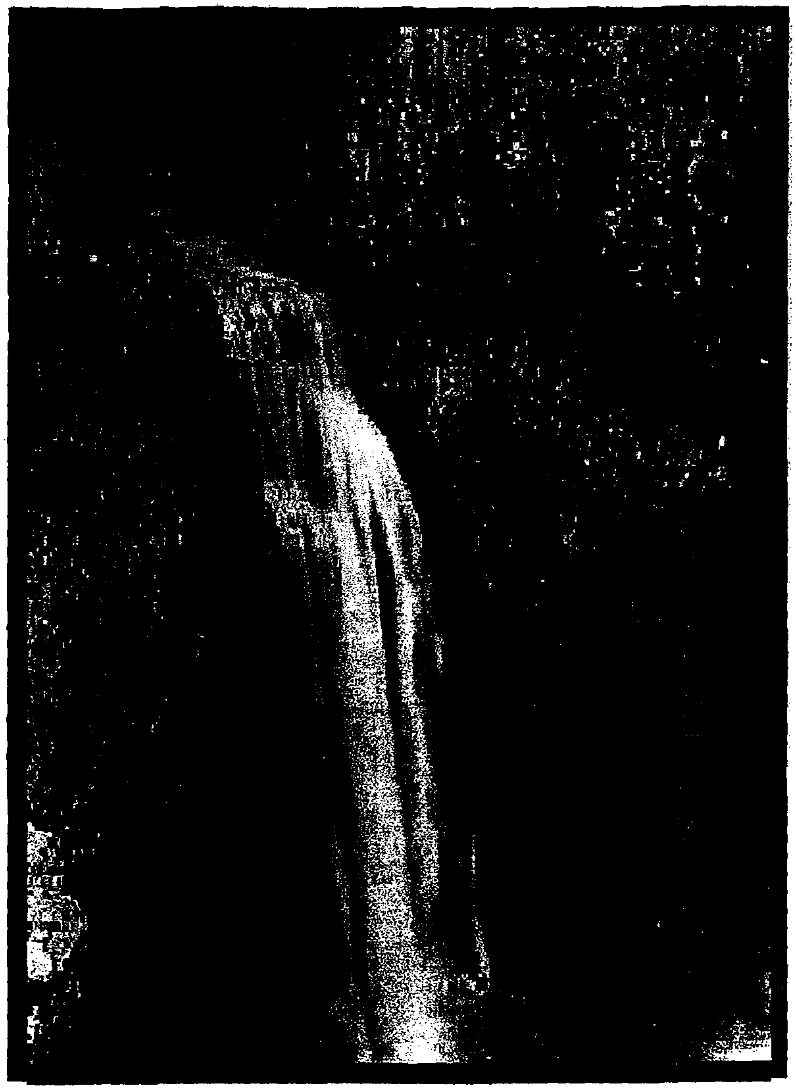
SALT CREEK



WATERSHED ANALYSIS

* * * * *

Willamette National Forest

Oakridge Ranger District

Oakridge, Oregon

September 1997

TABLE OF CONTENTS

TABLE OF CONTENTS

Chapter II

ISSUES AND KEY QUESTIONS

Chapter III

Page

REFERENCE AND CURRENT CONDITION

Chapter IV

INTERPRETATION

Page

Chapter V

RECOMMENDATIONS

APPENDICES

LIST OF FIGURES

INTRODUCTION

CHAPTER I

CHARACTERIZATION

CHAPTER II

Page

ISSUES / KEY QUESTIONS

(none)

CHAPTER III

REFERENCE / CURRENT CONDITIONS

LIST OF TABLES

CHAPTER I

Page

CHARACTERIZATION

CHAPTER II

ISSUES / KEY QUESTIONS

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CHAPTER III

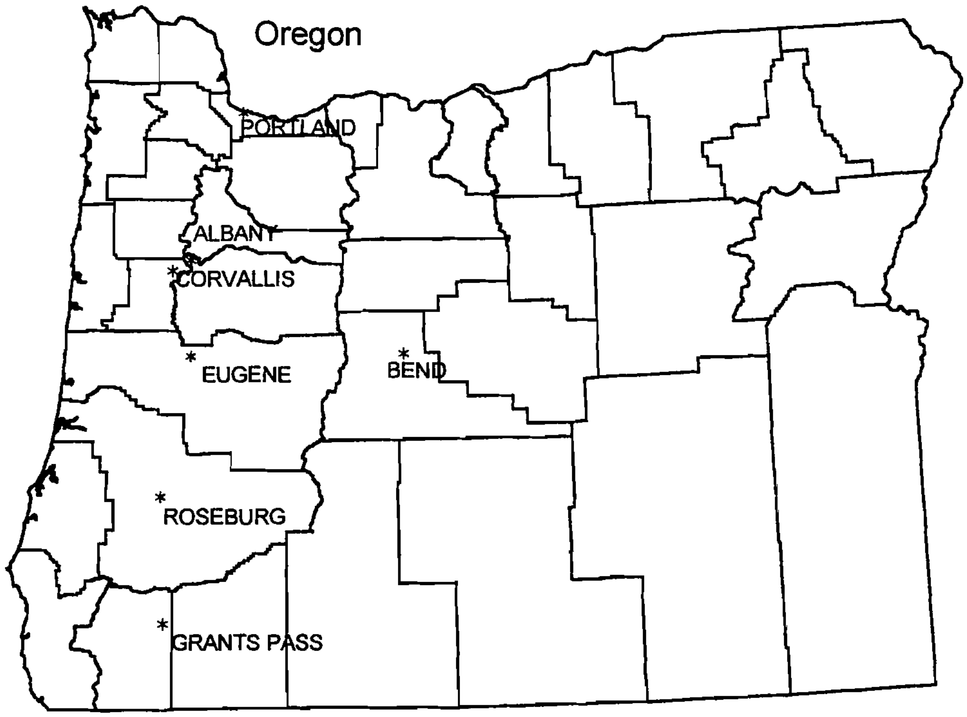
REFERENCE / CURRENT CONDITIONS

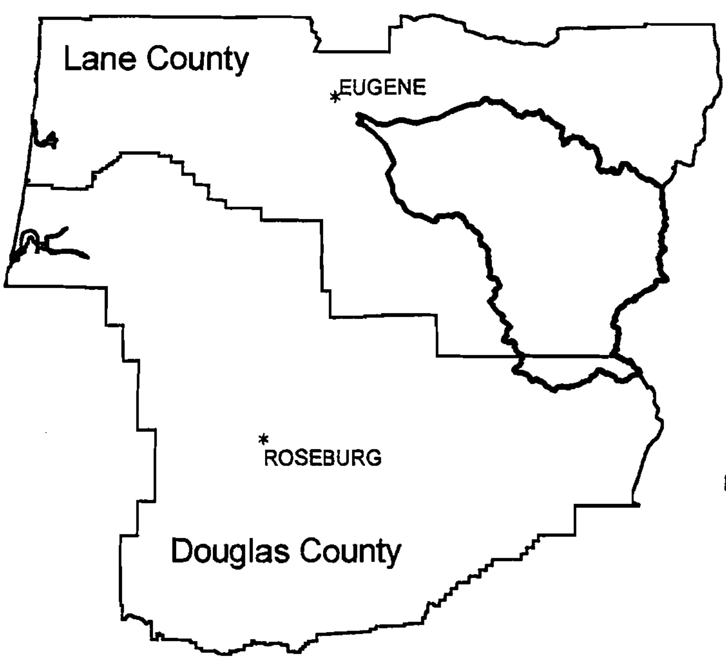
INTRODUCTION

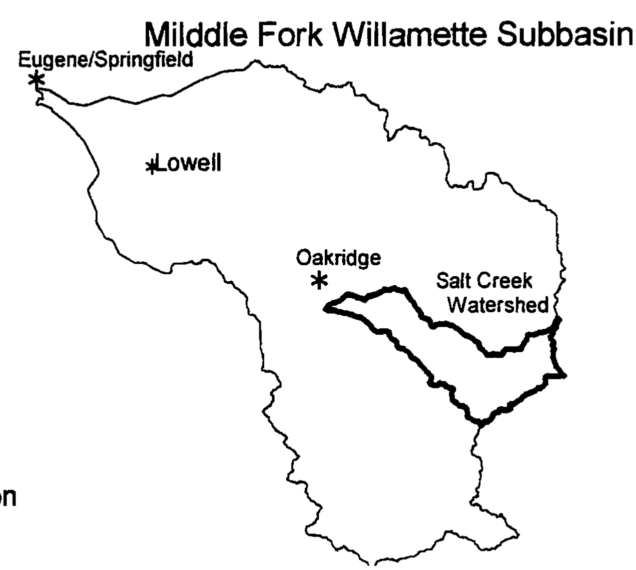
Figure 1:

Vicinity Map

Salt Creek Watershed Analysis







INTRODUCTION

LOCATION AND LAND OWNERSHIP

The Salt Creek watershed is located within the Oakridge Ranger District of the Willamette National Forest, approximately 38 air miles (or 44 river miles) from the Eugene/Springfield metropolitan area. It lies upstream from and to the southeast of the City of Oakridge. The watershed consists of one fifth field watershed (Salt Creek, 20) and three sixth field watersheds (Lower Salt Creek, 20 1; Middle Salt Creek, 20 2; Upper Salt Creek, 20 3). The Salt Creek watershed totals 71,770 acres. Approximately 175 acres (0.2 percent of the watershed) is privately owned, most of which is used for residential, agricultural, or forestry purposes. The remainder of the watershed is National Forest land.

MANAGEMENT DIRECTION

The Record of Decision for the Final Supplemental Environmental Impact Statement (FEIS) on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA, USDI, et. Al. 1994a) requires that a watershed analysis be completed for all watersheds on federal lands. The SEIS has become popularly known as the Northwest Forest Plan, and has resulted in the amendment of the Willamette National Forest Land and Resource Management Plan (USDA, 1990). This watershed analysis has been done to comply with this direction and in a larger sense to provide decision-makers with a more comprehensive body of information upon which to base their land management decisions.

DOCUMENT FORMAT

This analysis tells how this watershed came to have the characteristics it has, of the particularly important processes occurring within it, and how management activities have affected landscape processes and patterns in the watershed. The document is comprised of the following components:

- A <u>Characterization</u> chapter that describes the unique or particularly important characteristics of the watershed.
- An <u>Issues and Key Questions</u> chapter that describes the various concerns and opportunities that exist in the management environment. This chapter identifies the questions that need to be answered to better make the many decisions that need to be made now, and in the future.
- A <u>Reference and Current Conditions</u> chapter that discusses the historical conditions of the watershed and how those conditions have changed over time. This chapter puts into perspective the current condition existing in the watershed, presented in relation to the various relevant resources.
- An <u>Interpretation</u> chapter that explains the differences between historical, current and natural conditions and how those factors affect our ability to achieve management objectives in this watershed, presented in relation to issues and Key Questions. This chapter provides answers to the Key Questions.
- A <u>Recommendations</u> chapter that identifies those management activities that could move the system towards reference conditions or management objectives.

This format is based on that presented in "Ecosystem Analysis at the Watershed Scale, (USDA, USDI, revised, August 1995). The presentation of this analysis is essentially linear; one page follows another. The processes and features of this watershed are complex, interact with one-another, and can be generally conceived of as a multi-dimensional entity. Describing such a complex phenomenon as a watershed in a linear format invariably will result in a substantial amount of overlap and/or generalization. For example, water quality can be influenced by a number of very different activities, processes, and underlying structures. While water quality can be considered a physical condition (as opposed to biological), biological processes may have profound influences on the quality of water. We beg the readers' indulgence for the unavoidable repetition of some key concepts and conditions as we attempt to illustrate the three-dimensional nature of this watershed and the complex processes occurring within it.

CHARACTERIZATION

CHAPTER I

CHARACTERIZATION

This section describes the dominant characteristics of the physical, biological, and human aspects of the watershed that are useful in understanding how the processes occurring within the watershed affect its conditions and functions. This chapter describes the unique and particularly important characteristics of the physical, biological, and social aspects of the watershed.

PHYSICAL ENVIRONMENT

GEOLOGICAL FEATURES

The Salt Creek Watershed Analysis area is 71,770 acres in size. It is located in the transition from the Western Cascades to the High Cascades physiographic subprovince of the Cascade Range. The downstream area from Salt Creek Falls to the confluence of Middle Fork of the Willamette are within the older Western Cascades. From Salt Creek Falls to the crest of the Cascade Mountains, bedrock transitions from younger Western Cascades to High Cascades in the uplands.

The bedrock of the older Western Cascades is predominantly pyroclastic (tuffs and breccias) and altered flows and intrusions. Soils range from clay to sand dominated, depending upon whether derived from pyroclastics or flows/intrusions respectively. Several large earthflow landforms exist, most notably on the north side of Salt Creek near Blue Pool Campground and south of Salt Creek in the Shady Gap area. These earthflow features are currently stable on the large scale, but have localized areas of active or potential slope instability, especially along Highway 58 near the Blue Pool Campground and the railroad tracks at the Shady Gap crossing.

The bedrock of the younger Western Cascades and High Cascades are predominantly unaltered flows and minor intrusions. Soils tend to be sand and cobble dominated. The geomorphology of this area (from Salt Creek Falls to the uplands) is best characterized as alpine glacial with U-shaped valleys and an abundance of glacial till. Valley sidewalls are steep and prone to debris slides.

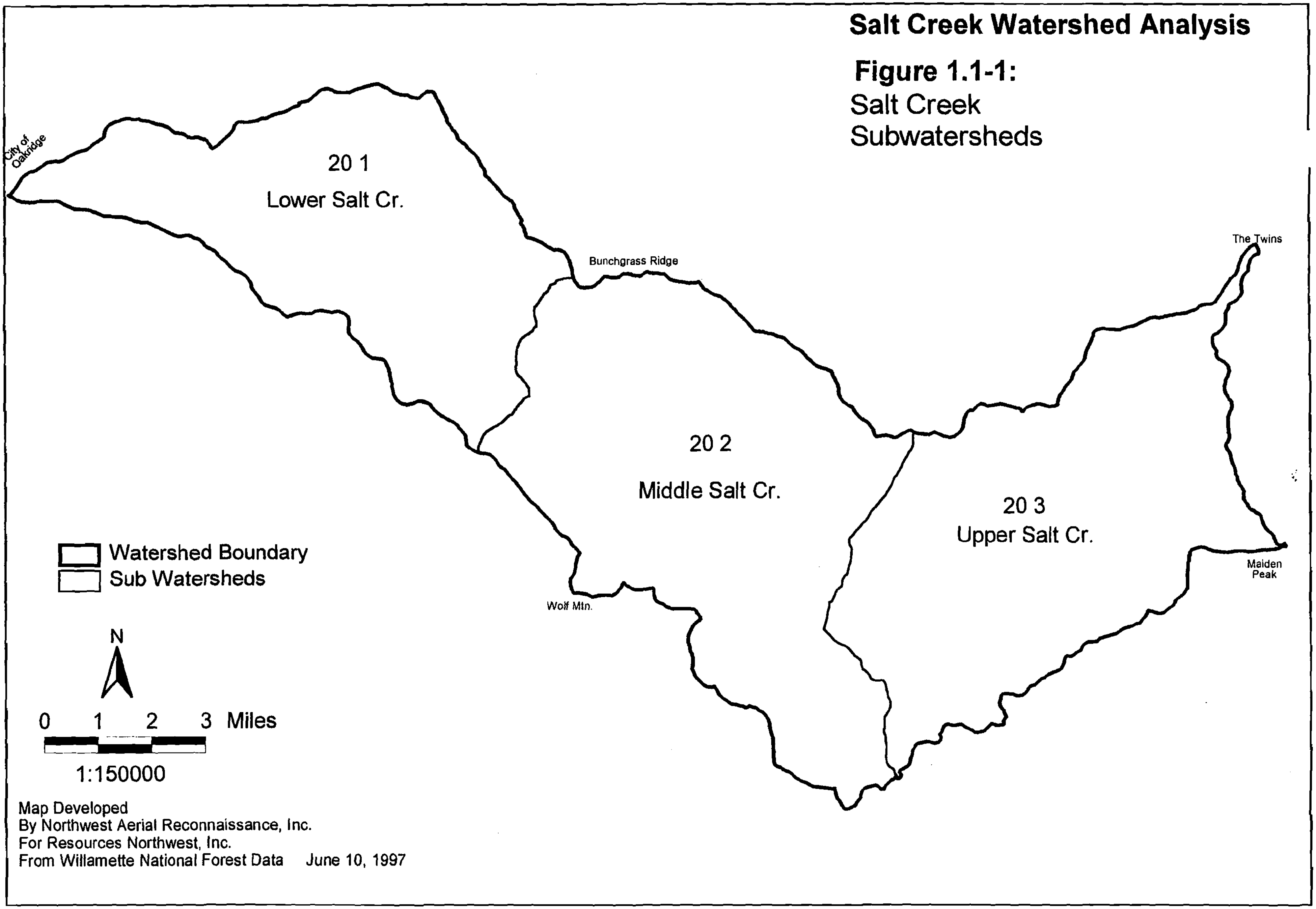
HYDROLOGY

Salt Creek is a major tributary of the Middle Fork of the Willamette River. Surface hydrologic features within the Salt Creek watershed are composed of an extensive intermittent and perennial stream network, many small seeps and wetlands, and numerous ponds and lakes located primarily in the upper portion of the watershed. The elevation ranges from 1,300 feet near the mouth of Salt Creek to 7,818 feet in the upper watershed. Figure 1.1-1 of this chapter shows the location of the Subwatersheds within the Salt Creek watershed.

Water Quality and Use

The Oregon Department of Environmental Quality (DEQ) has identified beneficial uses for Willamette River tributaries (OAR 340-41-442). Relevant beneficial uses for Salt Creek include: domestic water supply, resident fish and aquatic life, fishing, boating, water contact recreation and aesthetic quality.

The primary sources of water pollution along the length of Salt Creek are considered nonpoint sources. These pollutants originate from diffuse sources rather than a discharge at a single location. The primary nonpoint source problems of concern include elevated levels of sediment and increased stream temperatures. Elevated levels of sediment are often associated with soil erosion from road surfaces and hill slopes where vegetation has been disturbed. Elevated stream temperatures can be attributed to reduced amounts of streamside vegetation, from natural disturbances, and past harvesting prior to establishment of policies requiring retention of riparian vegetation.


Salt Creek Watershed Analysis
Figure 1.1-1:
Salt Creek
Subwatersheds
City of Oakridge
20 1
Lower Salt Cr.
Bunchgrass Ridge
The Twins
20 2
Middle Salt Cr.
20 3
Upper Salt Cr.
Watershed Boundary
Sub Watersheds
Maiden Peak
Wolf Mtn.
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Climatic Factors
The watershed has a temperate climate with generally wet cool winters and dry warm summers. Average annual precipitation ranges from about 40 inches in the lower portion of the watershed to approximately 80 inches in the higher elevations. Above 4,000 feet in elevation, the majority of the winter precipitation falls as snow. Between 1,300 and 5,000 feet in elevation, fluctuating weather patterns result in a transient snow pack. Approximately 59 percent of the watershed is considered to be within the transient snow zone.

Streamflow
The lowest flow period during the year is typically August and September. The majority of the runoff occurs between November and May. Including the majority of high flow events, which generally occur during periods of high rainfall associated with rapid snowmelt. During the summer months, melting of the seasonal snowpack at high elevations contributes to summer base flows. Timber harvesting and road construction have likely increased the magnitude and frequency of peak stream flows.

Stream Channel Variation
Considerable variation exists in the valley characteristics of the mainstem of Salt Creek. Throughout the watershed, the channel is constrained by Highway 58 and levies installed in the late 1950s to provide flood protection for Highway 58. Lower mainstem stream reaches of Salt Creek tend to have relatively low gradients except in reaches where the channel is highly constrained by valley walls and controlled to a large extent by bedrock. Depositional areas, occurring in the relatively low gradient areas are typically less constrained by valley walls, and the channel displays a higher degree of sinuosity.

Structures
At this time the Salt Creek watershed has approximately 223.7 miles of developed roads. The total road miles includes 25.72 miles of Highway 58, a major transportation corridor and 45.9 miles of railroad. Of the 223.7 miles of roads, 198.38 miles are Forest Service roads of maintenance level which is assigned to roads that provide a high degree of user comfort and convenience. Normally, these roads are double-lane and paved or single-lane paved with turnouts. Almost 37 miles of this system is of maintenance level 3 which is assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities on level 3 roads. The remaining 142.43 miles of the system is of maintenance level 2 which is assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration in maintenance of level 2 roads.

BIOLOGICAL ENVIRONMENT

VEGETATION
Plant communities in the watershed are diverse and reflect landscape influences, varied soils and landforms, and a wide elevation gradient. Most of the plant associations described by Hemstrom et al. (1987) are represented within this watershed. Forest age classes and structure reflect the influences of wildfire and timber harvesting.

Plant Communities
Approximately 93 percent of the watershed is occupied by coniferous forests ranging in age from several to over 600 years. Other plant community types that are found within the watershed include: herbaceous wetlands (bogs, marshes, and meadows dominated by sedges, rushes, and grasses); hardwood and shrubby wetlands (hardwood marshes and swamps); coniferous wetlands (cottonwood and western red cedar swamps); red alder stands acres (wet and dry types); coniferous-hardwood forests; temperate and high temperate coniferous forests (with lodgepole pine); subalpine forest parks; rock outcrops, talus and talus/shrub communities; Oregon white oak woodland inclusions; and grass and forb dry hillsides. None of these communities are unique to the province except as mentioned in the following remnant populations section.

Stand Age and Structure
The harvesting which has occurred over the last 60 years has created most of the younger forest age classes but wildfire has had the largest influence of any natural process upon the structure and distribution of vegetation age classes within this watershed.

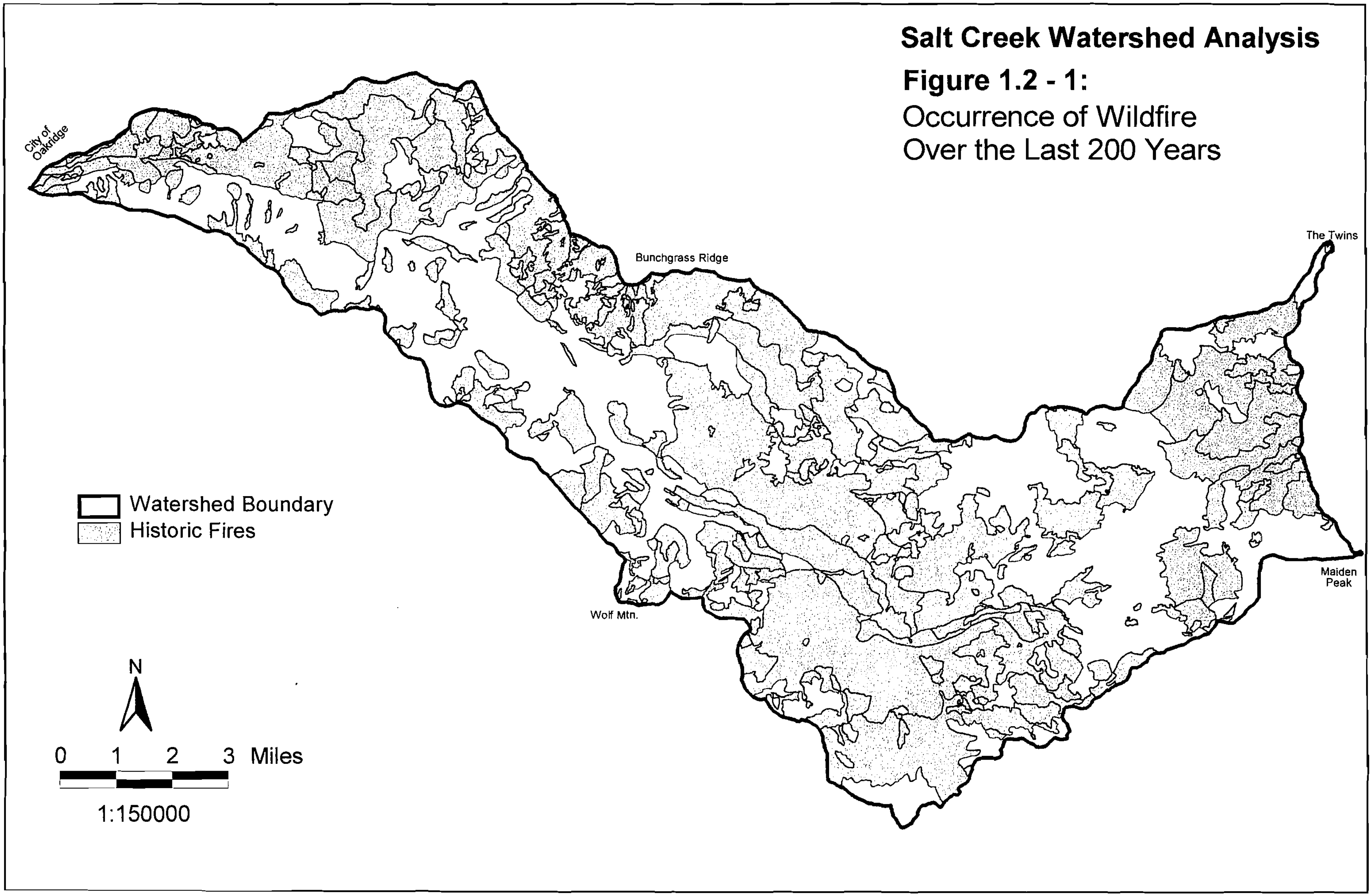
Approximately 17,917 acres have had intensive harvest treatment in the last 60 years, leaving approximately 53,854 acres (75%) of the watershed unharvested. Approximately 55,400 (77%) acres are vegetated with forests 30+ years of age. The total includes land allocations both available and unavailable for timber management. Little harvest has occurred in the upper northeastern area of the watershed which is under semiprimitive non-motorized land use allocation.

Remnant Populations
Though the non-forested areas represent a small portion of this watershed, these areas provide habitat for some relatively uncommon plant communities. Some south-facing rock outcrops support populations of rabbit brush, a shrub that typically grows only on the east side of the Cascades. Some of the rocky meadows on south facing slopes contain stands of Oregon white oak, a species typically found at lower elevations and is quite abundant in the Willamette valley.

Alaska yellow cedar and sub-alpine fir, trees more typically found at much higher latitudes, can occasionally be found on high ridges and north-facing cirque basins. Whitebark pine, typically a sub-alpine and alpine tree, occurs in limited areas within the watershed, generally above 6500 feet in elevation.

Fire History
Aside from the general climate that provides for the forest growth in this watershed, wildfire is the most dominant natural force shaping the structure and age class distribution of the forest. Over the past two centuries, 64 percent of the watershed has been subject to stand replacing, or catastrophic, wildfire. Many of these areas have burned two or more times in this period. Portions of the Warner Creek fire that burned in 1991 are examples of such areas. Much of the acreage affected by fire over the last 200 years burned with less severity, retaining small to moderate numbers of trees from the pre-fire stand. Many stands in the watershed also have experienced ground fire with little overstory mortality.

As shown in Figure 1.2-1 of this chapter, wildfire occurrence has been relatively uniform over the watershed. By looking at fire patterns on the landscape, it is estimated that the fire event of 1790-1799 (200 years ago) burned or underburned approximately 75 percent of this watershed. Within Subwatershed 20 2, approximately 90 percent burned or underburned. This was probably due to steep continuous slopes combined with the strongest east wind influence in the watershed. The majority of the subsequent large fire events in the watershed occurred within the 1790-1799 event. This was probably due to heavy fuel loadings of large dead material that fell to the ground and carried the fire. The lack of large woody material on the ground in most of these areas support this scenario. Based upon Figure 1.2-1, 100 to 200 years ago Subwatersheds 20 1 and 20 2 on the north side of Salt Creek (south facing aspects) had very frequent stand development events and were probably very open with pockets of trees.


