01	0.02
					Algae	0.69	0.4	0.6
					Aq. Macrophytes	0.69	0.4	0.6
Glyphosate	2	0.48	8	1.92	Fish	0.5	1.0	3.8
					Aq. Invertebrates	78	0.006	0.025
					Algae	0.89	0.5	2.2
					Aq. Macrophytes	3	0.2	0.6
Imazapyr	0.45	0.39	1.5	1.30	Fish	5	0.1	0.3
					Aq. Invertebrates	100	0.004	0.01
					Algae	0.02	20	65
					Aq. Macrophytes	0.013	30	100
Metsulfuron	0.03	0.03	0.15	0.13	Fish	4.50	0.01	0.03
					Aq. Invertebrates	17.00	0.002	0.01
					Algae	0.01	2.6	13
					Aq. Macrophytes	0.00016	163	815
Sethoxydim	0.3	0.26	0.45	0.39	Fish	0.06	4	7
					Aq. Invertebrates	0.26	1.0	1.5
					Algae	0.25	1.0	1.6
					Aq. Macrophytes	0.25	1.0	1.6
Sulfometuron	0.03	0.03	0.38	0.33	Fish	4.5	0.006	0.1
					Aq. Invertebrates	6.1	0.004	0.05
					Algae	0.0025	10	132
					Aq. Macrophytes	0.00021	124	1,573

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