Salt Creek Watershed Analysis
Figure 1.2 - 1:
Occurrence of Wildfire
Over the Last 200 Years
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Historic Fires
N
0 1 2 3 Miles
1:150000

Wildlife Species and Habitat

General Terrestrial (Including Spotted Owls and Other Late-Successional Species)

The range of elevation, aspect, slope, and soil types described previously contribute to a wide ranging diversity of wildlife habitat types within this watershed. As described in the Vegetation section, timber harvest and wildfire have contributed greatly to the diversity of stand conditions and stand ages present within the watershed.

Habitat for northern spotted owls and other late seral dependent species such as northern goshawk, brown creeper, American marten, and red tree vole is found in a variety of stand sizes and configurations throughout the watershed.

Higher elevation areas within the watershed provide habitat for high-elevation associates such as fisher and great gray owls. Wolf Mountain and Bunchgrass Ridge provide western extensions of high elevation habitat and link these areas to the High Cascade Plateau in the eastern portion of the watershed. Lower and mid elevation habitat predominates in the remainder of this watershed, and provides important wintering ground for numerous altitudinally migratory wildlife species such as Roosevelt elk.

Appendix E contains a list of species expected to occur within the watershed along with their guild identification. Many of the vertebrate species expected to occur on the Willamette National Forest (327 species of birds, mammals, reptiles and amphibians combined; USDA, 1995) have suitable habitat, and are expected to occur within this watershed. The distribution of these species and their aggregation into communities vary with the distribution of plant communities, vegetational condition, and climatic conditions across the landscape.

Federally listed threatened or endangered species known to use or occupy habitat within this watershed include northern bald eagle, American peregrine falcon, and northern spotted owl. In addition, notable terrestrial species listed as threatened or sensitive by Oregon Department of Fish and Wildlife, candidates for Federal listing, or ROD and J2 wildlife species of concern (USDA, USDI, 1994b) that have been documented (indicated by a "D" after the species in the following species list) or that have potentially suitable habitat within this watershed include: great gray owl (D), flammulated owl, northern pygmy owl (D), northern goshawk (D), harlequin duck (D), common merganser (D), black-backed and three-toed (D) woodpeckers, black swift (D), American marten (D), fisher (D), California wolverine (D), Pacific western big-eared bat, and red tree vole.

Aquatic Habitat

Reports made during 1937 stream surveys indicate that approximately 25 miles of habitat were available for spring chinook salmon and bull trout in the Salt Creek watershed including the mainstem of Salt Creek, South Fork Salt Creek, Eagle Creek as well as the lower reaches of many of the larger tributaries to Salt Creek.

In many Salt Creek tributaries as well as in the upper reaches of the mainstem of Salt Creek, waterfalls create year-round upstream migration barriers for fish. In addition to these natural barriers, numerous road/stream crossing culverts create additional barriers to the upstream migration of fish and have resulted in isolated resident populations of fish in some of these tributaries.

Habitat complexity in streams and localized stream bank stability has in many areas been reduced below natural levels due to removal of in-channel large woody material during "clean-out" projects such as those occurring after the 1964 flood.

Significant diversity exists in the numerous lakes and ponds that are mostly located in or adjacent to wilderness areas. The majority of the lakes within the watershed can be categorized as being either oligotrophic or ultraoligotrophic. These classifications mean the lakes have low to very low concentrations of nutrients in the water and low organic production.

Fish

Salt Creek historically supported runs of spring chinook salmon. Migration was blocked in the 1950's with the construction of Lookout and Dexter dams on the Middle Fork of the Willamette, downstream from Oakridge. Bull trout are believed to have inhabited the watershed but there have been no official sightings in recent years (although anglers reported catching a bull trout in the lower reaches of the mainstem of Salt Creek in the summer of 1992 &

1996). Bull trout numbers are thought to have declined in this watershed due to a lack of an anadromous fish prey base, dam construction, and habitat decline.

The Salt Creek watershed contains a variety of native resident fish species. Wild populations of cutthroat and rainbow trout exist throughout the watershed. The lower reaches of the mainstem of Salt Creek are stocked by the Oregon State Department of Fish and Wildlife with rainbow trout. Non-game fish species, mountain whitefish, sculpin, lamprey, speckled dace, largescale suckers, squawfish and redsided shiners, also exist throughout the watershed.

Brook trout are the only known non-native fish species in the Salt Creek watershed. Brook trout have been stocked in many of the high lakes in this watershed. Brook trout have been observed only in the mainstem of Salt Creek above the falls, Deer Creek, Diamond Creek and Fall Creek.

The Salt Creek watershed contains several lakes, located primarily in wilderness areas. Many of these lakes were originally fishless. Most of the larger wilderness lakes have been stocked with fish species such as rainbow trout, cutthroat trout, and brook trout. Many have naturally reproducing populations. The introduction of fish to naturally fishless lakes in the North Cascades in Washington has been shown to affect amphibian, macroinvertebrate, and zooplankton populations (Liss, 1991). It is possible that similar results have occurred in the Salt Creek watershed. These effects may be due to competition for food or due to the fact that these organisms are often prey for introduced fish species.

There is potential for the reintroduction of spring chinook and bull trout into this watershed if a method can be developed to capture and transport migrating juveniles downstream where they could be released below Lookout and Dexter dams. The low summer water temperatures of the upper Salt Creek watershed and many of its larger tributaries would be suitable for the reintroduction of bull trout and spring chinook salmon.

Amphibians

There are several sensitive amphibian species known or likely to occur in the Salt Creek watershed, including the tailed frog, red-legged frog, Oregon spotted frog, cascade frog, Oregon slender salamander, and the western toad.

Macroinvertebrates

There is not much information available on the macroinvertebrate species occurring in much of the watershed, however, several sensitive species of aquatic insects are known to occur on the Willamette National Forest.

SOCIAL ASPECTS

MANAGEMENT HISTORY

The Salt Creek watershed has been visited by people for perhaps 10,000 years. Historic, archaeological and paleoclimatic research in the watershed suggests that people adapted to changing conditions and influenced the development of their environment, especially over the last 150 years.

Native Americans

At the time of European exploration, at least three tribes are thought to have used the Salt Creek watershed. The Molala are believed to have had winter villages in the Oakridge/High Prairie area and, with the Kalapuya of the Willamette Valley, to have seasonally visited the higher elevations of the watershed. In later times, possibly after the arrival of the horse, the Klamath made trips into the area on their way to the Willamette Valley to trade.

Over 40 archaeological sites representing seasonal base camps and campsites of a more temporary nature have been found in the Salt Creek watershed to date. The majority of these sites are located in lower elevation terraces or meadows and prairies which were much more extensive before Euro-American settlement.

There is good evidence from General Land Office survey plats, explorer's journals and tribal oral history that fire was used as a tool to maintain a more open landscape. Both prairie fires and underburning were techniques used to hunt game and to ensure the return of berries, roots, and other important plants.

The local tribes were nearly decimated by the epidemic diseases and social dislocation that followed the arrival of fur trappers, explorers, and settlers between 1790 and 1840. A few well-known Molala, especially Charlie Tufti and Jim Chuck Chuck, remained in the Oakridge area and shared their skills with the new settlers. Many of the descendants of local tribes are currently part of the Siletz, Grande Ronde, Warm Springs, and Klamath reservations.

The Homestead Era

The majority of early settlement in the Oakridge area was along the mainstem of the Middle Fork Willamette River. A few homesteads were claimed on the lower portions of Salt Creek near Oakridge. No mining claims were made in the watershed.

Beginning in 1914, the Forest Service permitted grazing allotments in the Salt Creek watershed for cattle and sheep. Animals were trailed up Salt Creek to allotments at Bunchgrass Meadows.

Administrative History

In 1891, Congress gave the President the power to create forest reserves from public domain. In 1897, Congress passed the Organic Administration Act which provided for the administration of the reserves, including controlling forest fires. The early Forest Service embarked on a ground patrol system of fire detection in the early 1900's, using rangers on horseback covering a system of trails and vantage points connected to ranger stations by telephone lines. In the Salt Creek watershed, lookout sites or stations were established on Heckletooth Mountain, Little Bunchgrass and Fuji Mountain.

The Southern Pacific Railroad was extended through the Salt Creek watershed from 1911-1926. McCredie Hot Springs was developed in 1914 under lease to John Hardin of Portland. The resort was destroyed by fires in the late 50's and early 60's. The remains were washed away in the flood of 1964.

A system of trails was constructed which accelerated greatly with the advent of the Civilian Conservation Corps, from 1933 to 1942. This labor force made possible the construction of a system of trails and bridges with shelters, guard stations, lookout towers and associated buildings, as well as ranger stations. The Oakridge CCC Camp was located to the south of Salmon Creek and west of the Fish Hatchery. Their projects included development of the Blue Pool Campground and construction of the Cottonwood Ranger Station.

Forest Management

Commercial logging within the watershed began with the construction of the Davis-Weber sawmill in 1920. From 1920 through 1924, about 328 acres were logged in the lower portion of the watershed.

CURRENT MANAGEMENT DIRECTION

The Willamette National Forest Land and Resource Management Plan (USDA, 1990) prescribes land uses by assigning various Management Area designations to land within the Forest. The Salt Creek watershed contains 23 management areas (Table 1.3-1 and Figure 1.3-1 of this chapter). Late-Successional Reserve RO220 Assessment also provides specific management direction for portions of this watershed.

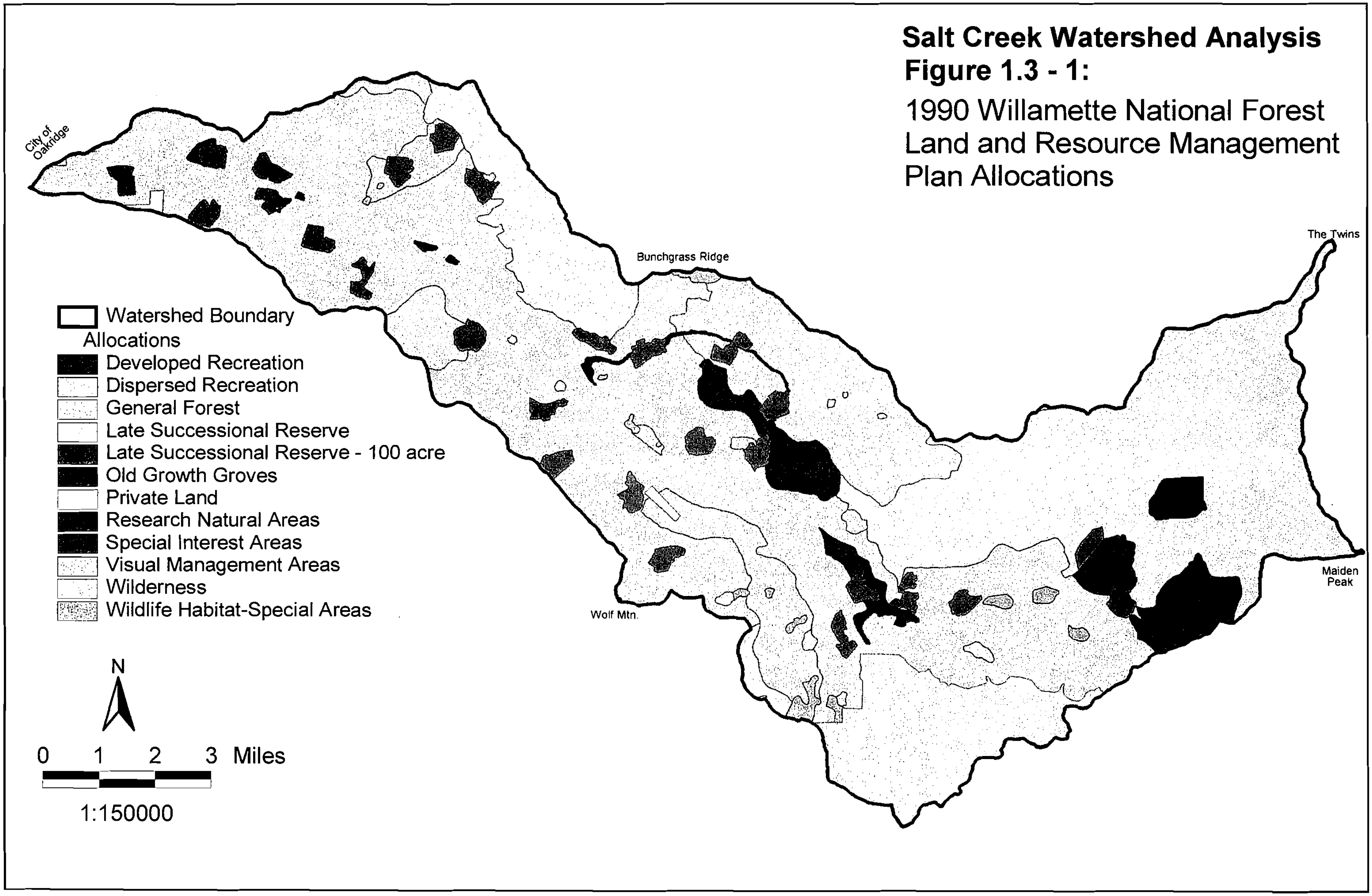

Salt Creek Watershed Analysis
Figure 1.3 - 1:
1990 Willamette National Forest
Land and Resource Management
Plan Allocations
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Allocations
Developed Recreation
Dispersed Recreation
General Forest
Late Successional Reserve
Late Successional Reserve - 100 acre
Old Growth Groves
Private Land
Research Natural Areas
Special Interest Areas
Visual Management Areas
Wilderness
Wildlife Habitat-Special Areas
N
0 1 2 3 Miles
1:150000

Table 1.3-1: Ownership Pattern and Willamette National Forest Plan Management Areas as Amended

Management Area	Description	Acres	Percentage
1	Wilderness	4,855	6.8
10a	Dispersed Recreation - Roaded Natural	263	0.4
10c	Dispersed Recreation - Semi primitive Motorized	963	1.3
10e	Dispersed Recreation - Semi primitive Nonmotorized	14,095	19.6
10f	Dispersed Recreation - Lakeside setting	193	<1
11a	Scenic, Modification Middleground	6,979	9.7
11c	Scenic, Partial Retention Middleground	8,632	12
11e	Scenic, Retention Middleground	255	<1
11f	Scenic, Retention Foreground	3,532	4.9
12a	Developed Recreation - Forest Service Site	79	<1
12b	Developed Recreation - Special use Permits	1,222	1.7

Management Area	Description	Acres	Percentage
14a	General Forest - Intensive Timber Management	6,975	9.7
15-1	Class I Riparian Reserve	2,338	3.3
15-2	Class II Riparian Reserve	3,288	4.6
15-3	Class III Riparian Reserve	1,238	1.7
15-4	Class IV Riparian Reserve	4,377	6.1
15-L	Lake Riparian Reserve	876	1.2
15-WSH	Wet Special Habitat Riparian Reserve	708	1.0
16a	Late-Successional Reserve	3,743	5.2
16b	Late-Successional Reserve - 100 acre	3,277	4.6
4	Research Natural Areas	408	0.6
5a	Special Interest Areas	1,858	2.6
7	Old Growth Groves	450	0.6
8000	Private Land not in Riparian Reserve	94	<1
9d	Wildlife Habitat - Special Areas	609	<1
WA	Major Water Bodies	463	<1

Total Acres in watershed = 71,770

RECREATION EXPERIENCES

Scenic Values

The scenic resources of the Salt Creek valley are shaped by ongoing geological and biological processes. The lower elevations are characterized by relatively steep, densely forested canyon walls, a diversity of managed and old-growth Douglas-fir stands, and riparian and wetland vegetation. As the visitor ascends by forest roads, the vista opens onto a flat, glaciated valley where dispersed camping is popular. Continuing up to Salt Creek Falls, one climbs from the old Western Cascades geologic province to the High Cascades landscape of rolling terrain, mantled by pumice and ash. Punctuated by views of volcanic features such as Mt. Yoran and Diamond Peak to the south, this landscape is generally forested with Pacific silver fir and mountain hemlock stands.

The Willamette Forest Plan Visual Quality Objective for the lower portions of the watershed adjacent to Salt Creek is Partial Retention foreground.

Among the special places of scenic interest in the watershed are the Salt Creek Falls, the McCredie Hot Springs, Gold Lake Bog Research Natural Area, Willamette Pass Ski area, and Big Bunchgrass Meadows. The upper Salt Creek watershed contains several trailheads accessing the Waldo Lake basin. Expansive scenic views of the Diamond Peak Wilderness area exist from Highway 58.

Developed Recreation

Only two campgrounds have been developed within the watershed. Blue Pool and Gold Lake campgrounds are both popular with local people and people traveling along Highway 58. Gold Lake campground is especially popular with anglers.

The Trail System

The most popular trails for hiking are the Eugene to Crest trail, Diamond Creek falls, and the Pacific Crest trail.

Dispersed Camping

The majority of the dispersed camp sites are located along Salt and South Fork of Salt Creek because they offer easy road access and proximity to the river. The use is most concentrated in the lower portion of Salt Creek, especially during hunting season.

The Waldo Lake Wilderness area provides numerous primitive camp sites, concentrated mainly at Salt, Gander, and Swan Lakes.

Swimming and Boating
Swimming holes in lower Salt Creek and the higher elevation lakes are used for swimming. There is currently some kayak and small raft use on lower Salt Creek in the Spring.

Hunting and Fishing
The watershed is very popular with both elk and deer hunters, and the majority of use at dispersed sites takes place during the hunting season. Salt Creek receives use mainly by local anglers, who take mainly hatchery-stocked rainbow trout.

Winter Recreation
The Willamette Pass area is very popular during the winter months. Downhill skiing at Willamette Pass Ski Area; Nordic skiing on groomed trails at Willamette Pass Ski Area and ungroomed Forest Service trails at Gold Lake Sno-Park and Salt Creek Falls; and snowmobiling at the Waldo Sno-Park. Winter use varies from year to year depending upon the snow conditions. Winter recreation visit occasions range from approximately 124,100 in 1994 to 74,962 in 1996.

COMMUNITY-BASED RECREATION AND RELATED ECONOMIC BENEFITS
Surrounded by forest lands, the community of Oakridge is heavily reliant on recreation and extractive resources for its economic base. Since World War II, the Forest Service has played an increasingly important role in community planning and development.

Community-Based Recreation
People in Oakridge use the forest for recreation, especially hunting and fishing. Hunting still retains the character of a subsistence activity for many people in this community.

The Salt Creek watershed has the potential to provide the setting for increased recreation use.

Firewood
Firewood was the major source of heating fuel in local communities prior to rural electrification. It persisted as a major source in timber dependent communities such as Oakridge until the 1970's, when air pollution became an issue. A booming timber industry allowed for an ample supply of log decks where firewood could easily be obtained for very small fees.

Since the 1970's, more efficient wood stoves and pellet stoves, as well as the increasing availability of natural gas in the Eugene-Springfield area have reduced the demand for firewood. With reduced timber harvests in the 1990's, suitable log decks have become scarce, and any sizable area of timber blowdown is reserved for commercial salvage sales. Areas that have been administratively or Congressionally withdrawn place additional constraints on the availability of firewood. In the current year, two thirds of the permits issued by the Oakridge Ranger District were for the Deschutes National Forest, where firewood is more plentiful. Only portions of the lower Salt Creek watershed are available for firewood collection. Permits for single logs, found by the permittee, comprise the majority of the wood permits issued. In the past year, only 21 of the 146 firewood permits issued on the Oakridge Ranger District were for the Salt Creek watershed area. Most of these single logs permits are issued to residents of the Oakridge and Westfir community.

Special Forest Products
Special forest products such as ferns, boughs, beargrass, salal, and other plants are commercially extracted from the watershed. Huckleberries have the potential to become a more important product in the future.

Source of Raw Materials and Jobs
Traditionally, local people have worked in the woods as loggers and truck drivers, and in the sawmills and related businesses. Timber harvesting in this watershed helped supply the Pope and Talbot Mill that existed in Oakridge from the 1940's until it closed in 1989. The Pope and Talbot mill site is currently owned by the City of Oakridge. The

industrial site has received some environmental clean up and is now the site of several secondary wood products businesses, with more development planned.

An average of 28 million board feet of timber has been harvested per year since logging began in this watershed, about 55 years ago. A grand total of about 1.6 billion board feet has been harvested to produce lumber and plywood products from this watershed. This timber harvesting and associated mill processing created many jobs over the years, as further discussed in the FEIS for the Willamette National Forest Plan on pages III-213 to 235.

As the supply of timber from National Forest lands declined in the 1990's, tourism and special forest products have played a more important role in the local economy. However, Oakridge is still home to a number of people who make their living cutting, yarding or hauling trees, or working for the Forest Service.

ISSUES & KEY QUESTIONS

CHAPTER II

ISSUES AND KEY QUESTIONS

INTRODUCTION

The main purpose of this Watershed Analysis is to facilitate, direct, and support management activities and decisions by providing decision makers with current resource information and a priority listing of various potential management activities. Therefore, the issues identified in this Watershed Analysis are focused on past, current, and expected future management activities and how they affect the current and reference conditions. Individuals using this analysis during project development should find it to be user-friendly. They will be able to find direct references to the activities they are contemplating rather than having to sort through a number of resource discussions to find references to the activities in question.

Key questions have been developed for each issue. These are questions that need to be answered in order to understand how human activities may affect the processes occurring in the watershed. They are also those questions which most need to be answered in order for decision-makers to make fully informed decisions about current and proposed management and social activities in this watershed.

Key questions are answered in the last two chapters of this analysis: Interpretation and Recommendations. These conclusions are a synthesis, by issue, of the Reference/Current Conditions (Chapter III) and the answers to the Key Questions.

***ISSUE #1* - INTENSITY AND PATTERN OF VEGETATION MANIPULATION RELATED ACTIVITIES**

Timber harvest and associated activities such as slash disposal, reforestation, and precommercial thinning have played a significant role in shaping the vegetation patterns within this watershed, since fire suppression began near the beginning of this century (see Issue 2). Timber harvest for lumber production has been occurring in this watershed for about 55 years on federal land and for over 100 years on private land. This has resulted in a substantial economic benefit to local communities and the nation as a whole. Wildlife forage enhancement activities, such as brush cut-back, seeding, and fertilizing have also played a role, but to a lesser extent.

The intensity of vegetation manipulation activities, especially timber harvest, may be considerably outside the historic range of conditions which would have resulted from wildfires. The amount of stand replacement due to regeneration harvest over the past 55 years has been 17,917 acres, or 25 percent. This amount has ranged from 593 acres to 7,044 acres per decade. The amount of stand replacement due to wildfire in the last 200 years has been 122 percent, ranging from 5 acres to 12,075 acres per decade (the 5 acre decade occurred after fire suppression became standard practice). Continuation of past harvest intensities could ultimately result in low amounts of late-successional (80 years and older) forest at any given time in certain areas within the watershed and could result in eliminating late-successional forests on all but those acres reserved from harvest (such as wilderness and other non-harvest allocations and reserves).

The intensity of application of vegetation management activities (again, especially timber harvest) may have also had an effect on hydrological processes. Such effects may include increases in surface erosion, mass movement rates, peak stream flows, water quality, and water yield. Another effect has been the deterioration of stream channel conditions.

The pattern of vegetation manipulation activities across the landscape, especially harvest of timber, has resulted in fragmentation of late-successional forests, isolation and/or removal of riparian forests, a reduction in connectivity, and a net reduction of late-successional forest due to edge effects. These changes may have had a profound effect on the amount and quality of interior habitat and the dispersal of native and non-native plants and animals across the landscape. They have also created a pattern that is not natural, except on acres reserved from harvest.

Timber harvesting and associated activities have also reduced the bio-diversity and site productivity of the replacement stands and riparian areas of some harvest units. Most or all the large woody debris has been removed from some harvested stands. Regenerated stands were often planted densely to avoid reforestation failure. They were also typically planted with fewer species than occurred on the sites prior to harvest. Precommercial and commercial thinning have tended to homogenize stands by making the tree spacing, diameter, and species distribution more uniform. Where late-successional forests still exist, some have been salvaged leaving few snags and down logs on the ground or in streams. Certain species, such as Pacific yew, were removed, resulting in replacement stands with less vertical structure and species diversity than natural stands tend to have.

ISSUE #1 KEY QUESTIONS

1) Given current land allocations in the Willamette Forest Plan, as amended by the Northwest Forest Plan, what is the location and acreage of areas that are available for regeneration harvest for the next two decades and for commercial thinning, by decade, for the next 50 years?

2) How has the intensity and pattern of vegetation manipulation affected native and non-native plant and animal habitat diversity, species composition, guild viability, amount of interior habitat, and habitat connectivity?

3) How has the intensity and pattern of vegetation manipulation affected trails, recreation, aesthetics, special forest products, and firewood availability?

4) Where and to what extent has the change in spatial and temporal distribution of vegetation influenced the potential for water yield, water quality (especially water temperature), and peak flow changes?

5) What are the most important delivery mechanisms for sediment generated by vegetative manipulation in this watershed? What are relative amounts of sediment delivery to streams by these mechanisms? Where are the high risk areas?

6) Where and to what extent has removal of existing and future sources of large wood material in stream channels affected in-stream habitat condition? Where and to what extent has vegetation manipulation affected channel function and riparian habitat condition and its contiguity?

7) How have our vegetation management practices affected any domestic water supplies?

8) How will we protect small wetlands, seeps, and springs from management activities?

***ISSUE #2* - THE EXCLUSION OF NATURAL FIRE FROM THE ECOSYSTEM HAS ALTERED THE NATURAL PROCESSES**

Fire suppression, over the last seven decades, has reduced the impact of wildfire as a major shaper of vegetational landscape patterns and processes.

Given the amount of land affected by fire over the last few centuries (see the fire frequency discussion under Issue #1), this suppression effort may have had a number of vegetational effects across the landscape. For example, meadow sizes and abundance have been shrinking as trees encroach upon them; forest structure may have become more complex in some areas; the landscape distribution of natural forest age classes may have become less diverse in some areas; populations of some fire dependent species may have declined (such as lodgepole pine, *Montia diffusa*, and *Astragalus spp.*); and fuel loading across the landscape may have increased in some areas. However, as described in Issue #1, other areas have been treated to reduce fuel loading.

Continued fire exclusion in this watershed could have several negative consequences on long-term landscape processes. Increasing fuel accumulations may ultimately result in fires that are more frequent, more severe, larger, and less suppressible. Continued fire exclusion may result in an increase in insect and/or disease outbreaks on harsher sites where dense stands may develop in the absence of fire. It could also result in positive changes in long-term site productivity as more organic material accumulates, and negative changes as fires burn more intensely.

Fire exclusion may have increased the habitat available for threatened, endangered, and sensitive (TE&S) species such as spotted owls as forests become more structurally complex in terms of understory layers and snag and down wood accumulation. However, increasing fuel accumulations may be of special concern within the Late-successional Reserve (LSR), where there is much less opportunity for vegetation management activities to modify fuel accumulations and where there are or will be more contiguous fuel beds accumulating, which could lead to larger and more severe wildfires in the LSR.

ISSUE #2 KEY QUESTIONS

1) Fire pattern, fire behavior, and burn intensity are affected by fuel loading conditions. How do current conditions compare to fuel loading conditions before the advent of fire suppression? What areas are at high risk?

2) If we utilize prescribed fire within established forest stands (as opposed to post-harvest site preparation) in order to reduce high fuel loading and bring the landscape back to the reference condition, under what conditions could we control the fire? How many acres (per period of time and allocation) and under what conditions could we prescribed burn and still remain within air quality limits, and where are the high priority areas?

3) Under a reference condition fire regime, what would the habitat diversity look like? Where could prescribed fire help us to re-establish or maintain the reference condition?

4) How would prescribed fire affect TE&S and ROD species habitat, fire dependent plant species, big game habitat, and aquatic species habitat?

***ISSUE #3* - THE DENSITY, CONDITION, USE, AND LOCATION OF TRANSPORTATION SYSTEM HAS ALTERED THE LANDSCAPE PROCESSES AND INFLUENCED WILDLIFE HABITATS**

This watershed currently contains 224.1 miles of system and non-system roads and approximately 79 miles of maintained trails. About 52 miles of these roads are seasonally closed for a variety of reasons, most commonly to avoid traffic related wildlife disturbance, although some of these roads are used occasionally for administrative use, e.g., fire suppression. Approximately 9 additional miles of road are closed year around. This extensive road system is for the most part a direct result of past timber harvest as discussed in Issue #1. The system also provides access for recreational activities as well as administrative uses such as fire suppression. The roads in this system were generally designed for a 20 year service life. Roads that have reached their 20 year service life and have not been reconstructed are beginning to deteriorate. There are about 7.8 miles of non-system road that do not meet current standards for management.

Roads can result in increased peak flows as a result of vegetation removal, as with timber harvest (see Issue #1). Roads also increase peak flow by providing for more efficient slope drainage. Roads may increase the amount of mass movement and magnitude of peak stream flow because they often intercept and re-direct the surface and sub-surface flow of water.

Effects on wildlife and plants include elimination or creation of wetlands or a change in the hydrologic character of special habitats (for example the drainage of a moist meadow). Roads can also affect the connectivity of habitats. They fragment habitat for organisms that find it difficult to cross small bare openings and for organisms that find stream culverts impassable. Road and trail use has the potential to disturb wildlife and affect species viability. Roads and trails can be a vector for the spread of non-native plants.

An extensive road system can have beneficial impacts by providing access to large areas for various recreational activities such as hunting, fishing, dispersed camping, hiking, mountain biking, and driving for pleasure. Road closures can limit these opportunities and concentrate use in areas with more open roads, which could create resource problems. Local economies can be positively or negatively affected by changing the amount and ease of access, changing traffic patterns, recreational uses, and the availability of firewood and special forest products.

A portion of the road system is deteriorating and funds are no longer available for proper maintenance of the entire road system. Roads that are not properly maintained can cause sediment delivery to streams as a result of ditch and roadbed erosion. Maintenance needs, including culvert upgrading, need to be prioritized to most effectively make use of the limited maintenance funds. The Northwest Forest Plan standards and guidelines require existing culverts, bridges, and other stream crossing structures which pose a substantial risk to riparian conditions to be improved to accommodate at least a 100 year flood event. Many stream crossing structures do not meet this design criteria and correcting this situation would entail a substantial cost that is not now funded.

Recovery and growth of riparian vegetation immediately upstream from bridges and large culverts could result in the accumulation of large amounts of woody debris. This could ultimately threaten the stream crossing structure as well as down-stream resources.

<u>ISSUE #3 KEY QUESTIONS</u>

(Transportation Systems - Road (system and non-system), trails, and railroads)

1) Where does the density, condition, location, and use of roads and railroads result in high risk of disturbance (i.e. landslides, surface erosion, slope movement)?

2) Where and to what extent have the presence, patterns, and use of roads and trails affected native and non-native plant and animal habitat diversity, species composition, guild viability, amount of interior habitat, habitat connectivity, and riparian reserves?

3) Where has the density and location of roads affected hydrological function (i.e. wetlands, stream characterization, expansion of the drainage network, and streamflows)?

4) What are the potential resource effects of not maintaining all the roads in this road system due to lack of funding?

5) Where are the high risk or high priority road/stream crossings which do not have drainage structures designed to withstand 100 year events?

(ACCESS)

6) How does changed access influence the potential for human caused fire ignitions, suppression response time, and the amount of acres burned?

7) How does changed access, including impacts from recent floods, affect public and administrative use of the forest?

8) What would be the risk of a hazardous material spill from Highway 58 or the Southern Pacific Railroad?

9) What is the current method of response to a hazardous material spill in the transportation corridors?

<u>ISSUE #4</u> - AQUATIC COMMUNITIES MAY HAVE BEEN CHANGED FROM REFERENCE CONDITIONS DUE TO THE INTRODUCTION OF NON-NATIVE SPECIES MIGRATION BARRIERS AND OTHER MANAGEMENT ACTIVITIES, MIGRATION BARRIERS, AND OTHER MANAGEMENT ACTIVITIES

The introduction of fish to naturally fishless lakes may have effects on naturally occurring populations of amphibians and aquatic insects through competition and predation. Introductions of other non-native species such as bull frogs have also had effects on the native aquatic species.

Restoration of salmon, steelhead trout, and bull trout runs could also create some negative effects such as increased recreational impact in riparian areas.

<u>ISSUE #4 KEY QUESTION</u>

1) What are the effects of introduction of non-native species on native aquatic communities?

<u>ISSUE #5</u> - THERE IS A CONCERN FOR HOW EXISTING AND PROPOSED DEVELOPED AND DISPERSED RECREATION MAY HAVE EFFECTED LANDSCAPE PROCESSES AND WILDLIFE HABITAT

<u>ISSUE #5 KEY QUESTIONS</u>

1) What are potential impacts from recreation use on native and non-native plant and animal habitat diversity, species composition, and habitat use?
2) Do recreational use and facilities affect water quality?

3) What are potential impacts from proposed recreation (development of winter sports recreation, Willamette Pass ski area expansion, McCredie Springs, and Waldo Sno-park)?

REFERENCE AND CURRENT CONDITIONS

CHAPTER III

REFERENCE AND CURRENT CONDITION

GEOLOGY, SOILS, AND PHYSICAL PROCESSES

GEOLOGY

The Salt Creek Watershed Analysis area lies within two physiographic processes of the Cascade Range: High Cascade and Western Cascade. The division between these two provinces approximately bisects the watershed along a north-south line through Diamond Peak (Woller and Black 1983). Salt Creek Falls is also bisected by this north-south line.

The topography west of this division has been formed primarily by the processes of stream erosion and glaciation. U-shaped valleys were the result of the glaciers and formed the three major streams in the watershed: Salt Creek, South Fork Salt Creek and Eagle Creek. Salt Creek Falls is a hanging valley formed when the glacier retreated. Stratified and unstratified glacial drift is present along most of Salt Creek, South Fork Salt Creek and Eagle Creek. This glacial drift occurs along an elevational band from 3,000 to 6,000 feet. Glacial outwash (moderately sorted sand and gravel) occurs near the mouth of Salt Creek and the City of Oakridge. Salmon Creek and Hills Creek also contributed to the glacial outwash in this area (Sherrod).

The topography east of this division consists of constructional volcanic landforms which have been modified primarily by glaciation (Woller et al. 1983). This area is largely composed of younger volcanic flows that overlay older deposits. This has resulted in a gently sloping topography.

The geology of the watershed is largely composed of Basaltic andesite. Ridge capping basalt is present on Kitson Ridge, Bunchgrass Ridge, Aubrey Mountain, and Coyote Mountain and is generally considered the youngest bedrock unit in the Western Cascades (Sherrod).

Prominent topographic features in the watershed are Mt. Yoran (7,100 ft) and Fuji Mountain (7,144 ft). These are Quaternary composite volcanoes which have been deeply eroded by glaciation (Woller and Black 1983).

SOIL CATEGORIES

Soil categories and mapping units are defined in the Soil Resource Inventory (SRI) Data Dictionary. Table 3.1-1 identifies the SRI mapping units in each soil category. Figure 3.1-1 displays the location of these soil categories within the watershed (Table 3.1-2). Figure 3.1-2 displays the relative area of soil categories by subwatershed.

Table 3.1-1. SRI Mapping Units by Soil Category

Soil Category	Definition of SRI Soil Category	SRI Mapping Units
Category 1	Nearly 100% clay soils	25, 35, 255
Category 2	At least 50% clay soils	335,356, 301U, 316, 6, 601, 602, 61, 610, 610U, 71, 8, 9, 91, 910
Category 3	Steep terrain and shallow soils	1, 2, 201, 203, 3, 301,301S, 31
Category 4	At least 50% steep terrain and shallow soils	212, 313, 5, 571, 614, 616, 7, 714, 914, 920, 941
Category 5	All others	13, 14, 15, 15W, 16, 162, 17, 23, 233, 33, 56, 63, 73, 92, 923, 93, 94, 95

Category 1
The SRI mapping units in this category consist of soils that are on gentle to moderately hummocky sideslopes (5 to 40 percent) and are from 6 to 12 feet deep. Additionally, they have a high clay content, and are occasionally associated with earthflow geomorphology.

Category 2
The SRI mapping units in this category include at least 50 percent of the mapping units described in Category 1. The behavior of the soil types in this category are similar to those outlined in Category 1 and are frequently associated with draws and swales on midslopes.

Category 3
The SRI mapping units in this category are characterized by steep terrain with shallow rocky soils. This category is likely to have high surface and subsurface erosion potential and the highest number of road and harvest related slope failures. The harvest related slope failures tend to be due to the loss of root strength after timber harvest or stand replacement wildfires. These slope failures most often occur where water is concentrated. The sediments produced are typically coarse grained

Category 4
The SRI mapping units in this category include at least 50 percent of the mapping units described in Category 3. The behavior of these soil types is similar to those outlined in Category 3, but at a lower frequency.

Category 5
This category consists of the remainder of the SRI units and complexes. This category represents a wide range of geomorphic settings which tend to be more stable.

Table 3.1-2. Acres of Soil Categories by Subwatershed

Soil Category	Subwatershed 20 1	Subwatershed 20 2	Subwatershed 20 3	Total Soil Category Acres
1	1,021	0	0	1,021
2	4,387	372	0	4,759
3	5,032	10,579	1,859	17,470
4	3,427	4,325	3,609	11,361
5	6,290	12,058	18,779	32,127

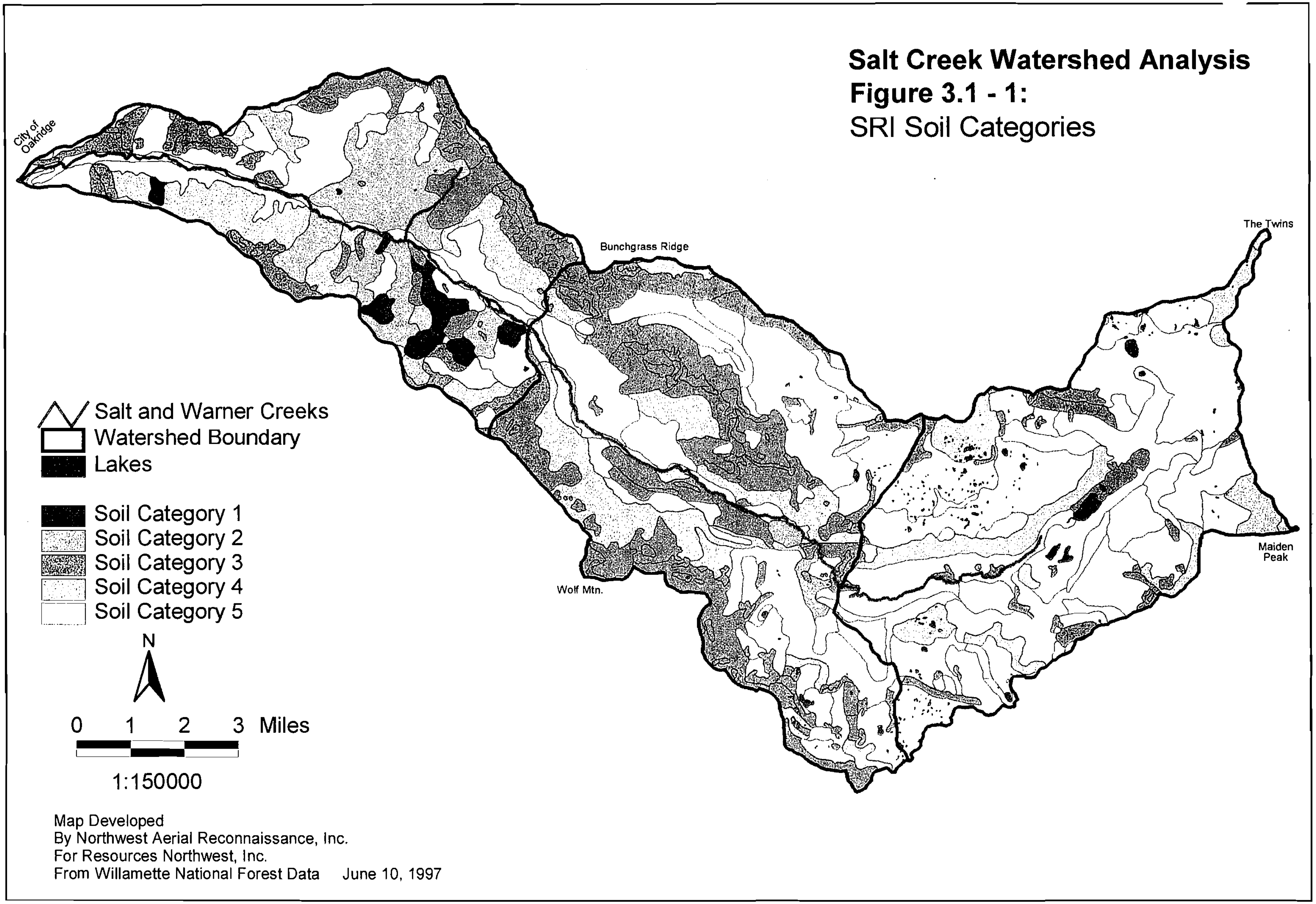
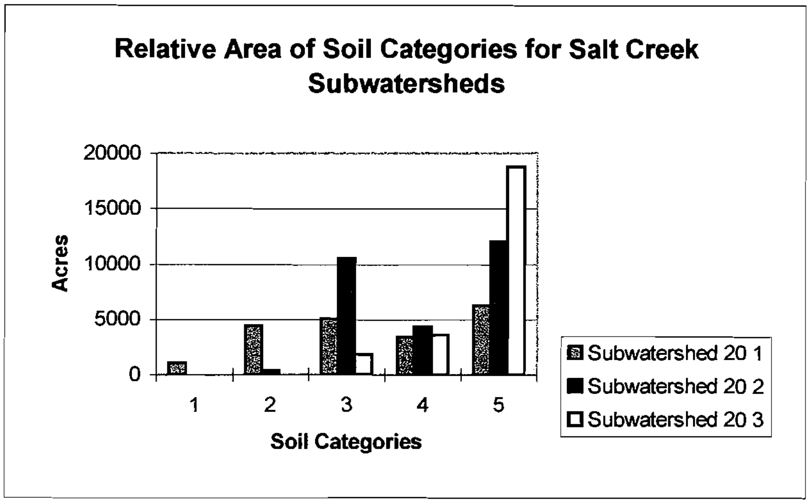

Salt Creek Watershed Analysis
Figure 3.1 - 1:
SRI Soil Categories
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Salt and Warner Creeks
Watershed Boundary
Lakes
Soil Category 1
Soil Category 2
Soil Category 3
Soil Category 4
Soil Category 5
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Figure 3.1-2. Acres of Soil Categories by Subwatershed



MASS WASTING

REFERENCE CONDITION

Geologically the reference conditions for the watershed are glacial and volcanic in its formation. Volcanic activity has been the source for material that has produced the landform for most of the watershed. Glacial activity is responsible for the most recent shaping of the landscape other than wind and water erosion.

Prior to land management activities in the 1940's, such as road building and logging, slope failures were typically localized slope movements in steep areas with deep soils, stream banks, and debris slides on steep slopes with thinner soils over shallow bedrock.

CURRENT CONDITION

The Watershed Inventory Needs (WIN) database which provides data on mass wasting locations, size and associated land use or mass wasting process was not available due to loss in a fire at the Oakridge Ranger District in Fall of 1996. There is some data available from stream surveys conducted in the watershed between 1990 and 1996. This data is limited to observed failures on stream slopes and sizes of failures are estimated. The following streams were recorded as having mass failures (Appendix H): McCredie, Warner, South Fork Salt, Eagle, Coyote, Fall, Diamond, and Deer Creeks. Of these, Warner and South Fork Salt Creek were the most unstable, having high numbers of failures.

There is a past active currently stable earthflow located at McCredie Springs north of State Highway 58. The toe of this earthflow has been active for years with the Union Pacific Railroad (UPRR) company needing to clear debris from their railroad tracks yearly. The size of this earthflow is approximately three square miles. The soils in this area are derived from pyroclastic material that weathers to fine silts and clays. These soils (categories 1 and 2) are very susceptible to sliding especially if saturated with water. Additionally, they can be expected to yield the greatest volume of fine grained sediments (Figure 3.1-3). Another earthflow is located near the railroad tracks at Wicopee. Debris slides can be found on Mt. David Douglas, Bunchgrass Ridge, and Judd Mt. (Mark Leverton, pers. comm.).

SURFACE EROSION

REFERENCE CONDITION

Natural occurring stand replacement wildfires are probably the closest comparison that can be made relating timber harvest (clearcut harvesting) with pre-historic conditions. High intensity fires and some medium intensity fires remove under brush and kill mature trees, creating abundant snags. The result is a loss of canopy closure and duff layers would allow a large amount of rain to fall upon bare soil. This can result in down slope movement of soil particles detached by raindrop impact and possibly by overland flow.

CURRENT CONDITION

When management activities started to occur in the watershed surface erosion from road construction and harvest increased. No quantitative information is available for amounts of sediment increase due to these activities, but all literature and visual observations show that sediment from roads is a major contributing factor adding sediment to streams.

Approximately 2,254 acres (3 percent) of the watershed has been burned since 1940. The locations of these burns can contribute surface erosion that is routed to roads and transferred to streams. Soil categories 3 and 4 can be expected to yield the greatest volume of coarse grained sediments which are often associated with debris failures (Figure 3.1-4).

SOIL COMPACTION

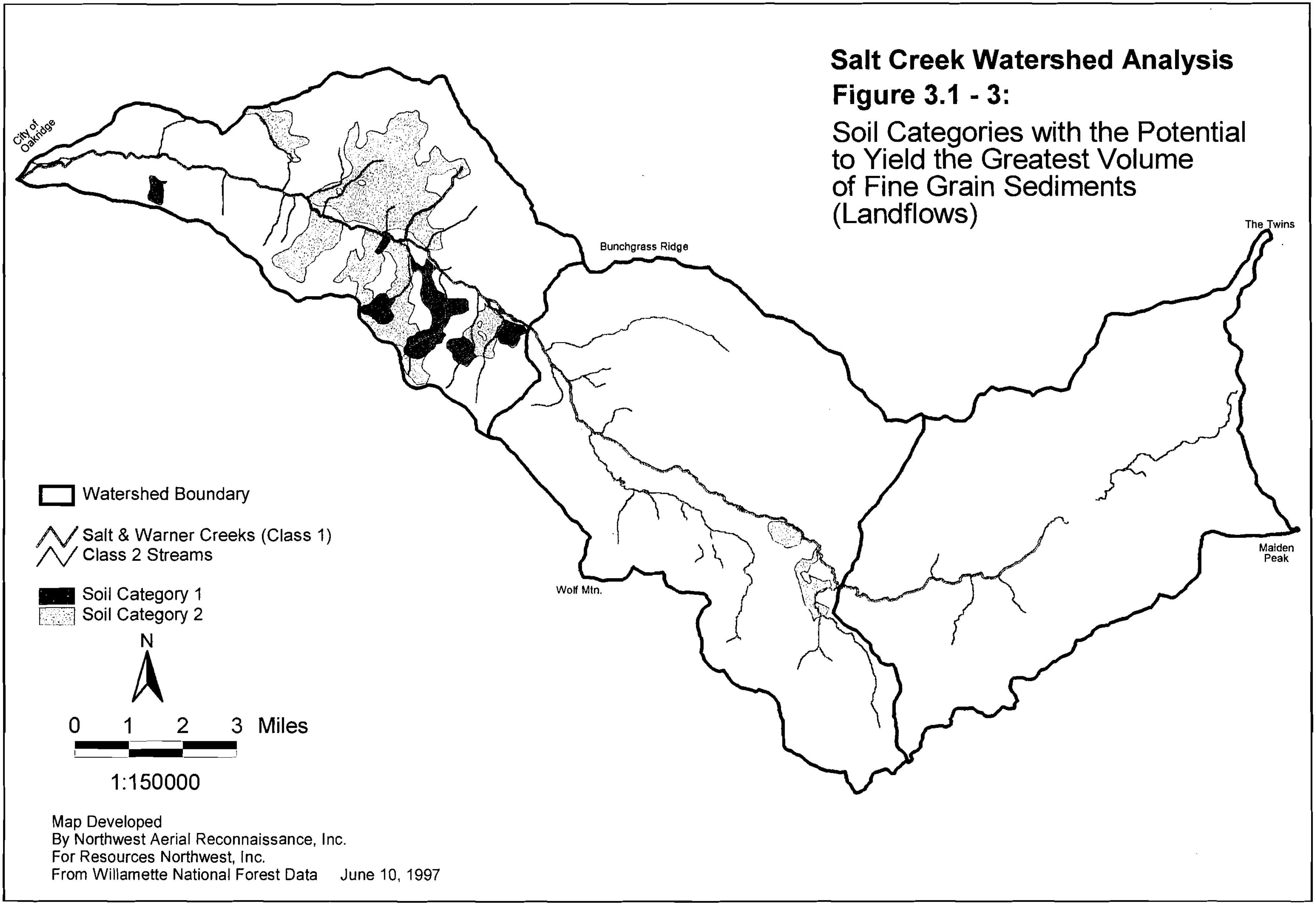
REFERENCE CONDITION

Soil compaction was rare prior to road building and timber harvest activities in the 1940's. There may have been a small amount of localized compaction caused by trails used by wildlife, humans. In addition, more widespread and sub-surface compaction occurred during glaciation.

CURRENT CONDITION

Tractor yarding began in the mid 1960's and would have been used extensively on slopes usually less than 35 percent. Data is currently not available to determine how many acres have been impacted by tractor yarding within the watershed.

Category 1 and 2 soils, which have a high clay content, would be the most susceptible to compaction regardless of the harvest method. Approximately 2,325 acres have been impacted by stand replacement timber harvest on soils with a relatively high clay content. Approximately 98 percent of this harvest type is located in Subwatershed 20 1.


Salt Creek Watershed Analysis
Figure 3.1 - 3:
Soil Categories with the Potential to Yield the Greatest Volume of Fine Grain Sediments (Landflows)
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Salt & Warner Creeks (Class 1)
Class 2 Streams
Soil Category 1
Soil Category 2
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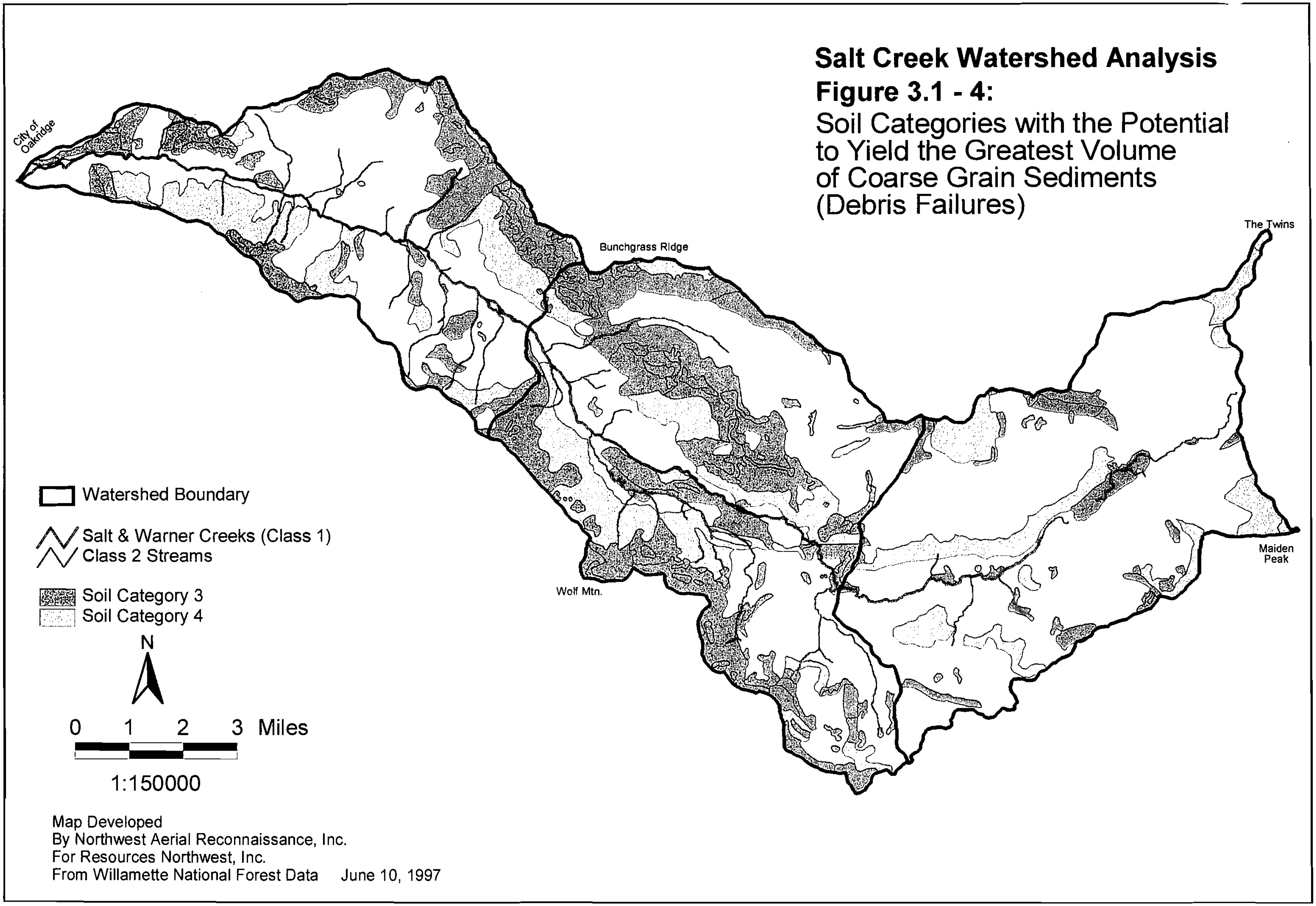
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997


Salt Creek Watershed Analysis
Figure 3.1 - 4:
Soil Categories with the Potential to Yield the Greatest Volume of Coarse Grain Sediments (Debris Failures)
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Salt & Warner Creeks (Class 1)
Class 2 Streams
Soil Category 3
Soil Category 4
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

SEDIMENT ASSOCIATED WITH ROADS

REFERENCE CONDITION

Very few roads were built in the Salt Creek watershed prior to the 1940's. The first road intrusions were railroads in the early 1900's, completion over Willamette Pass was in 1927. State Highway 58 was constructed in the late 1930's and was finished in 1940.

CURRENT CONDITION

Roads can contribute sediment to streams through runoff routed directly to streams from roadside ditches or by the formation of gullies below relief culverts, particularly on mid-slope roads. The probability of gully formation below a relief culvert has been significantly related to culvert spacing and hill slope steepness (greater than 40 percent) but not road grade (Wemple 1994). Figures 3.1-5, 3.1-6, and 3.1-7 display a map of roads on slopes greater than 40 percent for each subwatershed. These road segments are likely sources of management related sediment. The District Watershed Improvement Needs (WIN) database was lost to fire and data is not available for culvert spacing or culvert condition within the watershed.

Currently twelve planning subdrainages have a road density greater than 3 miles per square mile (Table 3.1-3). Subwatershed 20 1 contains eight of these planning subdrainages, followed by Subwatershed 20 2 with four.

Table 3.1-3. Road, Railroad and Trail Mileage and Total Road Density by Planning Subdrainage

Planning Subdrainage Name	Planning Subdrainage Number	Square Miles	Road Miles	Railroad Miles	Total Road Miles	Road Density mi/mi2	Trail Miles
Montieth Rock	20A	4.81	9.6	5.1	14.7	3.1	7.0
Gobel	20B	2.08	7.0	0.5	7.5	3.6	1.4
Basin	20C	3.93	15.1	2.2	17.3	4.4	1.8
Warner	20D	2.57	5.8	0.9	6.7	2.7	2.7
McCredie	20E	2.40	7.7	2.0	9.7	4.0	0.6
Side Salt	20F	3.28	8.2	1.9	10.1	3.1	0.2
Eagle Beak	20G	4.14	8.7	0.7	9.4	2.3	2.8
Verdun	20H	2.08	6.9	2.4	9.3	4.5	0.0
Swamp	20I	4.19	14.1	1.2	15.3	3.7	0.2
Eagle Head	20J	6.11	13.9	0.0	13.9	2.3	3.8
David Douglas	20K	6.94	9.1	1.0	10.1	1.4	1.3
Fuji Meadow	20L	4.21	8.2	0.0	8.2	1.9	5.3
Island Lake	20M	4.00	3.5	0.0	3.5	0.9	4.4
Lorin	20N	4.58	3.0	0.0	3.0	0.7	7.8
Skyline	20P	7.20	1.1	0.0	1.1	0.2	13.1
Marilyn	20Q	4.79	11.2	1.6	12.8	2.6	6.2
Abernathy	20R	6.29	10.1	3.5	13.6	2.2	4.7
Fall Creek	20S	6.63	5.2	1.0	6.2	1.0	4.7
Shady Cruzatte	20T	4.80	15.4	2.9	18.3	3.8	1.4
Noisy	20U	3.99	5.8	3.2	9.0	2.3	0.0
Coyote	20V	2.53	6.5	4.6	11.1	4.4	0.0
Wicopee Fields	20W	7.00	24.3	11.2	35.5	5.1	0.0
Cougar	20X	2.10	6.5	0.0	6.5	3.1	0.0
Tumble	20Y	4.63	14.2	0.0	14.2	3.1	0.5
Salt Head	20Z	6.96	2.6	0.0	2.6	0.4	9.1
Totals		112.24	223.7	45.9	269.6	66.8	79.0

Roads and trails in the watershed are often located in riparian areas and cross streams. These developments are sources of sediment and alter the hydrologic process. These areas are often sources of mass wasting events and surface erosion. A total of 575 stream crossings by roads and railroads exist in this watershed (Table 3.1-4). Subwatershed 20 1 contains the greatest amount of road and railroad crossings of streams. Subwatershed 20 3 has the fewest stream crossings by roads and railroads. Class IV streams have the highest incidence of road/stream crossings because they occur more frequently in this watershed.

Table 3.1-4. Number of Road and Railroad Stream Crossings by Stream Class

	Subwatershed						
	20 1		**20 2**		**20 3**		
Stream Class	**Road**	**Rail**	**Road**	**Rail**	**Road**	**Rail**	**Total Stream Class Crossing**
I	7	2	1	1	2	0	13
II	33	17	20	11	5	1	87
III	20	3	51	9	3	0	86
IV	162	56	85	41	32	13	389
Total by Subwatershed	222	78	157	62	42	14	575

STREAM MORPHOLOGY AND HYDROLOGIC PROCESSES

STREAM CLASSIFICATION AND DISTRIBUTION

REFERENCE CONDITION

The distribution of streams vary across the watershed due to changes in site specific characteristics including geology, soil properties, and rainfall. Historically there were approximately 30 miles of anadromous (Class I) habitat within the Salt Creek watershed before the damming of the Middle Fork of the Willamette River by the Lookout and Dexter dams in the 1950's. These dams had no fish passage facilities.

Stream class definitions are as follows:

Stream Class I

- Perennial or intermittent streams or segments that are a direct source for domestic use or used by large numbers of fish for spawning, rearing or migration. Stream flow contains enough water to be a major contributor to a Class I stream.

Stream Class II

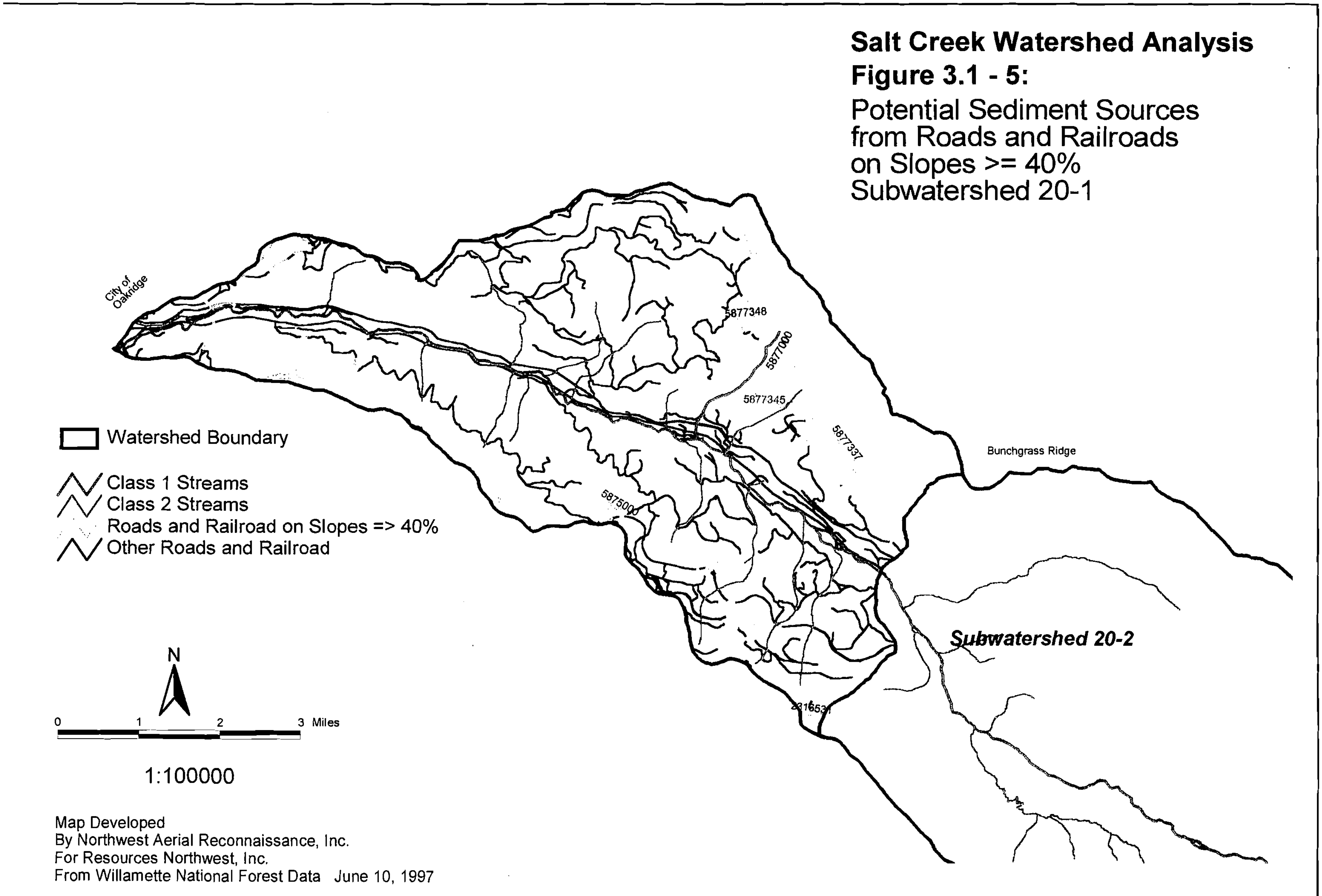
- Perennial or intermittent streams or segments used by moderate to significant numbers of fish for spawning, rearing or migration. Stream flow contains enough water to be a moderate contributor to a Class I stream, or be a major contributor to a Class II stream.

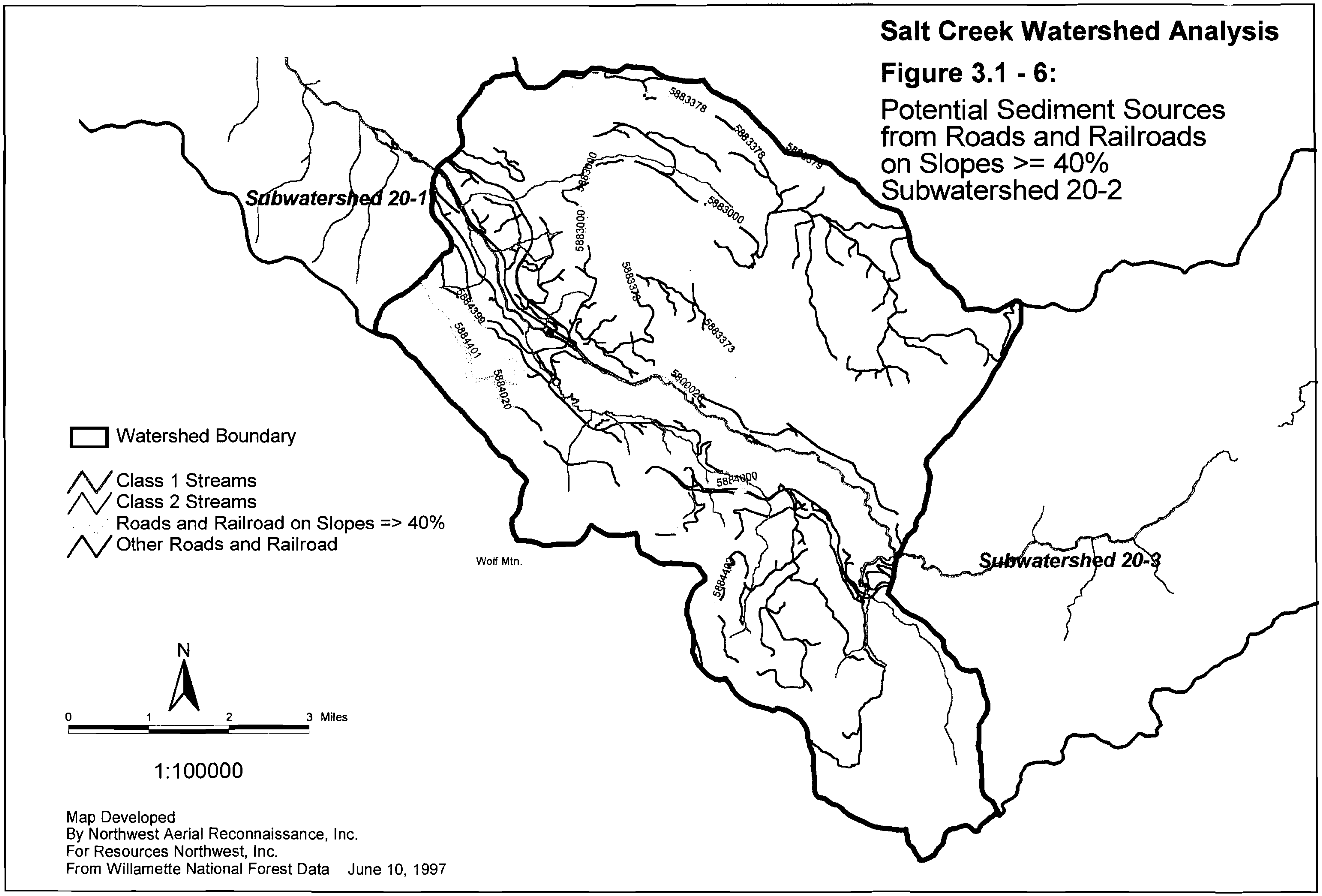
Stream Class III

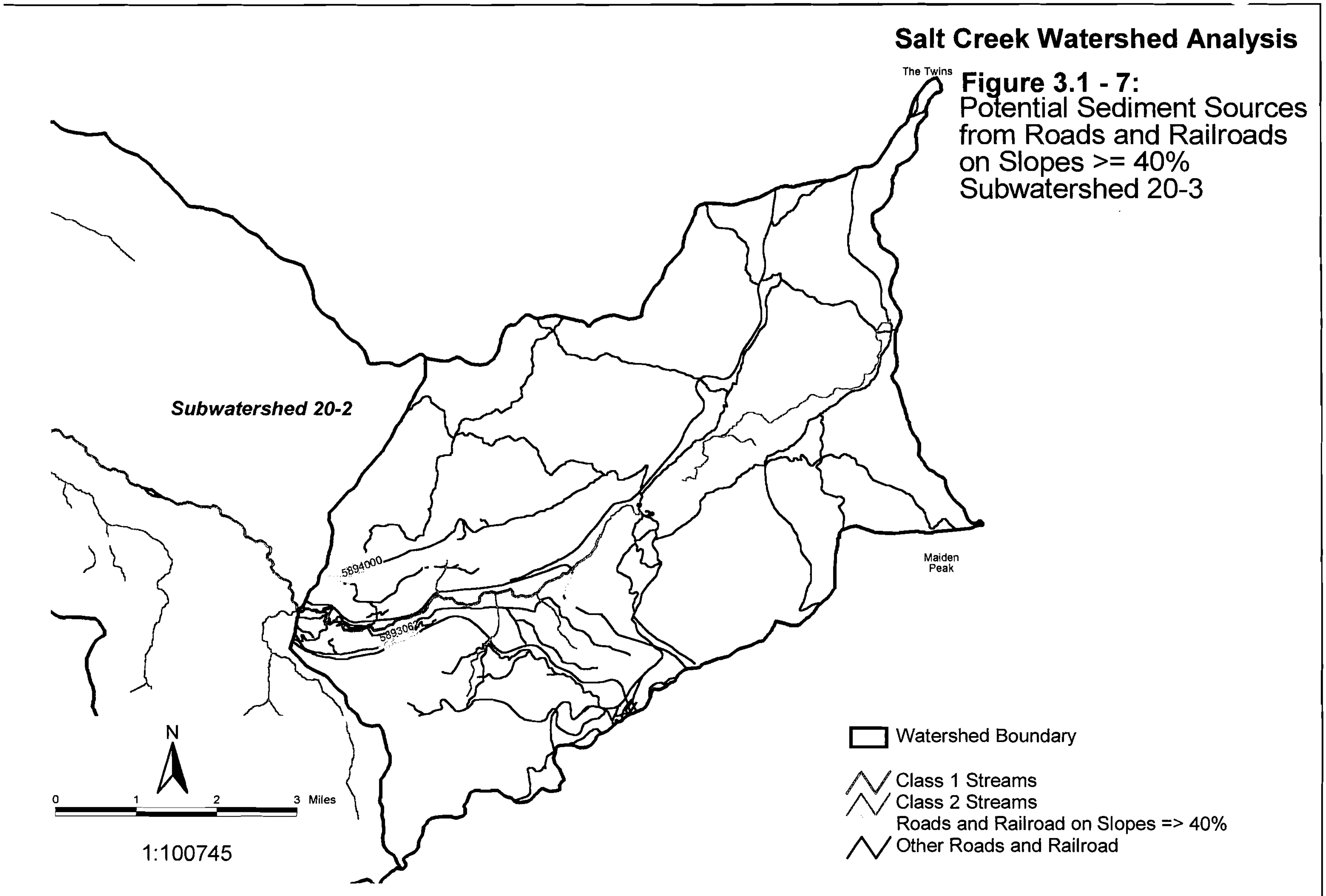
- All other perennial stream or segments not meeting the higher class criteria.

Stream Class IV

- Intermittent streams: any non-permanent flowing drainage feature having a definable channel and evidence of annual scour and deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria.


Salt Creek Watershed Analysis
Figure 3.1 - 5:
Potential Sediment Sources
from Roads and Railroads
on Slopes >= 40%
Subwatershed 20-1
City of Oakridge
5877348
5877000
5877345
5877337
5875000
Bunchgrass Ridge
Subwatershed 20-2
Watershed Boundary
Class 1 Streams
Class 2 Streams
Roads and Railroad on Slopes => 40%
Other Roads and Railroad
N
0
1
2
3 Miles
1:100000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997


Salt Creek Watershed Analysis
Figure 3.1 - 6:
Potential Sediment Sources
from Roads and Railroads
on Slopes >= 40%
Subwatershed 20-2
Subwatershed 20-1
Subwatershed 20-3
Wolf Mtn.
5883378
5883000
5883373
5800020
5884399
5884401
5884020
5884000
Watershed Boundary
Class 1 Streams
Class 2 Streams
Roads and Railroad on Slopes => 40%
Other Roads and Railroad
N
0 1 2 3 Miles
1:100000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997


Salt Creek Watershed Analysis
Figure 3.1 - 7:
Potential Sediment Sources
from Roads and Railroads
on Slopes >= 40%
Subwatershed 20-3
The Twins
Subwatershed 20-2
5894000
5893062
Maiden
Peak
Watershed Boundary
Class 1 Streams
Class 2 Streams
Roads and Railroad on Slopes => 40%
Other Roads and Railroad
N
0
1
2
3 Miles
1:100745

CURRENT CONDITION

Detailed mapping of all perennial and intermittent streams within the watershed has not been completed. Currently 301.2 miles of stream have been classified (Figure 3.2-1). Stream class mileage in Table 3.2-1 under represent the actual mileage for Class 3 and 4 streams

Table 3.2-1. Stream Class Mileage and Density by Subwatershed

	Subwatershed			
Stream Class	**20 1**	**20 2**	**20 3**	**Stream Class Totals**
I	14.0	9.0	4.9	27.9
II	19.9	23.5	8.7	52.1
III	10.6	30.4	10.5	51.5
IV	87.8	67.2	14.7	169.7
Total miles	132.3	130.1	38.8	**301.2**
Density (mi/mi^2)	4.2	3.0	1.0	

CHANNEL CONDITION

REFERENCE CONDITION

Historically channel conditions were generally stable due to less riparian fragmentation (no road/stream crossings), an abundance and greater recruitment potential of large woody material, and longer intervals between peak flow events of a specific magnitude due to a more forested watershed.

Channel conditions in general are heavily influenced by the presence and distribution of large woody material. Overall channel conditions prior to management varied by stream class and the influence of large woody material recruited from stream riparian zones. Streams located in areas of high fire frequency and high elevation areas may exhibit a natural condition of lower amounts of large woody material.

Surveyors noted during a 1937 stream survey new construction of State Highway 58 paralleling Salt Creek for the first 11.2 miles and the associated channelization of the stream in many sections (McIntosh et al. 1992). Pollution was observed from this construction and "there was considerable erosion of loose earth resulting in a silt at the bottom in quiet areas...though not sufficient to spoil spawning areas" (McIntosh et al. 1992).

CURRENT CONDITION

Channelization and removal of large woody material occurred as a result of stream cleanout and stabilization efforts in the mainstem of Salt Creek following the 1964 flood event.

Some channel widening has occurred since land management in the 1940's. In addition to stream cleanout activities, peak flow events of a given magnitude which can contribute to channel widening are likely to occur more frequently due to reduction in forest cover and roading associated with timber harvesting. Table 3.2-2 shows that the mainstem of Salt Creek has decreased in width in lower reaches and increased in width in upper reaches. Decreases in width are most likely due to channelization efforts while increases in width are probably due to removal of streamside vegetation including large wood and changes in peak flow events.

Channel conditions were analyzed by subwatershed, except for the mainstem of Salt Creek which was analyzed separately because it flows through the three subwatersheds. Current channel conditions were determined from 1990 and 1996 stream survey data for the mainstem of Salt Creek and from 1990-1996 for other streams in the watershed.

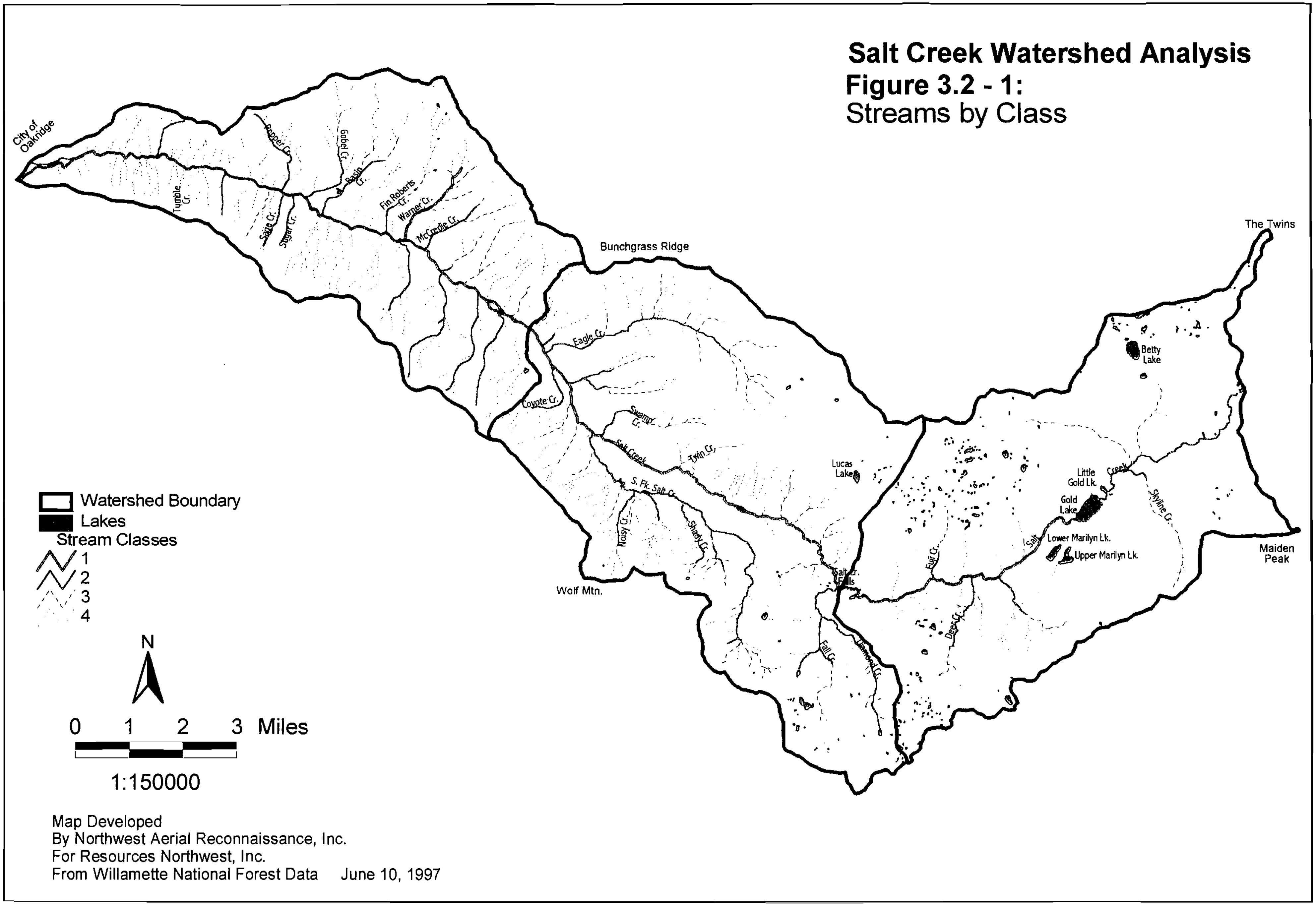

Salt Creek Watershed Analysis
Figure 3.2 - 1:
Streams by Class
City of Oakridge
Pepper Cr.
Gobel Cr.
Basin Cr.
Fin Roberts Cr.
Warner Cr.
McCredie Cr.
Tumble Cr.
Sage Cr.
Sugar Cr.
Bunchgrass Ridge
The Twins
Eagle Cr.
Coyote Cr.
Swamp Cr.
Salt Creek
Twin Cr.
S. Fk. Salt Cr.
Noisy Cr.
Shady Cr.
Wolf Mtn.
Lucas Lake
Salt Cr. Falls
Fuji Cr.
Deer Cr.
Fall Cr.
Diamond Cr.
Betty Lake
Little Gold Lk.
Gold Lake
Creek
Skyline Cr.
Salt
Lower Marilyn Lk.
Upper Marilyn Lk.
Maiden Peak
Watershed Boundary
Lakes
Stream Classes
1
2
3
4
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Table 3.2-2. Changes in the Average Channel Width of Salt Creek from 1937 to 1990

1937 Survey*		1990 Survey*		Percent Difference from 1937 to 1990
Channel Location	Width (ft)	Width (ft)	Stream Reach	
Salt Creek confluence w/ Middle Fk. Willamette River RM 0.0	52	50	1	3.8% decrease
2nd bridge above confluence RM 5.7	77	50	1	35.1% decrease
Eagle Creek confluence RM 11.2	33	43	2	23.3% increase
South Fork Salt Creek confluence RM 13.0	29	43	2	32.6% increase
One half mile above UPRR trestle RM 14.9	35	43	2	18.6% increase
Below Salt Creek Falls RM 18.9	30	35	4	14.3% increase

* *McIntosh et al. 1992* ** *Oakridge Ranger District Stream Surveys*

Channel Stability

Stream channel stability analyses were conducted on some streams in the watershed. A summary of the ratings is provided for streams in each subwatershed:

Subwatershed 20 1

McCredie Creek showed FAIR ratings for Reaches 1-7, some mass wasting was noted in Reaches 1-4.
Tributary 20f 41.3 was rated FAIR for all 4 reaches. Warner Creek had a total of 34 failures over 1.9 miles; failure size ranged from 6 to 88 square feet.

Subwatershed 20 2

The majority of South Fork Salt Creek was found to have a stream channel rated as FAIR, except for Reaches 7 (POOR) and 9 (GOOD). A total of 60 failures were found over 7.3 miles; failure size ranged from 28 to 500 square feet. Failures were also recorded on Eagle, Fall and Diamond Creek.

Subwatershed 20 3

Deer Creek showed a channel stability rating of FAIR for the 3 reaches. A total of 15 failures were recorded ranging in size from 6 to 150 square feet.

Valley Segment Types

Assessing channel condition and predicting channel response requires identification of functionally similar portions of the channel network. On the Willamette National Forest (WNF), the identification of Valley Segment Types (Appendix B) has been incorporated into the stream survey methodology to stratify stream segments based on similar drainage morphology.

Alluviated moderate slope bound valleys (M2) are the dominant valley segment type for the mainstem of Salt Creek (Table 3.2-3). Salt Creek occurs through all three subwatersheds, therefore data from Salt Creek is shown separately from its tributaries. Dominant valley segment types for tributaries in Subwatershed 20 1 include V-Shape, High Gradient Bottom (V2) and high gradient Valleywall/Headwall (H2). Subwatershed 20 2 consists of many different valley segment types, the most dominant being V-Shaped w/High Gradient Bottom (V2).

Table 3.2-3. Total Miles of Valley Segment Types for the Salt Creek Watershed

	Mainstem Salt Creek		Surveyed Tribs in Subwshed 20 1		Surveyed Tribs in Subwshed 20 2		Surveyed Tribs in Subwshed 20 3	
Valley Segment Type	Miles	%	Miles	%	Miles	%	Miles	%
F2 - Alluviated Lowlands	-	-	-	-	0.8	3.7	-	-
F3 - Wide mainstem valley	1.1	4.4	-	-	-	-	-	-
F4 - Alluvial/Colluvial fan	-	-	0.25	6.1				
F5 - Gently sloping plateaus and terraces	-	-	-	-	1.1	5.1	-	-
F6 - Palustrine spring fed, meandering flats	0.6	2.4	-	-	1.2	5.5	-	-
H1 - Moderate gradient valley wall/headwater	-	-	0.2	3.7	2.5	11.3	0.2	9.5
H2 - High gradient valley wall/headwater	-	-	1.6	38.1	0.2	0.9	-	-
M1 - Moderate slope bound	1.1	4.4	-	-	-	-	0.7	33.3
M2 - Alluviated moderate slope bound	19.9	78.9	0.5	12.3	0.7	3.2	-	-
U1 - U-shaped trough	-	-	-	-	3.4	15.9	-	-
U2 - Incised U-shaped valley, moderate gradient bottom	-	-	0.5	12.3	2.7	12.4	-	-
V1 - V-shaped moderate gradient bottom	0.7	2.8	-	-	1.5	6.9	-	-
V2 - V-shaped high gradient bottom	1.8	7.1	1.0	24.6	4.8	22.1	1.2	57.1
V3 - Bedrock canyon	-	-	-	-	0.1	0.5	-	-
V4 - Alluviated mountain valley	-	-	0.1	3.1	2.7	12.4	-	-
Totals	**25.2**	**100**	**4.2**	**100**	**21.7**	**100**	**2.1**	**100**

DISCHARGE

REFERENCE CONDITION

Salt Creek drains an area of 113 square miles. Stream discharge is a result of a combination of climatic and geologic conditions and can be influenced by natural events and management activities. Historically, stand replacement wildfires resulted in a temporary decrease in evapotranspiration resulting in greater water yield. Wildfires within the transient snow zone can also increase the magnitude of peak flows under some conditions.

Streamflow measurement records from the US Geological Survey stream gauging station on Salt Creek (0.7 miles from mouth) for the period 1913 to 1950 are displayed in Figure 3.2-3. The data displayed occurred from 16 years of annual data (1934-1950) and three years of partial data (1913-1914, 1933). Stream flow data was not collected from 1915 to 1932, a period of 18 years.

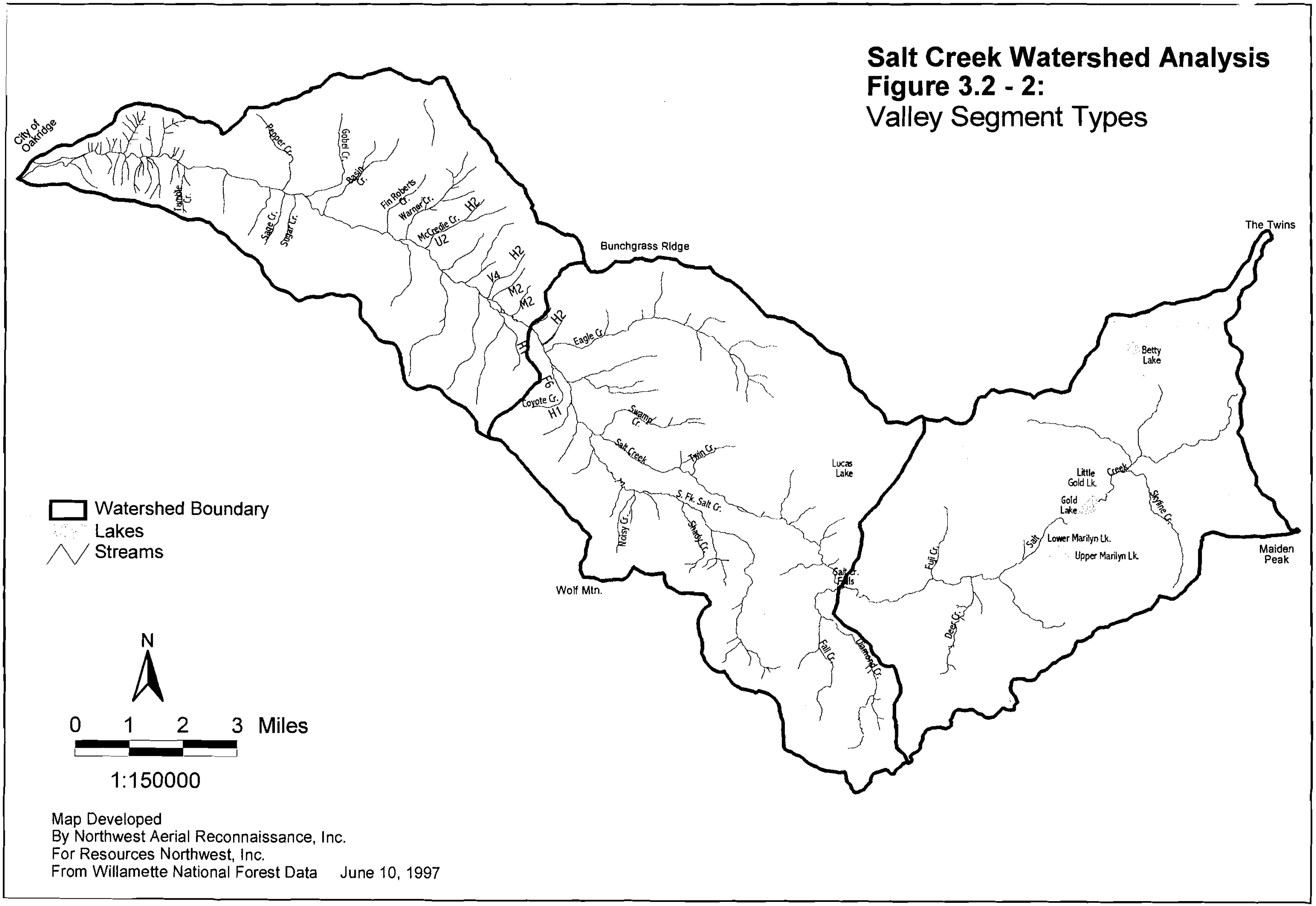
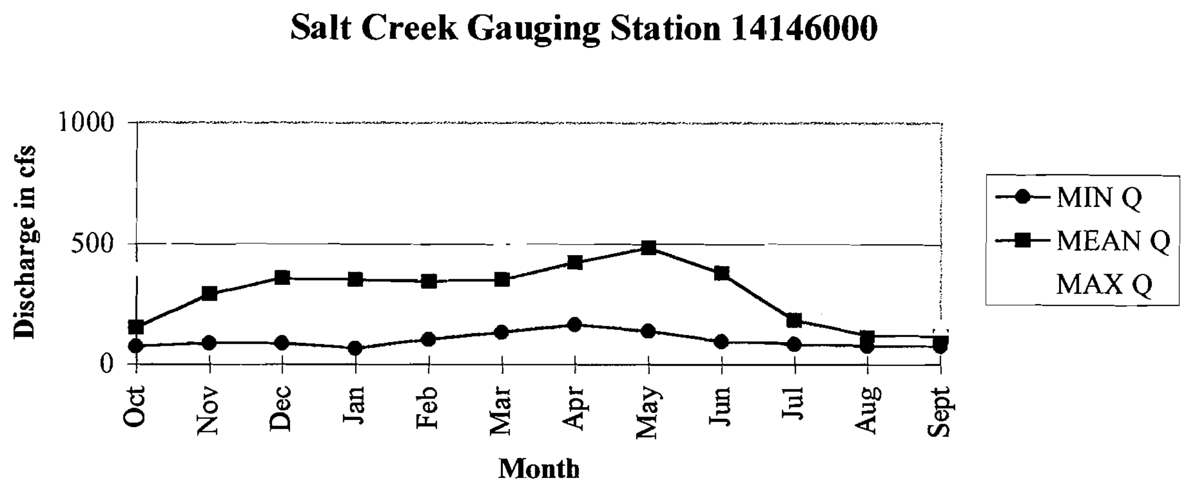

Salt Creek Watershed Analysis
Figure 3.2 - 2:
Valley Segment Types
City of Oakridge
Pepper Cr.
Gobel Cr.
Basin Cr.
Fin Roberts Cr.
Warner Cr.
McCredie Cr.
Sage Cr.
Sugar Cr.
H2
U2
V4
M2
H1
F6
Eagle Cr.
Coyote Cr.
Bunchgrass Ridge
Swamp Cr.
Salt Creek
Twin Cr.
S. Fk. Salt Cr.
Noisy Cr.
Shady Cr.
Lucas Lake
Salt Cr. Falls
Fall Cr.
Diamond Cr.
Fuji Cr.
Deer Cr.
Wolf Mtn.
The Twins
Betty Lake
Little Gold Lk.
Gold Lake
Creek
Salt
Skyline Cr.
Lower Marilyn Lk.
Upper Marilyn Lk.
Maiden Peak
Watershed Boundary
Lakes
Streams
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Figure 3.2-3. Statistics of Monthly Discharge Data for Salt Creek Based on Mean Daily Discharge (1913-1950)



A summary of streamflow data for this period of record:

- Base flow = 800 cfs
- Annual mean discharge = 292 cfs
- Maximum discharge = 4500 cfs on Oct. 29, 1950
- Minimum discharge = 55 cfs on Jan. 8, 1937

The variation in streamflow generally follows the pattern of precipitation. August and September are generally the low flow periods. The majority of streamflow runoff occurs from November through May. High flow events during this time period often coincide with high rainfall events and may be associated with rapid snow melt. During the spring season, melting of the seasonal snow pack at high elevations in the watershed can contribute a significant proportion of the streamflow runoff. Past floods within the Willamette River basin occurred in 1861, 1890, 1923, 1945, and 1955 (Waananen et al. 1971).

CURRENT CONDITION

Current condition data are not available due to the discontinued use of the gauging station on Salt Creek in 1951. There were two large flood events that occurred after 1951. These rain-on-snow events are summarized below:

1964 Flood

This was an "100 year" flood event that occurred in December. Much damage was done to bridges and roads during this event. The maximum discharge at Noisy Creek, near McCredie Springs was 940 cfs on December 1964.

1996 Flood

This flood occurred in November and was considered to be a rain-on-snow event. This flood produced significant impacts but on a lesser scale when compared to the flood in 1964.

HYDROLOGIC RECOVERY AND PEAK FLOW EVENTS

REFERENCE CONDITION

The vegetative condition of an area as it relates to snow accumulation and melt within the transient snow zone is termed hydrologic recovery. Calculated values of hydrologic recovery are used to estimate the capability of a timber stand to influence rain, wind and snow during rain-on-snow events. Prior to forest management, hydrologic recovery values probably varied widely through time due to stand replacement wildfires. The Salt Creek watershed likely experienced long periods of relatively high hydrologic recovery punctuated with relatively short periods (depending on the rate of reforestation) of very low recovery levels (similar to the effects of clearcut harvesting) after infrequent, landscape lev fire events.

Variation in stream flow are influenced by the intensity, duration and type of precipitation, and the capacity of the watershed to store runoff. Peak flow events are most likely to occur during storms delivering large quantities of precipitation in a short period of time.

CURRENT CONDITION

Hydrologic recovery can be quantified by the Aggregate Recovery Percent (ARP) model. This model was developed to provide a means to index the effects of forest cutting on peak flows resulting from rain-on-snow events in the Cascade Range in Oregon and Washington. Increases in peak flows can result in increased levels of channel erosion, decreased water quality, and damage to aquatic habitat conditions. The ARP provides an estimate of the percentage of the watershed area that has reached "hydrologic recovery" where hydrologic recovery is defined on the basis of stand regrowth in terms of age, soil condition, and eco-class (Megahan 1992).

Calculated ARP values were used as a measure of the risk of increased peak flow events related to management activities (Table 3.2-4).

Table 3.2-4. Hydrologic Recovery Percentages for Subwatersheds in the Salt Creek Watershed

Subwatershed 20 1	Subwatershed 20 2	Subwatershed 20 3
79%	76%	71%

For planning purposes, the Willamette National Forest Land and Resource Management Plan (WNF Forest Plan) describes the sensitivity of planning subdrainages (Table 3.2-5). Each planning subdrainage (Appendix A) has a mid-point ARP value as a reference point for assessment purposes. The mid-point ARP values provide a relative measure of drainage sensitivity. These may be viewed as threshold values below which a more detailed assessment should be conducted to determine the potential for adverse effects associated with increased in peak flow events. Although only one planning subdrainage (20V) is currently below mid-point ARP values, seven additional planning subdrainages are within 5 percentage points of the mid-point value. See Appendix J for ARP values by drainage and map of drainage locations.

- Montieth Rock (20A)
- Warner (20D)
- McCredie (20E)
- Verdun (20H)
- Swamp (20I)
- Noisy (20U)
- Coyote (20V)
- Tumble (20Y)

Table 3.2-5. Sensitivity Ratings and ARP Values for Planning Subdrainages

Planning Subdrainage Name	Subdrainage Num.	Land Sensitivity Rating[1]	Beneficial Uses Rating[1]	Slope Stability Rating[1]	Mid-Point ARP Value	Current ARP Value
Montieth Rock	20A	H	M	2.1	75	78
Gobel	20B	M	H	2.0	75	82
Basin	20C	M	H	2.0	75	85
Warner	20D	H	H	1.9	80	82
McCredie	20E	H	M	2.0	75	80
Side Salt	20F	H	M	2.0	75	81
Eagle Beak	20G	M	M	2.0	70	77
Verdun	20H	M	M	2.1	70	70
Swamp	20I	M	M	2.0	70	71
Eagle Head	20J	L	M	1.4	65	86
David Douglas	20K	M	L	1.6	65	87
Fuji Meadow	20L	*NA*	*NA*	1.2	*NA*	79
Island Lake	20M	*NA*	*NA*	1.2	*NA*	83
Lorin	20N	*NA*	*NA*	1.2	*NA*	78
Skyline	20P	*NA*	*NA*	1.1	*NA*	82
Marilyn	20Q	*NA*	*NA*	1.0	*NA*	63
Abernathy	20R	*NA*	*NA*	1.1	*NA*	85
Fall Creek	20S	L	M	1.2	65	85
Shady Cruzatte	20T	L	M	1.5	65	77
Noisy	20U	M	M	1.9	70	72
Coyote	20V	M	M	2.0	70	65
Wicopee Fields	20W	M	M	1.9	70	76
Cougar	20X	H	M	2.0	75	83
Tumble	20Y	H	M	2.3	75	75
Salt Head	20Z	*NA*	*NA*	1.0	*NA*	95

1 See Willamette National Forest Land and Resource Management Plan, Appendix E.

Peak Flow Recurrence Intervals

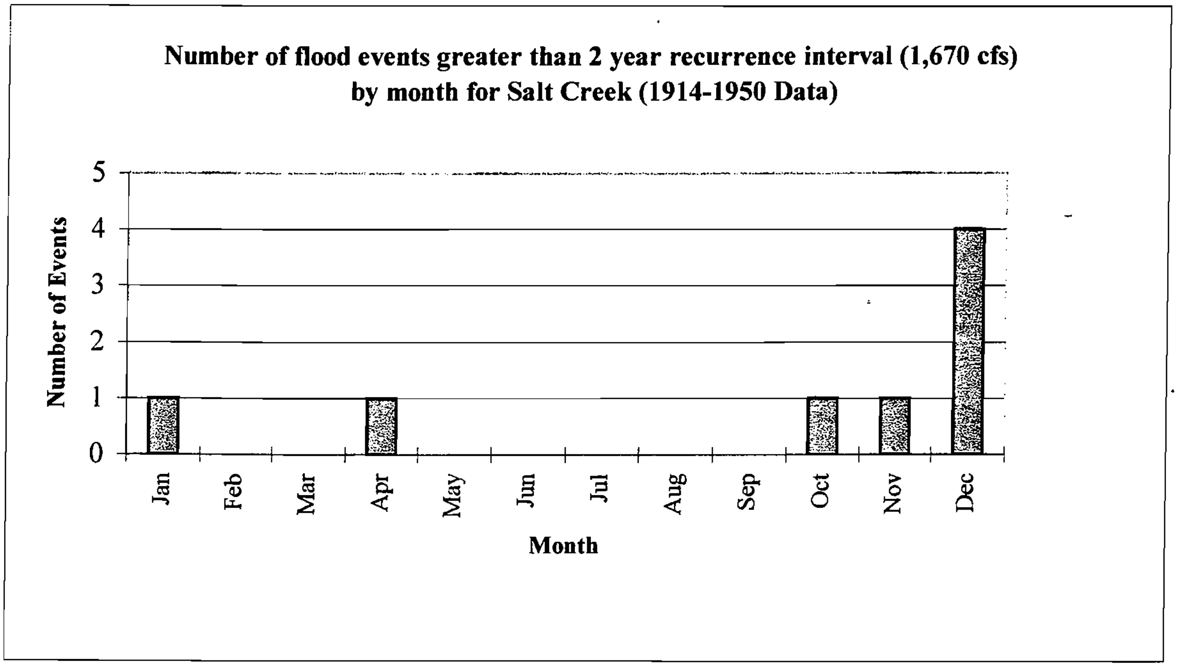
A recurrence interval is the probability that a certain magnitude flood event will occur over a given period of time. Instantaneous peak flow recurrence intervals are displayed in Table 3.2-6.

Table 3.2-6. Instantaneous Peak Flow Recurrence Intervals for Salt Creek, USGS Station 1414600 (Data from Harris et al. 1979).

Recurrence Interval	Discharge (cfs)
2 Year	1,670
5 Year	2,830
10 Year	3,760
25 Year	5,120
50 Year	6,270
100 Year	7,550

The month of December had the most flood events (4) recorded that are greater than the 2 year recurrence interval (1,670 cfs). Figure 3.2-4 displays the results of flood events by month for the years 1914 to 1950, that are greater than the 2 year recurrence interval.

Figure 3.2-4. Number of Flood Events Greater than 2 Year Recurrence Interval, by Month for Salt Creek.



WATER YIELD

REFERENCE CONDITION

The water yield of an area is a product of the amount of precipitation it receives, combined with the soil and landform properties. The vegetative condition of an area also affects water yield due to changes in the rate of evapotranspiration. Water yield increases have been observed following stand replacement wildfires (Potts et al. 1989) and after clearcut harvesting (Moring 1975, Harr 1983).

CURRENT CONDITION

Groundwater storage capacity is directly related to the type of soil and its depth. Relatively shallow soils have a lower ability to store water and have the potential to be the greatest contributors to increased stream flow during high runoff events. Deep soil areas have the ability to store more water and release this water at a slower rate and contribute to baseflow. Soil water yield classification for the Willamette National Forest Soils Resource Inventory (USDA 1994) was used as an indicator of the water storage capacity of the soil and the rate at which water would be transmitted through the soil contributing to streamflow. Soil water yield class definitions used in this analysis are as follows:

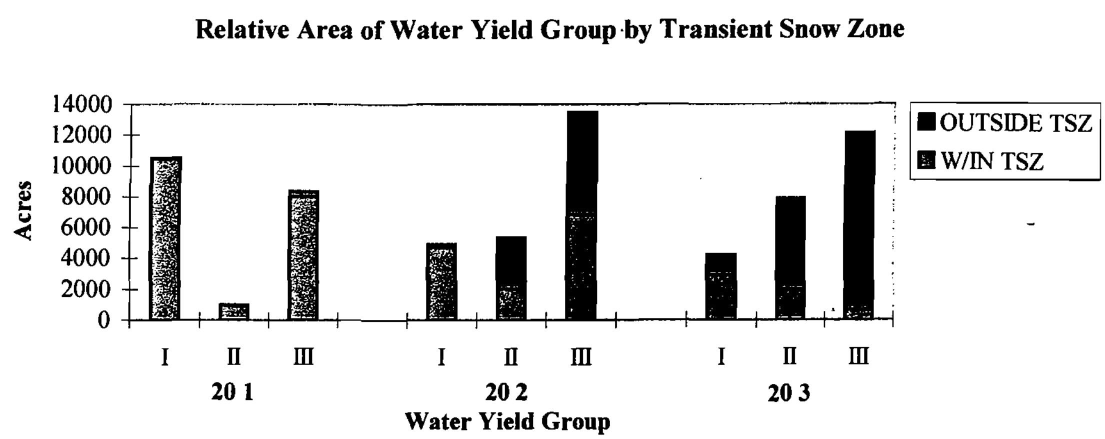
I. Soils with a low runoff rate and high water detention capacity, given that the soils are not saturated or frozen. These soils are important in sustaining high base flows.

II. Soils with a moderate runoff rate and moderate water detention capacity. Water contributes to both peak flow and base flow.

III. Soils with a high runoff rate and low water retention capacity. The storage capacity is low and easily exceeded with most of the water contributing to peak stream flow.

The analysis for determining water yield requires that landtypes be identified from the Soils Resource Inventory. These landtypes were aggregated into high, moderate and low water yield classifications. Figure 3.2-5 displays the relative area of each water yield class by subwatershed and the relative proportion of each subwatershed within the transient snow zone. Those subwatersheds that have a high proportion of their area in water yield class III and a high proportion of their area in the transient snow zone would be most susceptible to increases in peak stream flow during rain-on-snow events.

Figure 3.2-5. Area by Water Yield Group and Transient Snow Zone for Three Subwatersheds



WATER QUALITY

BENEFICIAL USES

The draft Revised Federal Guide for Watershed Analysis states that Management of water quality is carried out through the Federal Clean Water Act (CWA). The primary objective of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA directs states to establish water quality standard regulations which describe the beneficial uses to be protected in each of its drainage basins, numeric and narrative criteria necessary to protect these uses. For freshwater systems, these include water supply, recreation, and growth/propagation of fish and other aquatic life.

The Oregon Department of Environmental Quality has identified beneficial uses in Oregon Administrate Rules 340-41-442. This rule states that water quality in the Willamette River Basin shall be managed to protect beneficial uses. The following beneficial uses are recognized for Salt Creek, a tributary of the Middle Fork of the Willamette River:

- Public Domestic Water Supply
- Potential Anadromous Fish Passage
- Salmonid Fish Rearing
- Salmonid Fish Spawning
- Resident Fish and Aquatic Life
- Fishing
- Boating
- Water Contact Recreation
- Aesthetic Quality

There are 5 summer homes near the mouth of Salt Creek that obtain their domestic water from Salt Creek. In addition, one residence withdraws surface water from Warner Creek for domestic use.

WATER TEMPERATURE

REFERENCE CONDITION

Water temperature (of streams) is determined by a combination of factors, including stream discharge, stream morphology, air temperature, intensity of solar radiation, and amount of shade. The primary causes of elevated stream temperatures due to human activities are removal of streamside shade by timber harvest and creating wider and shallower stream channels by increasing sedimentation and peak streamflows. Wider, shallower streams are at increased risk of warming temperatures due to the added surface area of water exposed to the sun and loss of shade frorr vegetative edges.

Water quality of the Salt Creek watershed during prehistoric times would have been considered high quality water by today's standards. Stand replacement wildfires and floods have had the potential to significantly affect stream temperatures by removing stream side vegetation. After disturbances, stream temperatures would have been elevated for a period of time until riparian vegetation recovered. This recovery period would vary depending on site specific factors and may have been 20 years or more before shading reached pre-disturbance levels. Table 3.3-1 shows reference water temperatures for Salt Creek in years 1937 and 1964.

Table 3.3-1. Salt Creek Water Temperatures: Year 1937, 1964, 1965 (Stream Survey Data)

Date	Min. (F)	Max. (F)	n =	Location of Measurement
August 1937	49.0	51.5	6	measurements within subwshd 20 1, 20 2
April-October 1964	39.0	58.0	12	along mainstem in subwshd 20 1, 20 2, 20 3
March 1965	44.0	44.0	1	upstream of 1st bridge on Highway 58
July 1965	61.0	61.0	1	upstream of 1st ridge on Highway 58
September 1965	56.0	56.0	1	upstream of 1st ridge on Highway 58
Average Temperature	**49.8**	**54.1**		

CURRENT CONDITION

The Oregon Administrative Rules (OAR 340-341) do not permit measurable surface water temperature increases from authropogenic activities when stream temperatures exceed numeric temperature criteria, unless allowed under a Department of Environmental Quality approved surface water temperature management plan. Numeric temperature criteria are listed below.

- Oregon Bull Trout habitat; 50 degrees Fahrenheit
- Native salmonid spawning, egg incubation, fry emergence; 55 degrees Fahrenheit
- Salmonid fish rearing; 64 degrees Fahrenheit
- Significant coldwater refugia; no increase
- Stream segments with temperature sensitive Threatened and Endangered species; no increase
- Natural lakes; no increase

The numeric temperature criteria are measured as a seven-day moving average of the daily maximum temperatures. If the seven-day average of maximum temperatures can not be determined due to insufficient data, the numeric criteria is applied as an instantaneous maximum.

Mainstem Salt Creek

A nearly continuous data record of daily maximum and minimum stream temperatures of Salt Creek near the mouth exists for years 1981 through 1993. Figure 3.3-1 displays a monthly average of the daily maximum and daily minimum stream temperatures near the mouth for the period of record. Figure 3.3-2 shows the maximum stream temperature recorded for each summer season (June-August) and the maximum seven day rolling average for this time period. Streams in the watershed generally will reach their maximum temperatures in either July or August.

Figure 3.3-1. Average Monthly Stream Temperatures for Salt Creek Near Mouth: 1981-1990

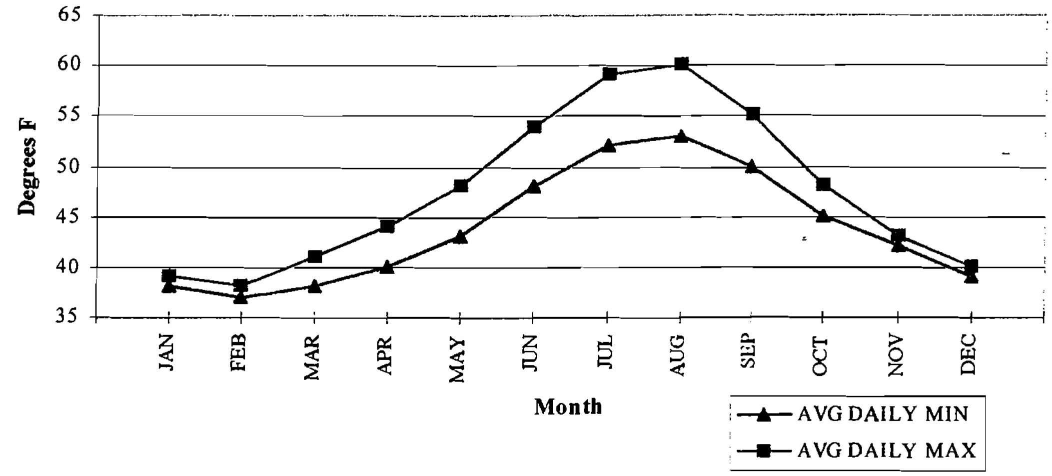
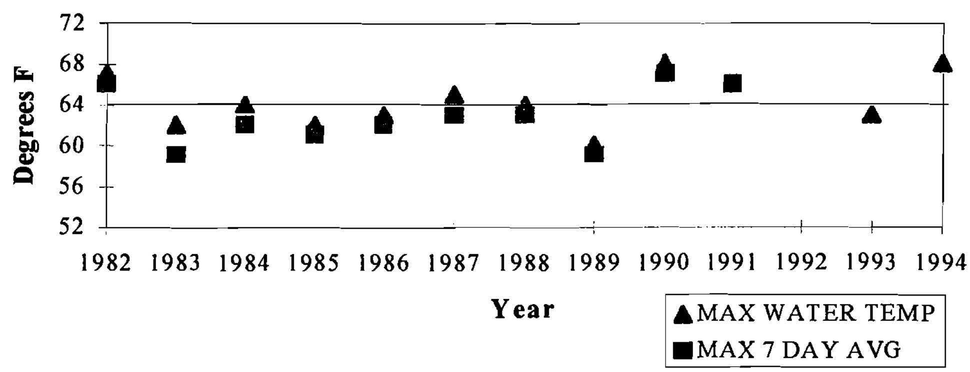


Figure 3.3-2. Salt Creek Water Temperatures Near Mouth: Maximum Temperature and Maximum 7 Day Average (June-August)



Between the years 1982 and 1991, the seven day average of the maximum daily stream temperatures for the mainstem of Salt Creek near the mouth was above the state standard in 1982, 1990 and 1991. In addition, instantaneous maximum daily temperatures for the years 1993 and 1994 indicate temperatures below and above the state standard for these years respectively.

Table 3.3-2. Maximum Daily and Maximum 7 Day Average Stream Temperatures for Eagle Creek and South Fork Salt Creek.

Stream	Year	Max Daily Temp (F)	Max 7 Day Average Temp (F)
Eagle Creek near mouth	1989	50	49
	1990	51	50
	1991	52	50
	1992	52	51
South Fork Salt Creek near mouth	1990	60	59
	1991	59	58
	1992	63	62
	1993	60	59

Tributaries within the Salt Creek watershed generally show lower maximum daily stream temperatures and maximum seven day average stream temperatures (Table 3.3-3 and Table 3.3-2).

Table 3.3-3. Maximum Daily and Maximum 7 Day Average Stream Temperatures for Tributaries in the Salt Creek Watershed: 1996

Stream	Max Daily Temp (F)	Max 7 Day Avg Temp (F)
Deer	53	53
Diamond	51	51
East Eagle	43	42
West Eagle	43	43
Shady	62	62

Data from water temperatures on Salt Creek taken during stream surveys (1990 to 1996) show that maximum temperatures have increased (Appendix C) from reference conditions. For comparison, water temperatures from Salt Creek tributaries have changed little from reference conditions.

The 1994/1996 Oregon Department of Environmental Quality Section 303(d) List Decision Matrix places the status of Salt Creek from the mouth to the South Fork, and the South Fork from mouth to headwaters on the potential concern list.

STREAM SEDIMENT AND TURBIDITY

REFERENCE CONDITION

Prior to land management activities in the Salt Creek watershed, elevated turbidity was probably associated with peak flow events, particularly after large and infrequent wildfires, or disturbance such as a localized debris torrent. The majority of the time, Salt Creek and its tributaries would have been clear with low levels of suspended sediment and turbidity.

CURRENT CONDITION

The Oregon Department of Environmental Quality (ODEQ 340-41) states that turbidity measurements should have no more than a 10 percent cumulative increase in natural stream turbidities, as measured relative to a control point immediately upstream of the turbidity causing activity.

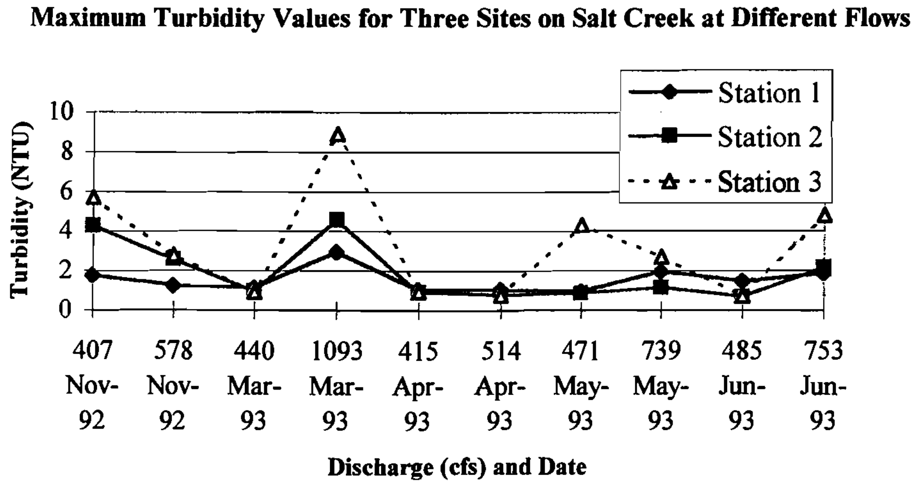
Turbidity samples were obtained on Salt Creek at three locations (Table 3.3-4).

Table 3.3-4. Turbidity Sample Locations.

Station	Legal Description	Location
1	T21S, R3E, SEC 36, SW 1/4	At crossing of F.S. road 5875
2	T22S, R5E, SEC 8, NW 1/4	500 feet downstream of confluence with Eagle Creek
3	T22S, R5E, SEC 8, SW 1/4	50 feet upstream of confluence with Eagle Creek

Maximum turbidity measurements were graphed against the lowest discharge and highest discharge for the months of November 1992 and March through June 1993 (Figure 3.3-3). Discharge measurements (cfs) were obtained from station 1 on Salt Creek. Data indicate that station 3 typically shows a higher turbidity measurement than stations 1 and 2 at similar flows.

Figure 3.3-3. Maximum Turbidity Values by Discharge for Three Sites on Salt Creek, November 1992, March to June 1993



VEGETATION, STRUCTURE, COMPOSITION, TES PLANT SPECIES

STAND STRUCTURE AND COMPOSITION

Vegetation structure and distribution is dynamic. The following discussions compare the watershed during two snap shots in time, one before large scale harvesting began, and the other after 60 years of timber harvesting. These twc periods are used as comparisons and are not absolute. In the past, there may have been periods when much of th watershed was dominated by young-aged forests after very infrequent, regional scale wildfire. Portions of the watershed vegetation has been periodically heavily disturbed under natural conditions, with recovery lasting over centuries. Under current and past management regimes, disturbance has been chronic; frequent and small scale over short periods of time such that certain structural and age classes have or may become relatively more rare than they were in between natural fire occurrences.

REFERENCE CONDITION

Two hundred years ago (before European influence at least in terms of the vegetation and fire frequency), about 7 percent of this watershed was in the early-seral, or stand initiation stage forest condition. There was relatively little edge effect between early and late-successional forests in this historic landscape. The early-seral forest and edge were created by wildfire that burned large areas, both as stand replacement fire and as underburns. The amount of forest fragmentation before fire suppression and timber management can be seen in Figure 3.4-1 of this section.

Approximately 23 percent of the watershed was composed of late-seral forest. Mid-seral forests, characterized by stem exclusion and understory reinitiation stand development stages, occurred on about 64 percent of the watershed.

The watershed probably had more non-forested acres due to repeated fire that created and maintained large meadow complexes along ridge tops caused by lightning fires, particularly on certain soil types (see Figure 3.4-3). Aboriginal burning was probably also responsible for a greater amount of meadows along major river bottom areas. In some areas, the forest was very open and park-like due to repeated underburning.

CURRENT CONDITION

Approximately 15 percent of the watershed is composed of early-seral stands in the stand initiation stage of development. This percentage is twice as large as what existed 200 years ago and it is distributed quite differently across the watershed. Nearly all current early-successional forest occurs in the central and western part of the watershe while two hundred years ago early-successional forests had a patchy distribution throughout the watershed. Currentl early-successional forests are primarily the result of dispersed regeneration harvest activities and recent fires. As a result of these smaller disturbances, a much higher proportion of edge and interior forest fragmentation has occurred compared to that in reference conditions (see Figure 3.4-2). Stand initiation acreage is currently 4 times greater in Douglas-fir/western hemlock plant associations than in reference conditions. Conversely, initiation stage acreage in true fir/mountain hemlock associations is about two thirds of the amount present in reference conditions.

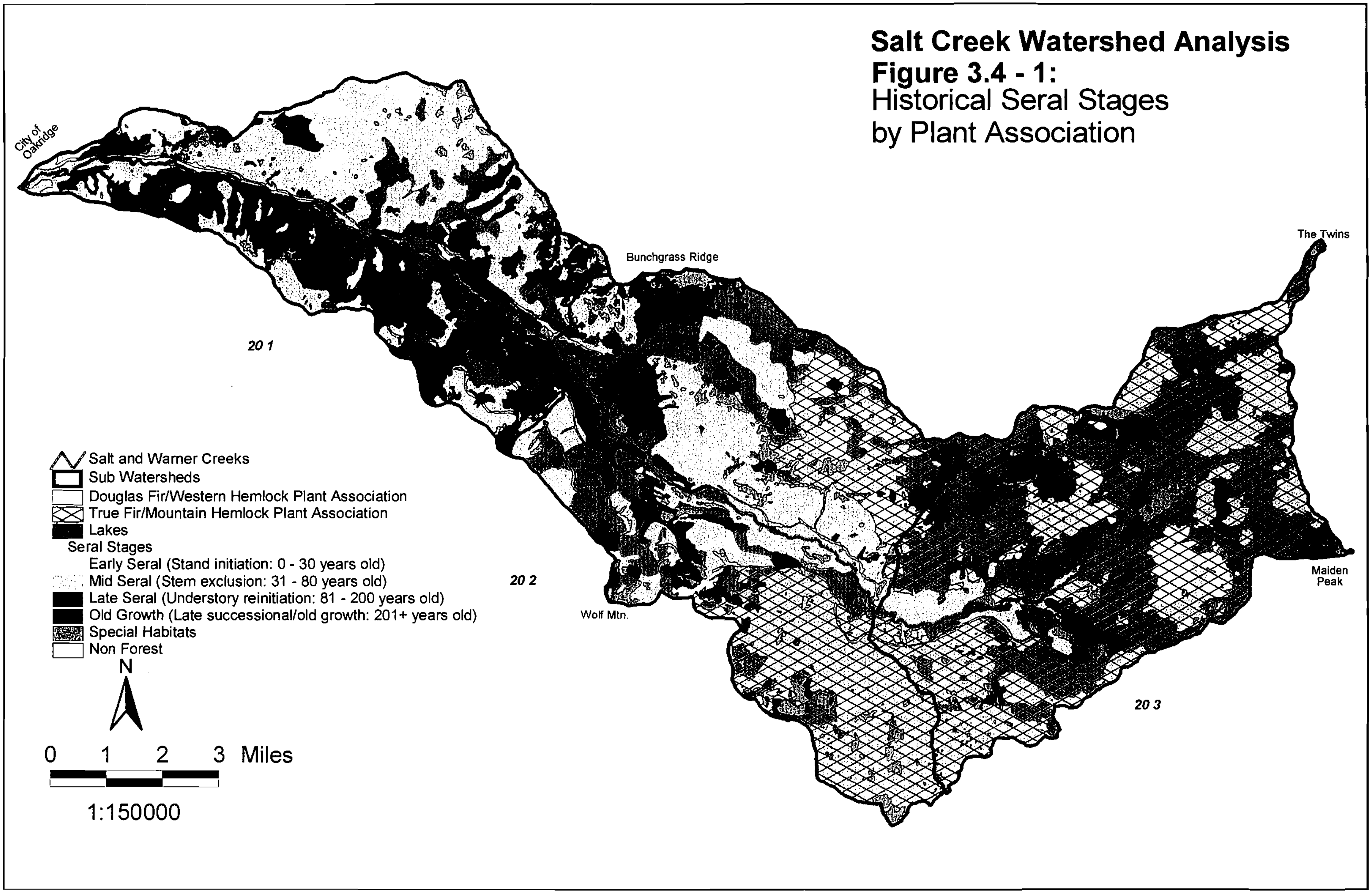
Currently, 5 percent of the mid-seral habitat across the watershed is in the stem exclusion stage and 42 percent is in the understory reinitiation stages. The current amount in stem exclusion for Douglas-fir/western hemlock stands is 5 times less than in reference conditions. The amount of current stem exclusion in Douglas-fir/western hemlock associations is approximately six times greater than current true fir/mountain hemlock associations. Understory reinitiation stage acreage is currently twice as great in Douglas-fir/western hemlock associations compared to reference conditions and slightly greater in true fir/mountain hemlock than what existed in reference conditions.

Approximately 30 percent of the watershed currently consists of late-seral forests, compared to about 23 percent that existed before forest management and fire suppression began. Late-successional forests are more prevalent in the true fir zone and more fragmented in the Douglas-fir zone than historically occurred in the watershed. Current late-seral stand acreage in Douglas-fir/western hemlock plant associations is slightly less than in reference conditions. Current late-seral acreage in true fir/mountain hemlock plant associations is approximately 3 times greater than in reference conditions.

This watershed has a very diverse set of age classes resulting from five decades of timber harvesting and the incidence of wildfire (Table 3.4-1). Most of the current younger, early-successional forests are a result of timber harvest. Forest management policy has changed considerably since the first timber harvest in the watershed. The first harvesting occurred as large, clustered clearcuts. Subsequent public concern with large clearcut areas resulted in law and agency policy directing management to avoid the creation of large openings in the forest. After about 1950, regeneration harvesting was limited in size, and dispersal was increased. The acreage of timber harvest was not reduced, only the distribution of harvests was modified resulting in increased fragmentation of forests.

Widespread partial harvest also occurred from the 1950's until the 1980's. The objectives of these partial harvest areas were to salvage expected mortality in mature and old-growth stands and to minimize the openings created by harvest. This partial harvesting may have imitated somewhat the effects of low intensity fire in terms of canopy closure and numbers of live trees per acre. However, it removed trees that would have normally remained after low intensity fires, and it resulted in compaction of soil from tractor yarding.

The data shown in Table 3.4-1 reflects the amount of various age and structural classes but not their distribution. The following section on Terrestrial Wildlife Habitat discusses the extent and implications of fragmentation and structural changes which have occurred in these forests.


Salt Creek Watershed Analysis
Figure 3.4 - 1:
Historical Seral Stages
by Plant Association
City of Oakridge
Bunchgrass Ridge
The Twins
20 1
20 2
20 3
Wolf Mtn.
Maiden Peak
Salt and Warner Creeks
Sub Watersheds
Douglas Fir/Western Hemlock Plant Association
True Fir/Mountain Hemlock Plant Association
Lakes
Seral Stages
Early Seral (Stand initiation: 0 - 30 years old)
Mid Seral (Stem exclusion: 31 - 80 years old)
Late Seral (Understory reinitiation: 81 - 200 years old)
Old Growth (Late successional/old growth: 201+ years old)
Special Habitats
Non Forest
N
0 1 2 3 Miles
1:150000

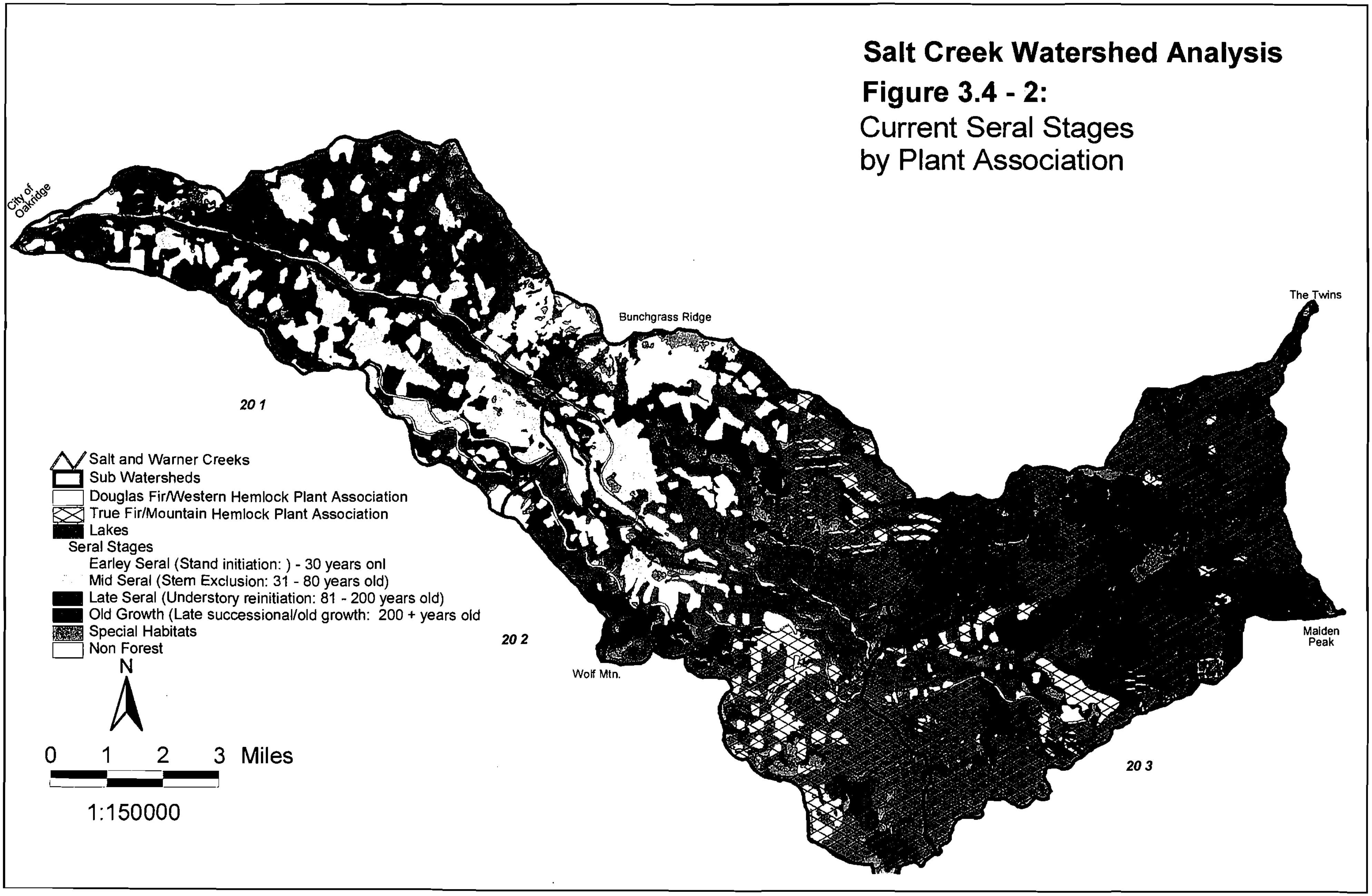

Salt Creek Watershed Analysis
Figure 3.4 - 2:
Current Seral Stages
by Plant Association
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
20 1
20 2
20 3
Salt and Warner Creeks
Sub Watersheds
Douglas Fir/Western Hemlock Plant Association
True Fir/Mountain Hemlock Plant Association
Lakes
Seral Stages
Earley Seral (Stand initiation:) - 30 years onl
Mid Seral (Stem Exclusion: 31 - 80 years old)
Late Seral (Understory reinitiation: 81 - 200 years old)
Old Growth (Late successional/old growth: 200 + years old
Special Habitats
Non Forest
N
0 1 2 3 Miles
1:150000

Table 3.4-1. Reference vs. Current Seral Stage Distribution by Plant Association

		Reference Condition								Current Condition							
		Sixth Field (Acres /% of sum total								Sixth Field (Acres /% of sum total							
Plant	Seral	20 1		20 2		20 3		Total		20 1		20 2		20 3		Total	
Assn.	Stage	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%
DF/WH	SI	1,661	8	411	2	0	0	2,072	3	4,648	23	3,803	14	293	1	8,744	12
	SE	7,011	35	6,635	24	400	2	14,046	20	1,830	9	961	4	0	0	2,792	4
	UR	1,847	9	3,711	14	1,397	6	6,955	10	7,394	37	6,793	25	478	2	14,665	20
	LS/OG	8,209	41	4,318	16	141	1	12,668	18	4,855	24	3,518	13	1,167	5	9,540	13
Sub total		18,728	93	15,075	56	1,938	8	35,741	50	18,727	93	15,075	55	1,938	8	35,741	50
TF/MH	SI	0	0	982	4	1,936	8	2,918	4	21	0.1	1,467	5	565	2	2,053	3
	SE	1	0	6,561	24	6,529	27	13,091	18	0	0	246	1	173	1	419	1
	UR	7	0	1,685	6	9,471	39	11,163	16	1	0	5,691	21	10,323	43	16,015	22
	LS/OG	21	0	589	2	2,693	11	3,303	5	7	0	2,413	9	9,568	39	11,988	17
Sub total		29		9,817	36	20,629	85	30,475	42	29	0.1	9,817	36	20,629	85	30,475	43
SHAB		887	4	1,999	7	951	4	3,837	5	887	4	1,999	7	951	4	3,837	5
WX		12	.05	66	0.2	399	2	477	1	12	0.1	66	0.2	399	2	477	1
XFOR		500	3	394	1	346	1	1,240	2	500	3	394	2	346	1	1,240	2
Sum total		20,156	100	27,351	100	24,263	100	71,770	100	20,155	100	27,351	100	24,263	100	71,770	100

Table legend: DF/WH = Douglas-fir/western hemlock TF/MH = true fir / mountain hemlock
SHAB = special habitat WX = water XFOR = non forested
SI = stand initiation (0-30 year old stand) SE = stem exclusion (31-80 year old stand)
UR = understory reinitiation (81-200 year old stand) LS/OG = late-successional / old-growth (201+ year old stand)

VEGETATION DIVERSITY

REFERENCE CONDITION

Historically, fire played an important role in shaping the vegetation composition within the watershed. The pattern and timing of fire has created diversity in vegetation and structural conditions. Fire has periodically created new early-successional stands, and areas which have not frequently burned developed late-successional characteristics. These may have persisted for centuries before stand replacement fire eventually swept through these areas. Many meadow complexes were enhanced and maintained on ridge tops and on south-facing slopes as a result of repeated fire, some of which were the result of aboriginal burning.

CURRENT CONDITION

While certain types of plant communities are not as widespread as they once were (for example late-successional forest, or dry meadows), they still exist in fairly large percentages compared to 200 years ago. No plant communities are known to have been eliminated from this watershed as a result of fire suppression or timber harvesting. However, fire suppression may have resulted in a reduction in acreage of meadows (refer to Figure 3.4-4), and timber harvest has resulted in a reduction in acres of late-successional forest in the Douglas-fir/western hemlock zone.

Structural diversity in many young stands regenerated after harvest may be less complex compared to natural young stands. Many young managed stands were planted with Douglas-fir as the primary tree species. Pre-commercial thinning often selected Douglas-fir trees as the desired retention species, resulting in less species diversity compared to natural stands; however, dense predominantly Douglas-fir stands can also be found in natural young stands regenerating after fire. Young managed stands often contained few residual structures (snags and large logs) especially those created by harvest between 1960 and 1990. Some natural young stands reburned however, because of the amount of fuels present (fine fuels, snags and woody debris), resulting in similarly low structural diversity.

The main effect management activities have had on vegetational diversity is an increase in stand edge (fragmentation) as mentioned above. Harvesting and associated road construction have increased the amount of edge habitat and decreased the amount of late-successional habitat in Douglas-fir/western hemlock plant associations in Subwatershed 20 1. Additionally, the distribution of late-successional habitat has been altered, and the establishment of non-native plants accelerated. Harvesting and road construction also may have created non-forest vegetation types that would not have existed otherwise.

Vegetation may be more diverse now than it was prior to management in terms of early-successional herb/shrub communities created by harvest. However these communities are often relatively ephemeral, as shrubs and sapling trees tend to dominate such sites quickly. Fire suppression may have decreased the extent of meadows and may have resulted in some areas of late-successional forest that would not have persisted otherwise.

SPECIAL AND UNIQUE NON-FORESTED HABITATS (SHABS)

REFERENCE CONDITION

Prior to European settlement, Native American populations are thought to have used fire as a tool to enhance or preserve meadows in order to maintain areas for food and medicinal purposes. Forested areas may have also been underburned in places to provide more productive animal forage and to facilitate travel.

A representation of potential non-forested openings on fire prone soils in stands less than 80 years of age, and in stands 81+ years combined with current non-forested special habitats (Figure 3.4-4) can be compared with a fire history map (Figure 3.4-7). The comparison reveals that potential SHABS often overlap fire prone areas, suggesting fire events may have maintained more extensive special habitats in the reference landscape. However, many SHABS appear to be more influenced by hydrologic conditions that create wetlands. Several meadows and prairies were included in major grazing allotment ranges on the district. The effects of grazing contributed to maintaining more open conditions in meadows. It is assumed that the total meadow acreage was higher around the turn of the century, prior to the cessation of grazing. Historical records indicate that cattle were grazed in the mid 1860's. District records show cattle and sheep were grazed in the late 1800's and early 1900's. Historic grazing harvest management, livestock grazing and fire suppression have all contributed to changes in the diversity, composition and function of the plant communities within the watershed.

CURRENT CONDITION

Approximately 5 percent (3,837 acres) of the watershed is comprised of special habitats. Appendix F provides current acres of wet and special habitat types within the watershed. The watershed has not yet been comprehensively surveyed for SHAB types and associated floristic inventories. Sampling is usually accomplished when associated with site specific projects. Figure 3.4-4 shows current and potential special habitats and Figure 3.4-5 shows wet/special habitats within the watershed.

Meadow opening size and abundance in the watershed may have been influenced by a reduction in the fire maintenance regime, caused by 70 to 80 years of natural fire suppression activities. Subsequent conifer invasion has since been occurring, being particularly prevalent on ridge line meadows where repeated lightning ignited burns may have maintained meadow conditions. *Vaccinium embranaceum/Xerophyllum tenax* communities present in the upper elevations of the watershed are examples where fire is thought to have played a key role in producing non-forested openings in drier mountain areas (Franklin and Dyrness 1988).

There are no current livestock grazing, allotments or permits within the Salt Creek Watershed.

LATE-SUCCESSIONAL RESERVES

The objectives of Late Successional Reserves are to protect and enhance conditions characteristic of late successional and old-growth forest ecosystems. Desired characteristics of late successional forest include: 1) multi-species, and multi-layered stands of trees; 2) moderate to high accumulations of large logs and snags; 3) moderate to high canopy closure; 4) moderate to high numbers of damaged and deformed trees; and 5) moderate to high accumulations of fungi, lichens, and bryophytes.

REFERENCE CONDITION

Historically, 49 percent of the watershed would have been considered late successional habitat. Snag and down log habitat are presumed to have been in greater abundance. Thirty-eight percent would have been in mid-seral condition which may have served as dispersal habitat for late successional dependent species.

CURRENT CONDITION

Late Successional Reserves within the Salt Creek watershed comprise approximately 10 percent (7,023 acres) of the watershed. The majority of the LSR's are located in Subwatersheds 20 1 and 20 2, with the largest block occurring in 20 1. Snag and down log habitat within the LSR's may be below historic levels in some areas. Fire suppression has not led to an overall reduction in the number of snags that would have been created under past fire regimes within portions of this watershed. In addition, the majority of dead trees that resulted from fires have not been salvaged recently.

RIPARIAN RESERVES

REFERENCE CONDITION
The reference condition of riparian reserves was one of relatively little fragmentation, specifically due to the lack of roads and timber harvest. Fires within the watershed may have fragmented riparian zones, but remaining snags may have contributed large woody material to streams.

CURRENT CONDITION
Approximately 22,880 acres (32 percent) of the Salt Creek watershed is within riparian reserves. The number of acres recognized as riparian reserves will likely increase as more detailed stream mapping is completed within the watershed. Tables 3.4-2, 3.4-4, and Figures 3.4-3, and 3.5-7 show the amount of riparian reserves for each subwatershed and the area harvested within these reserves. Subwatershed 20 1 has had the highest percentage (33 percent) of harvest in riparian reserves.

Management activities in riparian areas have occurred in varying degrees during the last century. Harvest impacts within riparian reserves increased substantially during the decade beginning in 1950 and generally continued to do so until 1990. Figure 3.4-3 and Table 3.4-2 show the number of acres of riparian reserves harvested by decade in each subwatershed.

Table 3.4-2. Riparian Reserve Acres Harvested by Decade by Subwatershed

	Decade of Harvest						Total Riparian Acres Harvested by Subwatershed
Subwatershed	**40-49**	**50-59**	**60-69**	**70-79**	**80-89**	**90-95**	
20 1	81	452	549	497	693	63	2,335
20 2	167	51	400	433	985	117	2,153
20 3	0	0	9	206	974	613	1,802
Total Acres by Decade	**248**	**503**	**958**	**1,136**	**2,652**	**793**	**6,290**

Figure 3.4-3 Acres of Riparian Reserve Harvest by Subwatershed and Decade

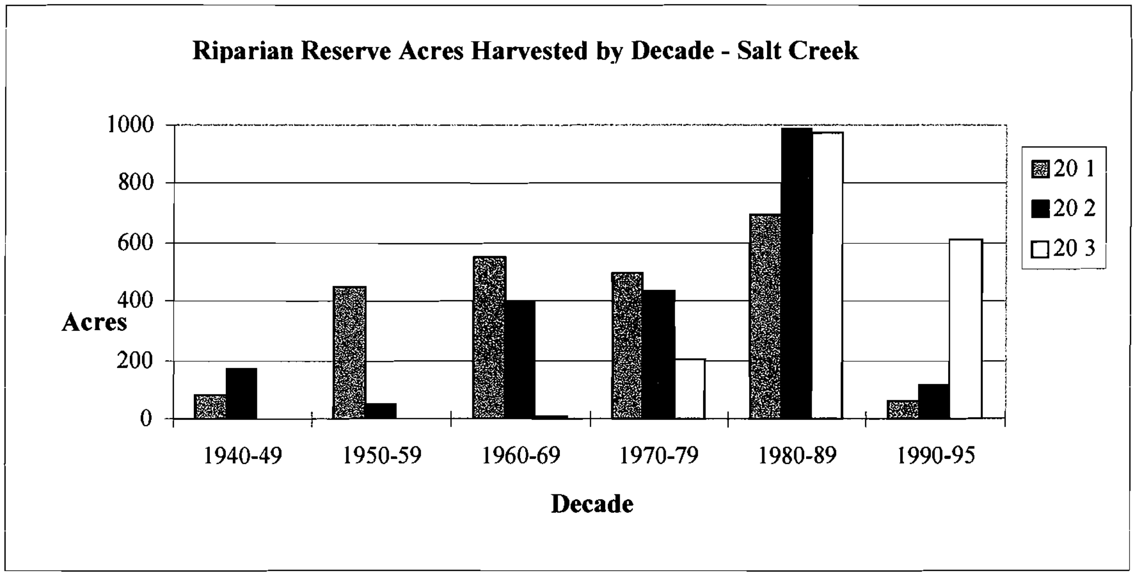
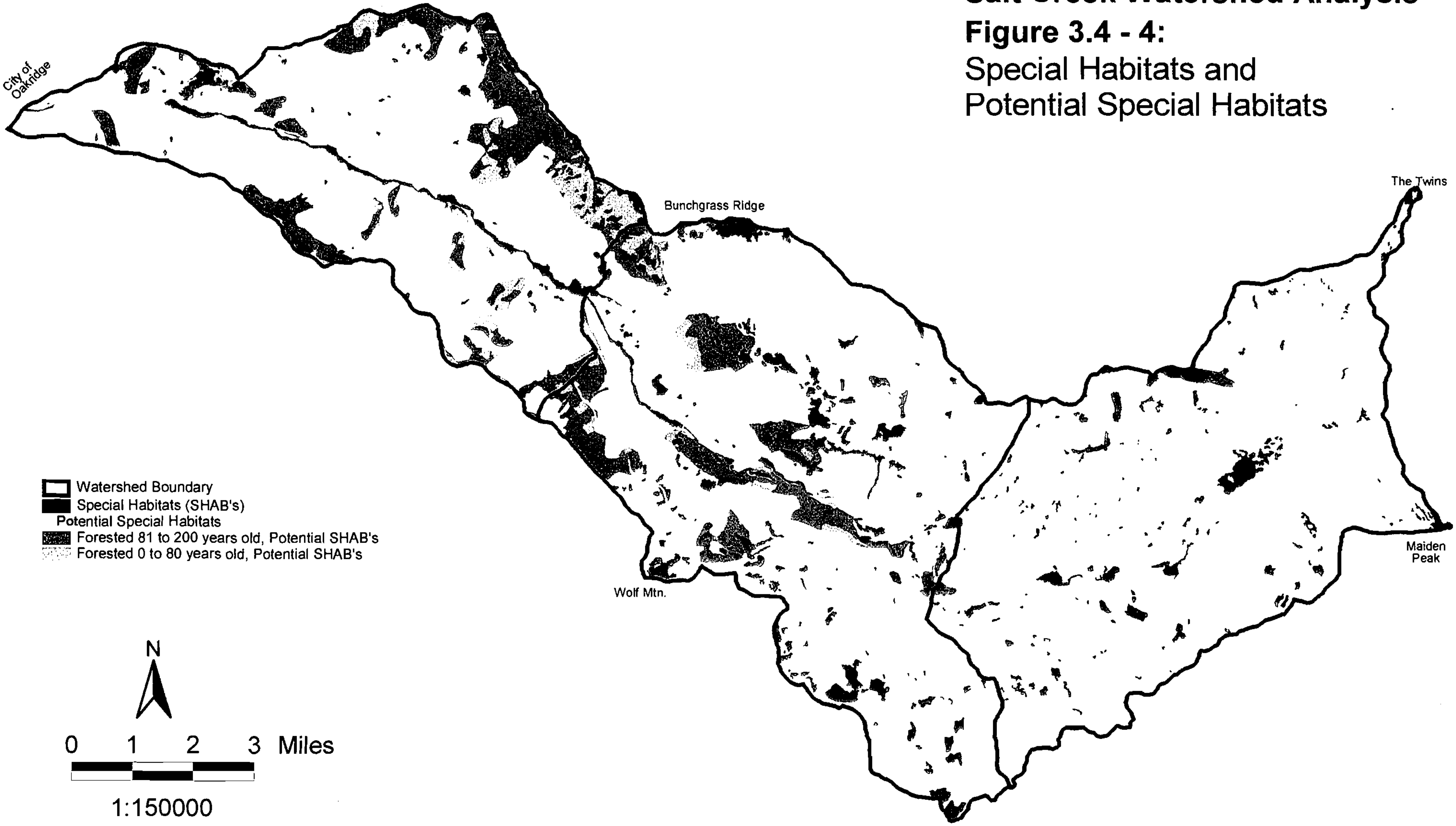


Table 3.4-3. Area and Percent of Land Within One half and One mile of Roads

Subwatershed	Total Acres	Total Acres within 0.5 mi of Roads	Percent of Total	Total Acres within 1.0 mi of Roads	Percent of Total
20 1	20,156	19,073	95%	20,061	100%
20 2	27,351	22,724	83%	25,738	94%
20 3	24,263	11,927	49%	17,571	72%
Totals	**71,770**	**53,724**	**75%**	**63,370**	**88%**

Salt Creek Watershed Analysis
Figure 3.4 - 4:
Special Habitats and Potential Special Habitats



Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

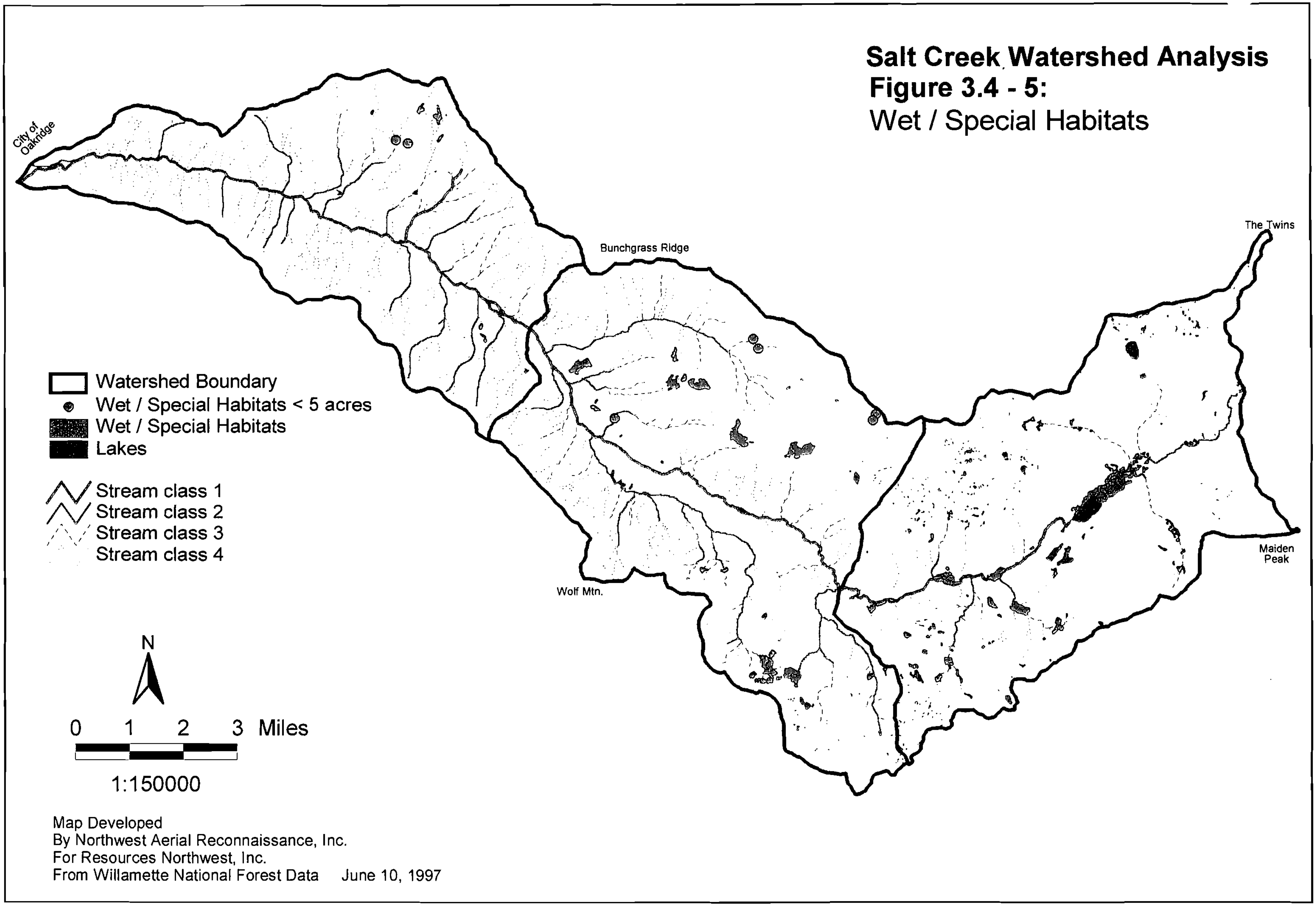

Salt Creek Watershed Analysis
Figure 3.4 - 5:
Wet / Special Habitats
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Wet / Special Habitats < 5 acres
Wet / Special Habitats
Lakes
Stream class 1
Stream class 2
Stream class 3
Stream class 4
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Table 3.4-4. Road Openings, Trails, and Railroads within Riparian Reserves

Subwatershed	Riparian Reserve Total Acres	Road Type	Acres of Road in Reserves	Percent Reserves in Road Openings	Miles of Trail in Reserves
20 1	7,160	Road	1,704	24%	5.5
		Railroad	1,302	18%	
20 2	8,625	Road	1,292	15%	2.3
		Railroad	848	10%	
20 3	7,095	Road	525	7%	2.4
		Railroad	200	3%	
TOTALS	**22,880**		**5,871**	**26%**	**10.2**

THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

REFERENCE CONDITION

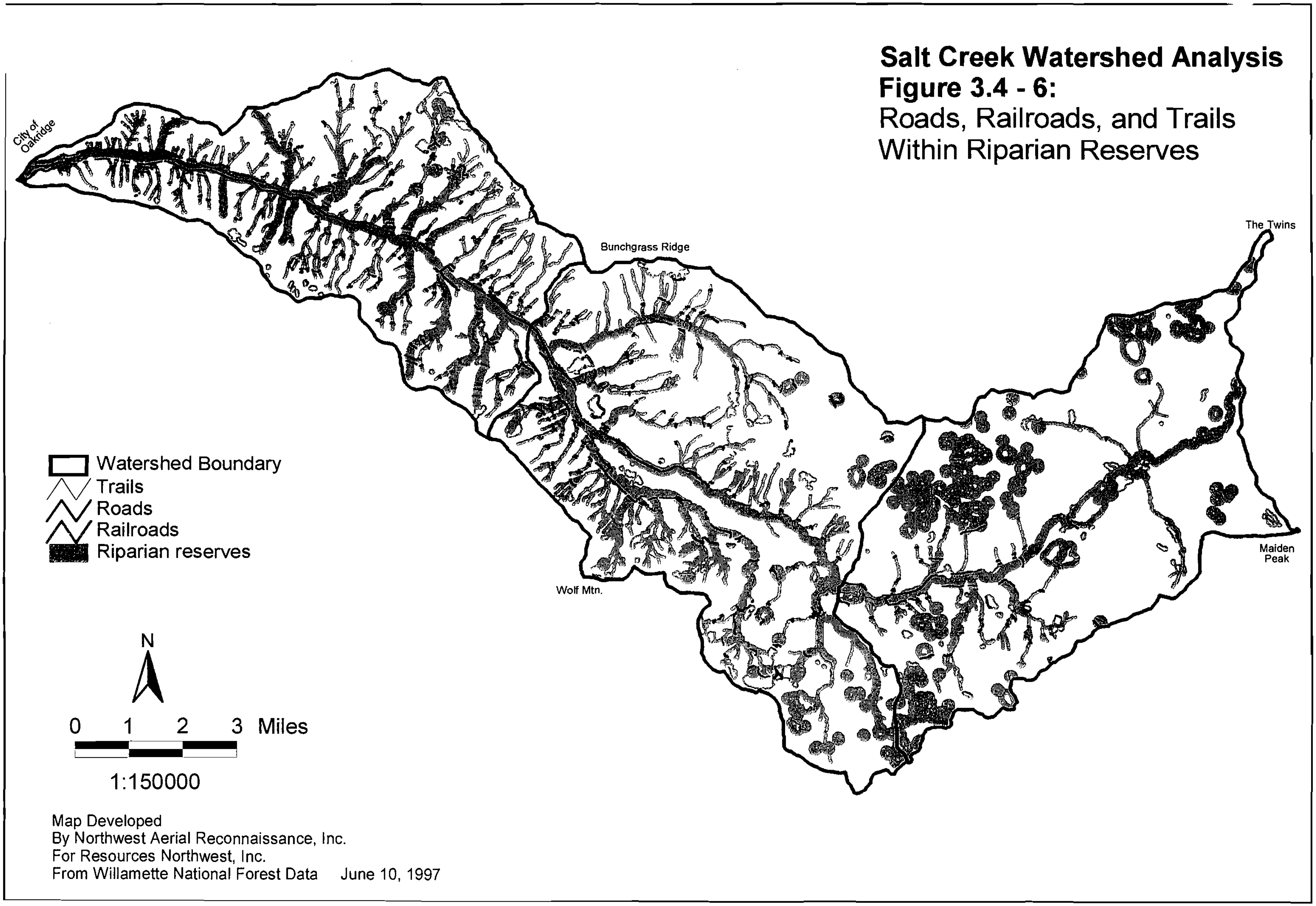
The historic distribution of sensitive and rare plant habitat is assumed to be generally similar to that of today, with some exceptions such as areas prone to frequent stand replacing fires which may have contributed to a higher abundance of non-forested patches, and to underburned areas that may have been maintained by more frequent fire events.

CURRENT CONDITION

Several types of natural openings and forested lands found in the watershed are habitat for plants currently listed as sensitive by the Region 6 Regional Forester's TES Plant List. See Appendix D for a list of potential habitats for sensitive plant species in the watershed. Four of these species have been documented in the Salt Creek watershed.

Succession, in the form of tree encroachment into meadows and tree canopy closure (possibly increased by fire suppression), is occurring where low intensity natural ground fires contributed to more open understory conditions. The germination of woodland milkvetch (*Astragalus umbraticus*) and branching Montia (*Montia diffusa*) is influenced by fire. Both species may have occurred more frequently in reference conditions following closely after fire events. Branching Montia and woodland milkvetch have been documented within the watershed.

Additional rare plant species occur in the watershed. Some, like most sensitive plants in this ecosystem, are found within non-forested habitats while others occur in forested habitats. Six species listed on the Willamette National Forest Watch and Concern Lists are located within the watershed. These species are usually located and tracked along with sensitive plant and other botanical inventories conducted in Wilderness Areas, Special Interest Areas, and other non-timber production land allocations. See Appendix D for a listing of rare and unique plants in the watershed.


Salt Creek Watershed Analysis
Figure 3.4 - 6:
Roads, Railroads, and Trails
Within Riparian Reserves
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Trails
Roads
Railroads
Riparian reserves
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

SURVEY AND MANAGE SPECIES: FUNGI, BRYOPHYTES, LICHENS, AND VASCULAR PLANTS

REFERENCE CONDITION

Historically the western portion of the watershed contained large tracts of old-growth forest with patchy fire occurrences, as suggested on the fire history map (Figure 3.4-7) and historic seral stages map (Figure 3.4-1). A majority of Subwatershed 20 3 also consisted of later-seral forest. Species diversity and richness in old-growth and riparian dependent communities, where many of these survey and manage species are found, had more time to develop where fire was less frequent.

CURRENT CONDITION

Late-successional species habitat in portions of the watershed has declined due to extensive harvest of old-growth forest and associated road building. Most old-growth in the watershed is concentrated at higher elevations or in areas associated with previously designated spotted owl reserves. In many areas old-growth stands are highly fragmented. Many Survey and Manage Species have limited dispersal capabilities, therefore gene flow may be restricted between populations in fragmented habitat areas. Management for single conifer species after harvest in riparian forests along with adjacent upland area has contributed to a simplification of species richness in affected plant communities.

Since fire suppression began in the watershed, longer intervals have occurred between large scale fire events. Species associated with late-seral forests have likely become established in areas where fire suppression has resulted in development of older forest conditions.

Many Survey and Manage Species have not yet been systematically inventoried in this watershed. The Regional Ecosystem Office species location information and survey protocols are expected to be released in the near future. Existing biological and ecological information is minimal for most of these species. However it is reasonable to assume that if systematic surveys were conducted for old-growth dependent species, a much larger number would be found in the watershed. See Appendix D for a list of Survey and Manage Species known to occur in this watershed.

NOXIOUS WEEDS AND OTHER NON-NATIVE PLANT SPECIES

REFERENCE CONDITION

Non-native plant species legally designated as "noxious", are "any weed designated by the Oregon State Weed Board that is injurious to public health, agriculture, recreation, wildlife, or any public or private property" (ODA Noxious Weed Policy and Classification System, 1995). Several detrimental effects are included in the criteria for rating and classifying weeds as noxious. One of these effects is "a plant species that is or has the potential of endangering native flora and fauna by its encroachment in forest and conservation areas" (ODA, 1995). Most northwest weeds are originally native to Europe or Asia, and were introduced intentionally or by accident in this region. Noxious weeds and other invasive non-natives have the potential to alter native plant communities, as they are able to displace and out compete native species. They are opportunists with broad ecological tolerances, can grow under a wide range of climatic and soil conditions, and have excellent reproductive capabilities (Taylor, 1990).

Noxious weeds were absent from the watershed prior to European colonization. Non-native plant species where introduced when settlers began arriving. In the 1930's, when large-scale logging and road building began in the watershed, large increases and the spread of non-native plants occurred. Livestock grazing also contributed to the spread of some noxious weeds.

CURRENT CONDITION

Non-native plant species play a significant role in influencing changes to native plant communities. Weed competition with native plant species is occurring in conifer plantations; wetlands and river flood plains, and road, railroad, and power line right-of-ways. Some weeds have also been documented spreading into natural dry and moist meadow openings and rocky areas. Non-desirable weed species are also outcompeting native plants in many areas by forming dense patches and thickets restricting growth of native species. Many noxious weed species and other non-native invasive plants are found in the watershed. Distribution of some species is currently increasing, largely due to logging and road building practices. Many of these species are widely distributed. See Appendix D for a list of noxious weeds present or with potential to exist in the watershed.

The spread of non-native plants within the watershed poses a serious threat to some native plants. The Willamette National Forest Integrated Weed and Management Environmental Assessment, April 1993, lists seven site types where a potential exists to harbor noxious weeds already established on the forest and potential invader weeds. All of these site types are found within the watershed. Site types range from bare, rocky, gravely ground, such as road beds and quarries, to floristically diverse areas such as meadows, sensitive plant habitat, and wetlands.

Forest roads and other travel right-of-ways serve as noxious weed dispersal corridors and establishment sites. The Willamette Highway (State Highway 58) and the Union Pacific Railroad (UPRR) are both well used travel corridors by vehicles and railroads where seed has been transported. In addition, timber harvested areas, associated roads and landings, trails, and other disturbed openings have created conditions which can increase weed populations. Other possible vectors for spread of weeds include wildlife (birds and mammals), livestock and their feeds, and weed seed contamination of forage and erosion control seeding projects.

Roadside inventories on the Oakridge Ranger District of noxious weeds were conducted by the Oregon Department of Agriculture in 1988 and again in 1993. The results of these inventories have shown that some noxious weed species are spreading at an alarming rate. For instance, scotch broom (*Cytisus scoparius*) is estimated to have infested an additional 35 percent of the area since the 1988 survey and the number of roads infested has increased to 51 percent (Glen Miller, pers. comm.).

DISTURBANCE

Natural disturbance within a landscape can take many forms; fire (natural and human caused) insects, disease, and windthrow. Each of these disturbances can occur at small or large scales with different effects upon the landscape.

Fire

Fuel Accumulation

Determining dead fuel accumulation is necessary to define potential fire behavior and suppression difficulty in the event of a fire. Once dead fuel loading is determined, it can be characterized into standard fuel models for predictive purposes.

REFERENCE CONDITION

This watershed is typical of a high-severity fire regime as described by Agee (1981). Fires in this regime are very infrequent on a given piece of land within the watershed (more than 100 years between fires). They are usually high-intensity, stand replacement fires. Fires are associated with drought years, east wind synoptic weather types with lower humidity, and an ignition source such as lightning (Huff and Agee, 1980, Pickford et al, 1980). Area burned within this watershed is displayed in Table 3.4-5. Accurate fire return intervals have never been calculated in these forests because the interval between fires are long and may not be cyclic (Agee and Flewelling, 1983). Fahnestock and Agee (1983) estimated that drier sites may burn again after 100 years. Within this subwatershed, the large fire return interval appears to be 30-50 years, with the majority of these occurring within previous fire events. 150 to 200 years ago 74% of this watershed burned, 40% burned between 1840 and 1889, 6% between 1890 and 1939, and 3% since 1940.

The following conditions were found in this watershed:

Subwatershed 20 1

Stand replacement fires since 1790 (Figure 3.4-7) have burned approximately 57% of this subwatershed. From 1790 to 1839 approximately 96% of the area north of Salt Creek (south facing aspect) burned and 7% burned in the area south of Salt Creek (north facing aspect). From 1840-1889, approximately 58% burned north of Salt Creek and 18% south of Salt Creek. From 1890-1939, 7% burned north of Salt Creek and 5% burned south of Salt Creek. Since 1940, only 10% burned north of Salt Creek and no major fires have occurred south of Salt Creek. The Pryor and Warner Creek fires account for these acres in the last 50 years. It is interesting to note that the majority of acres burned in this watershed occurred 100-200 years ago and 40 years prior to fire suppression management.

Subwatershed 20 2

Approximately 88 percent of Subwatershed 20 2 has burned between 1790 and 1839 of which 96% was north of Sa Creek (south facing aspect) and 78% burned south of Salt Creek (north facing aspect). Between 1840 and 1889, 49% burned with 47% north of Salt Creek and 52% south of Salt Creek. From 1890-1939, 6% of the subwatershed burned, 7% north of Salt Creek and 4% south of Salt Creek. From 1940 to present, 4% of this area burned, all being north of Salt Creek. These large fire events occurred 40 years before fire suppression management. This subwatershed receives the greatest influence from east wind events.

Subwatershed 20 3

Approximately 73 percent of Subwatershed 20 3 burned between 1790 and 1839, with 54% burning the area north of Highway 58 and 95% burning the area south of Highway 58. The area south of Highway 58 receives strong influence by east wind events. Between 1840 and 1889, 27% of the subwatershed burned, 25% north and 30% south of Highway 58. From 1890 to 1939, 8% burned, 5% north and 10% south of Highway 58. No large fires have occurred since 1940. The last large fire event over 1,000 acres occurred 40 years prior to fire suppression management.

Table 3.4-5. Acres and Percentage of Salt Creek Watershed Burned by Stand Replacement Fire: Time Period 1790 to Present

	Subwatershed 20 1 (20,157 acres)				Subwatershed 20 2 (27,351 acres)				Subwatershed 20 3 (24,263 acres)				
Time period	North	%	South	%	North	%	South	%	North	%	South	%	Total
Total Acres	11,401		8,755		14,550		12,801		12,631		11,632		71,770
1790 to 1839	11,000	96	588	7	14,000	96	10,000	78	6,775	54	11,000	95	53,363
% of Sbshed	57%				88%				73%				74%
1840 to 1889	6,641	58	1,587	18	6,838	47	6,690	52	3,126	25	3,483	30	28,365
% of Sbshed	41%				49%				27%				40%
1890 to 1939	746	7	443	5	965	7	569	4	691	5	1,181	10	4,595
% of Sbshed	6%				6%				8%				6%
1940 to present	1,093	10	--		1,161	8	--		--		--		2,254
% of Sbshed	5%				4%				--				3%

Approximately 122% or 87,484 acres of this watershed has burned in the last 200 years. Given the amount of stands greater than 200 years of age, this number is indicative of the amount and extent of reburn events that have occurred in this watershed. In most cases, the lack of large woody material on the ground and fire boundaries are not typical of a single event fire. The fire events of 1790 were probably first event fires which means stands had lots of large woody material standing and on the ground when the fires burned, leaving large quantities of standing dead woody material that over time decayed and fell to the ground. The remaining fire events appear to be second event fires, with most of the fire activity occurring in the same general topographic areas of previous fires and within 30 to 50 years. Given a fire start, this would be expected due to large accumulations of large woody material on the ground combined with young stands of brush and trees. Stand age determination is difficult but when a variance of 5 to 10 years is applied, the majority of these events correspond well to drought years and/or abnormally dry winters (Hemstrom and Franklin, 1982).

With this information, it is possible to identify trends in fuel loading over time. Fuel loading was classified into one of the Northern Forest Fire Laboratory (NFFL) fuel modes (FM) used to predict fire behavior. Table 3.4-6 shows the fuel models used in this analysis.

Table 3.4-6. Fuel Models

Fuel Model >>	FM5	FM8	FM10	FM11	FM12
Total fuel load, <3-inch dead and live, tons/acre	3.5	5.0	12.0	11.5	34.6
Dead fuel load, 1/4-inch tons/acre	1.0	1.5	3.0	1.5	4.0
Live fuel load, foliage, tons/acre	2.0	0	2.0	0	0
Fuel bed depth, feet	2.0	0.2	1.0	1.0	2.3

Table 3.4-7 shows the Post Fire Fuel Loading by 50 year periods of time (stand age) that will be used to determine fuel loading.

Table 3.4-7. Post Fire Event Fuel Loading

Years after event	0-30 years	31-80 years	81-200 years
1st event fire	FM5	FM12	FM10
2nd event fire	FM5	FM11	FM8

With this sequence of events, a determination of reference conditions would require looking at each 50 year period of time to determine fuel loading conditions for that period only (Table 3.4-8). For stands greater than 200 years of age, data was collected from 72 natural stand plots to determine fuel loading. For these stands greater than 200 years of age, FM8 represented 47% of all plots and FM10 represented 53% of all plots. These percentages were then applied to each time period. The last 50 years (1940 to present) was considered current condition for this analysis.

Beginning in 1939, the following conditions were estimated to have existed in this watershed:

Table 3.4-8. Fuel Models - 1790-1939.

North Side Salt Creek (South Facing Aspect)				South Side Salt Creek (North Facing Aspect)			
	38,582 Total Acres				33,190 Total Acres		
Fire Events	Acres	Fuel Model	Percent	Fire Events	Acres	Fuel Model	Percent
1790-1839	6,078	FM8	16	1790-1839	4,515	FM8	14
1840-1889	16,605	FM11	43	1840-1889	11,760	FM11	35
1890-1939	2,402	FM5	6	1890-1939	2,193	FM5	7
Total Acres Burned	25,085		65	Total Acres Burned	18,468		56
Total Acres Not Burned	13,497		35*	Total Acres Not Burned	14,722		44*
FM8 = 47%x13,497 = 6,344 acres				FM8 = 47%x14,722 = 6,919 acres			
FM10 = 53%x13,497 = 7,153 acres				FM10 = 53%x14,722 = 7,803 acres			

*Greater than 200 years of age

Table 3.4-9. Summary of Fuel Loading Acreage 1790 to 1939.

Fuel Model	Acres	Percent
FM5	4,595	6
FM11	28,365	40
FM8	23,856	33
FM10	14,956	21
FM12	0	0

Prior to 1890 (100 years ago), the following conditions were estimated to have existed (Table 3.4-10):

Table 3.4-10. Fuel Models - 1790-1889.

North Side Salt Creek (South Facing Aspect)			
	38,582 Total Acres		
Fire Events	Acres	Fuel Model	Percent
1790-1839	2,402	FM11	6
1840-1889	16,605	FM5	43
Total Acres Burned	19,007		49
Total Acres Not Burned	19,575		51*
FM8 = 47%x19,575 = 9,200 acres			
FM10 = 53%x19,575 = 10,375 acres			

South Side Salt Creek (North Facing Aspect)			
	33,190 Total Acres		
Fire Events	Acres	Fuel Model	Percent
1790-1839	4,515	FM11	14
1840-1889	11,760	FM5	35
Total Acres Burned	16,275		49
Total Acres Not Burned	16,915		51*
FM8 = 47%x14,722 = 7,950 acres			
FM10 = 53%x14,722 = 8,965 acres			

*Greater than 200 years of age

Table 3.4-11. Summary of Fuel Loading Acreage 1790 to 1889.

Fuel Model	Acres	Percent
FM5	28,365	40
FM11	6,917	10
FM8	17,150	24
FM10	19,340	26
FM12	0	0

Table 3.4-12. Fuel Models - 1790-1839.

North Side Salt Creek (South Facing Aspect)			
	38,582 Total Acres		
Fire Events	Acres	Fuel Model	Percent
1790-1839	31,775	FM12	82
Total Acres Not Burned	6,887		18
FM8 = 47%x6,887 = 3,237 acres			
FM10 = 53%x6,887 = 3,650 acres			

South Side Salt Creek (North Facing Aspect)			
	33,190 Total Acres		
Fire Events	Acres	Fuel Model	Percent
1790-1839	21,588	FM12	65
Total Acres Not Burned	11,602		35
FM8 = 47%x11,602 = 5,452 acres			
FM10 = 53%x11,602 = 6,150 acres			

Table 3.4-13. Summary of Fuel Loading Acreage 1790 to 1839.

Fuel Model	Acres	Percent
FM5	0	0
FM11	0	0
FM8	8,689	12
FM10	9,800	14
FM12	53,363	74

CURRENT CONDITION

Given the above reference conditions prior to timber harvest and with fire suppression, it is necessary to determine current fuel loading. The same percentages for stands greater then 200 years of age were used for acres not harvested. Table 3.4-14 shows harvest acres categorized by fuel model using the same NFFL fuel models used to determine reference conditions. Treated (T) acres are units that were either broadcast burned, underburned, hand piled and burned, or machine piled and burned. No treatment (NT) includes all acres that do not meet treated unit requirements. Table 3.4-14 identifies fuel model to type of treatment and specified time periods.

Table 3.4-18. Percent of Watershed Burned by Elevation Since 1940

Elevation (feet)	Percent of Acres Burned
1000 to 1999	<1
2000 to 2999	10
3000 to 3999	14
4000 to 4999	11
5000+	3

Insects and Disease

Insects and diseases are part of the natural ecosystem which have caused disturbances on the landscape. Native insects and diseases occur at normal levels, however, occasionally these infestations reach epidemic levels. The effects of these outbreaks can be serious at the stand or landscape level, affecting a few trees or entire watersheds.

REFERENCE CONDITION
Insects and disease likely affected the reference watershed by altering forest vertical and horizontal structural diversity and species composition. Trees killed or damaged by insects and disease created snags and downed wood that provided habitat to many wildlife species, and contributed to nutrient cycling. Gaps in the forest canopy increased the amount of light reaching the forest floor which affected species composition and vegetation growth rates. In addition, insects provided food for some wildlife species.

Very little is know about the amount and distribution of past outbreaks of insects and diseases within the watershed. However, some insects and diseases are not native to the Pacific Northwest and are new disturbance agents to the ecosystem. These disturbances may have occurred at various levels, however no serious outbreaks are known to have occurred in this watershed.

CURRENT CONDITION
No serious outbreaks of insects or diseases are present within the watershed. Only localized pockets of infestations are present affecting small areas of generally a few acres (less than 2 acres). The following forest insects (Table 3.4-19) and forest tree diseases (Table 3.4-20) have been documented or may be suspected within the watershed.

Table 3.4-19. Forest Insects Documented or Suspected within the Salt Creek Watershed

Common Name	Species	Documented or Suspected Within the Watershed
Balsam woolley adelgid[a]	*Adelges piceae*	yes
Douglas-fir beetle	*Dendroctonus pseudotsugae*	yes, almost exclusively associated with Phellinus
mountain pine beetle	*Dendroctonud ponderosae*	yes
fir engraver beetle	*Scolytus ventralis*	yes
silver fir beetle	*Pseudohylesinus sericeus*	unknown
Douglas-fir engraver	*Scolytus unispinosus*	yes (low risk)
Western Balsam fir bark beetle	*Dryocoetes confusus*	probable

[a] *introduced species*

Table 3.4-20. Forest Tree Diseases Documented or Suspected within the Salt Creek Watershed

Common Name	Species	Documented or Suspected Within the Watershed
laminated root rot	*Phellinus weirii*	yes
armillaria root rot	*Armillaria ostoyae*	yes
annosus root rot	*Heterobasidion annosum*	probable
dwarf mistletoe	*Arceuthobium tsugense*	yes
white pine blister rust[a]	*Cronartium ribicola*	yes
western gall rust	*Peridermium harknessii*	unknown

[a] *introduced species*

Windthrow

REFERENCE CONDITION

Wind served as a natural disturbance mechanism across the watershed when it was strong enough to topple trees. It has played a role in recycling some forest stands - renewing and maintaining stand diversity. Windthow induced gaps or openings in the forest canopy provided light and growing space for many types of vegetation, including tree regeneration. Smaller gaps may have stimulated regeneration of shade tolerant species, while larger more contiguous openings could have developed into even-aged stands of mostly shade-intolerant species. Areas of partial windthrow with irregular patterns of windthrown trees resulted in greater species diversity and vertical and horizontal heterogeneity. The amount of windthrow likely varied from a few scattered trees to large, contiguous patches of possibly several hundred acres in size.

Another effect of windthrow was disturbance of the soil profile. After a tree has blown down, soil and rocks are generally exposed which provide microhabitats used by some plant and animal species. Some windthrow areas may have also contribute to soil movement and debris avalanches.

Windthrown trees have provided downed wood, an important component to both forest and stream ecosystems. It can be the primary means of large woody material entering into stream ecosystems, providing nutrient input and invertebrate habitat, and creating pools and other fish habitat. Stream channel morphology and water temperatures are also affected by trees blown down in riparian areas.

CURRENT CONDITION

Windthrow has occurred at various levels throughout the watershed in recent decades. A major wind event occurred in December 1983. Approximately 3,000 acres were affected in what meteorologists described as an unusual set of conditions where an extreme downdraft occurred in the jet-stream. Smaller scale windthrow (less than a few acres) periodically occurs affecting a few acres at a time, especially along abrupt edges adjacent to clearcuts. High winter storm winds traveling up the drainage from the west have resulted in windthrow in some exposed areas. Relatively strong east winds also typically occur in the summer and early fall causing some occasional minor windthrow, although the major impact of these winds is increased fire danger.

Localized small scale (less than a few acres) windthrow, especially adjacent to exposed areas and adjacent to clearcuts will likely continue. However as these areas become more windfirm, and adjacent younger stands grow, windthrow frequency will likely decrease. Areas adjacent to new openings created in the forest will however be more susceptible to increased windthrow.

SITE PRODUCTIVITY

REFERENCE CONDITION

Wildfires, especially frequent fires reduce organic materials on the forest floor. Prior to timber management activities, wildfires were the primary factor influencing site productivity in the watershed.

Historically, the amount of large woody material (large logs) and snag habitat in the landscape probably varied within the watershed. Fire stands, especially areas repeatedly burned, may have had a decreased amount of snags and down wood on the forest floor. LWM typically was more abundant in areas with less favorable burning conditions such as riparian areas and north and east facing slopes. Generally, areas with infrequent fires or where they have not occurred have greater number of large snags and logs.

<u>CURRENT CONDITION</u>

Retention of large woody material (LWM) has varied over time with management practices. Approximately 25 percent of this watershed has been disturbed as the result of intensive harvest methods. The presence of large woody material and snag habitat varies within the watershed depending on past fires and harvest activity. Generally areas with better access and gentle topography, have been heavily salvaged in the past. In many areas snags and large logs have been harvested on the forest floor and within riparian and aquatic habitats, while other areas have had little salvage activity resulting in higher levels of snags and logs. The amount of large woody material and snag levels remaining after harvest has varied with the type of harvest and the time frame within which harvest occurred. Some areas harvested before 1950 had seed trees dispersed throughout harvested stands to serve as seed sources. These residual trees contribute to diversity within young stands and ultimately provide a source for snag and large wood recruitment.

Many of the areas logged prior to 1970 also have large logs remaining from the original harvest, due to merchantability standards of the time. Later, utilization became an issue and slash treatment became standard practice between 1970 and 1989. Harvested areas were often left with little or no snags, large woody debris, or residual trees big enough to offer recruitment for these habitat structures. As YUM (yard unmerchantable material) and PUM (pile unmerchantable material) requirements were used less and Forest Plan standards for snag and large woody debris retention were adopted (1990), the amount of wildlife tree and down log habitat within harvested areas began to increase. Table 3.5-2 of this chapter displays the acreages within the watershed that were treated with intensive harvest treatments prior to 1970, from 1970 to 1989, and from 1990 to 1995.

The spatial and temporal distribution of non-vegetated areas on erosive soils in the watershed has been altered when compared to the historic fire pattern. Stand replacement fires tended to be larger localized blocks rather than the dispersed patchwork of clearcuts in varying stages of vegetative recovery currently exhibited.

This change in patterns may or may not be beneficial to the system. Larger stand replacement fires may tend to have a higher impact to a few drainages until vegetation is re-established. The dispersed patchwork of smaller clearcut units may tend to have a lower impact, but would be distributed over a larger area.

In contrast to past management practices, the recent change toward the retention of more trees, snags and large woody material comes closest to mimicking historical fire impacts. The residual root strength from the trees and the energy dissipating effect of large woody material on overland flow tend to retain more soil on the hillside.

TERRESTRIAL WILDLIFE AND HABITAT, TES SPECIES

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Emphasis on species listed as Federally threatened, endangered, proposed, or Forest Service sensitive (TES) has had a significant role in shaping agency management direction. Significant shifts have occurred over Forest Service management guidelines since the 1990 listing of the northern spotted owl as a federally threatened species in the Pacific Northwest. Management of the entire forest ecosystem continues to evolve with less emphasis on single species and a shift to groups or guilds of species using similar habitats and life requirements. However, emphasis on specific rare species will continue to be important especially with their unique habitat requirements.

Threatened, endangered, and sensitive terrestrial wildlife species documented, suspected, or that may be expected to occur within the watershed are listed in Appendix E. Terrestrial wildlife species confirmed or documented within the watershed will be discussed below. These species have been grouped according to similar home range size, habitat use, or habitat characteristics. Their guild association can be found in Appendix E.

The following two species have been associated with aquatic habitat of rivers and streams.

Northern Red-legged Frog (*Rana aurora*)

<u>REFERENCE CONDITION</u>

Red-legged frogs were likely inhabitants of suitable habitat throughout the watershed during the reference era. Natural disturbance events, particularly fire, may have affected spatial and temporal distribution for local populations of this species.

CURRENT CONDITION

Red-legged frogs have been documented at numerous sites in the watershed associated with both breeding and foraging habitat. Current habitat and habitat use may have been altered by management activities that have changed features of aquatic habitats and/or shade and humidity of terrestrial habitats.

Harlequin Duck (*Histrionicus histrionicus*)

REFERENCE CONDITION

Riparian conditions associated with Salt Creek during reference conditions provided suitable habitat most likely occupied by harlequin ducks during the breeding season. Periodic flood events may have affected nesting habitat in some areas for this species.

CURRENT CONDITION

Harlequin ducks are known to occupy habitat in the watershed during breeding season and successful reproduction of this species has been documented.

Salt Creek has been impacted by past management practices, especially timber harvest and salvage activity in riparian areas and from construction and maintenance practices associated with Highway 58 and the Union Pacific Railroad. In the past, large woody material within the river and associated riparian areas was removed, adversely affecting breeding habitat. Recent heavy debris flows over the last few years (particularly in November 1996) have replaced some woody material in aquatic and riparian habitats.

The following two species have been assigned to large home range guilds.

California Wolverine (*Gulo gulo*)

REFERENCE CONDITION

Habitat conditions in the watershed during the reference era favored the likelihood of occupancy by wolverine as it is located well within the historic range for this species, and would have been relatively free from human disturbance especially during early breeding season.

CURRENT CONDITION

Numerous sightings of wolverine have been reported in recent years in the higher elevation eastern portions of the watershed. Confirmation of habitat occupancy by this species has not yet occurred. If they do occur in the watershed, human disturbance would be the greatest threat to successful reproduction and long-term occupancy.

Northern Spotted Owls (*Strix occidentalis caurina*)

REFERENCE CONDITION

Northern spotted owls are generally associated with late-seral and old-growth interior forest habitat. Spotted owls are considered a large home range mosaic late-seral guild species (TLML) whose habitat is shown in Figure 3.5-5 of this section. Areas within the watershed that had large patches of late-seral and old-growth habitat within the median home range (about 3,000 acres) are shown in this map. However, plant associations (vegetative communities) are not identified on this map; therefore not all of the area mapped in the watershed was necessarily suitable for northern spotted owls (i.e., high elevation areas composed of true-fir and mountain hemlock plant associations).

Wildfire was the major disturbance affecting northern spotted owl habitat, population densities, and distributions in the watershed prior to the influence of man. Periodic stand replacement fire events affected relatively large areas (refer to Fire History, page 39). As a result of large fires many of these stands were unsuitable for spotted owl use for up to several decades. The distribution of spotted owls likely shifted with suitable habitats. There are no estimates of th historic numbers of spotted owls.

CURRENT CONDITION

Intensive timber harvesting began in the 1940's primarily within late-seral Douglas-fir and western hemlock in lower elevation forests. These high volume stands contained very large diameter trees which also provided high quality nesting, roosting, and foraging habitat for spotted owls. Extensive harvesting has occurred over the last five decades within Subwatersheds 20 1 and 20 2 (see Figure 3.5-7 and Table 3.5-4) and within the last three decades in 20 3.

Prior to intensive harvesting in the 1940's, approximately 16,000 acres (23 percent of the watershed) of late-seral forest habitat (average dbh greater than 21 inches) may have been present in the watershed. Currently, there are approximately 21,528 acres (30 percent) of late-seral forests present in the watershed providing nesting, roosting, and foraging habitat for spotted owls. In the western and central portion of the watershed, most suitable habitat has been heavily fragmented. The eastern portion of the watershed is relatively unfragmented, however, much of this area is high elevation forests which are marginal or unsuitable for spotted owls.

Approximately 30,680 acres (42 percent) in the watershed are mid-seral forests including closed pole and small saw timber averaging less than 21 inches dbh. These stands may serve as dispersal habitat. Many of these stands, especially under 5,200 feet in elevation may become suitable spotted owl habitat over time if permitted. This change in the amount and distribution of suitable habitat within the watershed may have had adverse impacts on spotted owl prey base, population densities, reproductive rates, and their distribution within the watershed.

A commonly accepted way to assess habitat conditions for northern spotted owls is to describe the conditions of the individual home ranges for each habitat activity center (HAC). The amount of habitat within an average size home range for the Oregon Cascades Province (1.2 mile radius or approximately 2,900 acres) should be above 40 percent of the area within the home range in order to maintain reproductive viability of the site. Current amounts of suitable habitat within the provincial radius of known spotted owl sites within this watershed are displayed in Table 3.5-1 of this chapter.

Table 3.5-1. Current Spotted Owl Home Range Conditions (Acres of Suitable Habitat) in the Salt Creek Watershed (32 activity centers).

Owl MSN	0.7 Mile Habitat	1.2 Mile Habitat	LSR No.
1131	669	2,042	1131
1132	627	1,729	1132
1133	829	2,224	1133
1136	691	2,112	0220
1137	483	1,550	0220
1146	522	1,395	1146
1148	549	1,613	1148
1149	581	1,229	1149
1789	622	2,102	1789
2769	449	1,074	0220
2773	338	1,184	2773
2778	689	1,686	2778
2787	644	1,895	2787
2790	677	1,806	2790
2800	415	1,747	2800
2805	726	1,951	2805

MSN = Master Site Number LSR = Late-Successional Reserve

Owl MSN	0.7 Mile Habitat	1.2 Mile Habitat	LSR No.
2806	326	886	2806
2811	589	1,507	2811
2812	471	1,535	2812
2816	760	2,210	2816
3094	459	1,405	3094
3574	466	1,003	3574
3579	770	1,771	0220
3984	278	1,092	3984
3985	644	1,243	3985
3986	645	1,905	3986
3992	606	1,291	3992
4100	821	1,828	4100
4423	355	932	-
9006	431	1,200	9006
9010	574	1,582	9010
9807	796	1,714	-

Highlighted values indicate suitable habitat at or below 40 percent

The following two species could occur in some special and unique habitats shown in Figure 3.4-2.

Peregrine Falcon (*Falco peregrinus anatum*)

REFERENCE CONDITION
It is highly probable that active peregrine falcon nest sites existed in the watershed under reference conditions. High quality nesting habitat was present at numerous locations. It is known that aboriginal activity in some areas may have potentially resulted in human disturbance to peregrines during the breeding season.

CURRENT CONDITION
There are currently three known peregrine falcon nest sites located within this watershed. Portions of management areas for these nest sites extend into adjacent watersheds. Portions of management areas for two peregrine nest sites in adjacent watersheds include areas within this watershed. Recent wildfires have significantly affected habitat conditions to varying degrees in portions of all five of these management areas. Habitat and use of habitat may have been altered by management activities and human disturbance.

Pacific western big-eared bat (Townsend's big-eared bat) (*Corynorhinus townsendii*)

REFERENCE CONDITION
Presence of Pacific western big-eared bat has not been historically documented within the watershed, however they probably occurred in the past. There are some known (and probably many more unknown) caves that could have been used as maternity and nocturnal roosts. Aboriginal use of some caves could have resulted in disturbance to the species. This species also likely utilized large hollow snags in the watershed.

CURRENT CONDITION
Even though presence of this species has not been documented in the watershed, it is likely to occur. No known caves are used for breeding, however, they are likely to exist. Habitat and use of habitat may have been altered by management activities; removal of large hollow snags, rock fissures or caverns; construction of shelters or bridges; modification of open water habitats. Bats may have been impacted by human disturbance (especially during hibernation or at maternity roosts). Protection measures limiting disturbances at known locations are essential for this species.

SURVEY, MANAGE, AND PROTECTION BUFFER SPECIES

The Northwest Forest Plan Record of Decision (ROD) identified survey and manage amphibian, mammal, bryophyte, mollusk, vascular plant, fungi, lichen, and arthropod species in Table C-3 beginning on page C-49. Very little is known about the historic populations and distribution of most of these species. Some of these species require very specific habitat conditions to survive. The ROD also identified other wildlife species requiring additional buffers for protection listed on pages C-19 to C-21 and C-45 to C-48. Many of these species may occur within the watershed, however comprehensive surveys have not been conducted. Species documented to occur in the watershed are addressed below. (See also discussion on Survey and Manage Species, page 38)

REFERENCE CONDITION
Great gray owls (*Strix nebulosa*) were likely common in mixed coniferous forests adjacent to meadows and burned over areas. These owls foraged in meadows and openings and generally nested in later-seral forest stands with large broken top trees or snags. Historic habitat for this species is displayed in Figure 3.5-1. The primary factor influencing great gray owl populations may have been prey base habitat. Thus, primary habitat for this species was closely associated with fire events (See Figure 3.4-7) and the relatively less abundant large meadow complexes (see Figure 3.4-4).

Whiteheaded woodpeckers (*Picoides albolarvatus*) are typically found in sugarpine, ponderosa pine or true fir mixed coniferous forests with relatively open canopies. They forage on insects and pine seeds. Habitat for this species may have been promoted by effects of fire such as maintenance of open pine stands and creation of snags.

Black-backed Woodpeckers (*Picoides arcticus*) inhabit lodgepole pine, ponderosa pine, and mixed conifer forests with a preference for late-seral stands and fire or insect damaged stands. This species was likely not widespread in the watershed, occurring in smaller localized populations in the eastern portion of the watershed. Their habitat may have been closely associated with old burns, windthrow areas, and insect infestations which supported sufficient populations of woodboring insects for foraging. Pine beetle infestations may have been important to this species (See Appendix E for guild information and habitat map).

CURRENT CONDITION

As shown in Figure 3.5-2 contrast habitat has become more abundant and widespread, especially in the western 2/3 of the watershed. Great gray owls have been observed foraging in harvested areas and have responded from timber stands adjacent to harvested stands.

Though ponderosa pine and sugar pine are not as prevalent in the watershed as in areas to the east and south, these species have been included in reforestation stock used on south and west facing slopes in this watershed. In some areas fire suppression may have reduced the occurrence of pine dominated patches and the openness of late seral stands that may have otherwise underburned. Management activities have reduced the number of large trees, diseased and defective trees and snags, especially in the western 2/3 of the watershed. Whiteheaded woodpeckers have been observed foraging in some higher elevation habitat in the southeastern portion of the watershed.

The majority of the area expected to be occupied by black-backed woodpeckers has been exposed to relatively little timber harvest activity. In portions of potential habitat however, snag density has likely been substantially reduced. Fire suppression has likely increased the amount of late-seal forest within the expected range of this species. However in the event of a future fire, the accumulation of fuels that has resulted from fire suppression may increase the risk of loss of larger trees and snags, which are important to this species.

NON-NATIVE ANIMAL SPECIES

REFERENCE CONDITION

No non-native species are known to have been present prior to European colonization. Native species had co-evolved to maintain their individual viability, though fluctuation in habitat conditions caused fluctuations in species populations, favoring some and disfavoring others.

CURRENT CONDITION

Non-native wildlife species are found within the watershed. The effect of their presence on native species is unknown. They may act as competitors for similar habitats, may prey upon or provide food for native species, or parasitize them.

The opossum (*Didelphis marsupialis*) may have been introduced to the Oakridge area in the 1930's by folks immigrating to the area during the great depression. During this period of time the animals were frequently raised as a cheap source of meat. Opossums are typically found in close proximity with humans such as residential or agricultural areas, and have likely established a small population in the lower elevation western portion of the watershed. The opossum is an opportunist and will feed on essentially anything it can kill and eat or scavenge. Rock doves, European starling and brown-headed cow birds have successfully established populations in low elevation areas within the watershed.

In the early 1960's the barred owl (*Strix varia*) began to expand its range into the range of the spotted owl in the Pacific Northwest. The first record of barred owls in Oregon was documented in 1974. Although barred owls and spotted owls have been listed in the same Habitat Species Guild, vegetation manipulation during the past decades has seemed to favor the barred owl. Barred owls have been documented at numerous sites throughout this watershed suggesting the species has successfully exploited a niche for itself in fragmented areas.

Introduced game birds (ring-necked pheasants and wild turkeys) may have established small, localized populations in low elevation areas within the watershed.

Feral house cats are occasionally reported at random locations in the watershed. Other species have been occasionally been reported lost or abandoned in the watershed. It is unknown whether these species have established local populations or what effect they may be having on native species.

Refer to discussions of introduced plant and aquatic species, pages 38 and 99.

HABITAT STRUCTURE AND COMPOSITION

REFERENCE CONDITION

The amount of large woody debris and snag habitat in the historic landscape varied widely within the watershed. In some areas reburning of previously burned areas removed many of the snags and logs that remained after the original fire. Repeated burning lowered the amount of snags and down wood on the forest floor, particularly in areas on steep south and west facing slopes. In other fire areas, reburning did not occur and "natural" levels of snags and logs were high. Large wood typically was retained at higher levels within riparian and aquatic habitats except on very steep Class IV draws that may have acted like chimneys during fire events.

A historical representation of what was thought to be the pattern of seral stages on the watershed landscape is provided in Figure 3.4-1. Figure 3.4-7 provides spatial information on fire history. As shown by these maps, fire burned over large areas in the watershed (north half of 20 1, east half of 20 2, southwest end of 20 3). In these areas snag and large wood levels may have varied considerably with fire intensity and extent of reburn. Areas that were less prone to frequent fires such as the south half of 20 1, likely provided more uniform abundance and distribution of snags and down wood as stands developed.

CURRENT CONDITION

The amount and distribution of large woody material and snags varies within the watershed. Salvage of large logs, snags, and dying trees, has been concentrated near roads and gentle slopes. Snags and woody material have been removed on the forest floor, riparian areas, and aquatic habitats. Areas that have not had salvage or other harvest activity may have higher snag and log numbers. The amount of snags and large woody material in managed stands varies with the type of harvest and when this activity occurred. Some stands have residual trees within them. Shelterwood stands contain larger diameter trees providing overstory structure and future snag and large woody material recruitment. These residual trees contribute to diversity within otherwise uniform young stands. (Many older harvest units (logged prior to 1970) also have very large logs remaining from the original harvest, due to merchantability standards of the time. See Figure 3.5-7.)

Utilization standards changed and treatment of slash became standard practice during the period between 1970-90. Most of the existing snags, large woody material, and residual trees which could provide for recruitment of these habitat structures were removed. Forest Plan standards for snag and large woody material retention were adopted in 1990, resulting in an increased amount of wildlife tree and down log habitat left in harvest areas. Table 3.5-2 lists acres within the subwatersheds having intensive harvest treatments prior to 1970, from 1970 through 1989, and from 1990 to present. Figure 3.5-7 illustrates where harvest activity has occurred and can be applied to these three timeframes.

Table 3.5-2. Acres of Intensive Harvest Treatment for Three Timeframes

Harvest Years	Harvest Code	Subwatershed Acres 20 1	20 2	20 3	Total Acres	Sum Total 20(%)
≤ 1969	110	2,660	1,727	66	4,453	
	130	0	67	10	77	
	141	0	0	0	0	
	143	0	0	0	0	
	150	0	0	0	0	4,753 (6.6%)
	160	56	0	0	56	
	231	151	16	0	167	
	232	0	0	0	0	
	total	**2,867**	**1,810**	**76**	**4,753**	
Percent of Watershed						
1970 - 1989	110	1,685	1,442	463	3,590	
	130	197	452	364	1,013	
	141	18	0	0	18	
	143	0	137	0	137	
	150	0	3	0	3	10,543 (14.7%)
	160	594	325	688	1,607	
	231	804	1,170	1,726	3,700	
	232	0	475	0	475	
	total	**3,298**	**4,004**	**3,241**	**10,543**	
Percent of Watershed						
≤ 1990	110	177	150	10	337	
	130	0	20	0	20	
	141	13	31	0	44	
	143	0	138	0	138	
	150	0	0	0	0	2,629 (3.7%)
	160	6	0	9	15	
	231	0	285	1,757	2,042	
	232	0	33	0	33	
	total	**196**	**657**	**1,776**	**2,629**	
Percent of Watershed						**17,925 (25%)**
Total Watershed Acreage						**71,770**

Table Legend (harvest codes): 110 = clearcut 130 = shelterwood cut 141 = shelterwood removal 143 = overstory removal 150 = Selection cut 160 = Partial removal 231 = Mortality salvage 232 = Sanitation salvage

WILDLIFE GUILDS

Species guilds include those groups of species with various home range sizes that prefer specific types and arrangements of habitat. A process (HABSCAPES) was utilized for identifying and mapping habitat for wildlife guilds at a landscape level. This model (Mellen et al. 1994) was run on reference and current vegetation conditions. Mapped results can be compared to determine differences in quality and distribution of guild habitats.

Appendix E provides lists of species and their guild habitat associations as well as guild maps for guilds which are not presented in this chapter (Figures 3.5-1 to 3.5-6). The following guilds are expected to have been most affected by change between reference and current time frames:

Edge and Early-Seral Habitat

Contrast guilds include those species that prefer distinct edges between open areas or early-seral stands, and late-seral or old-growth forests for breeding and/or foraging. Early seral guilds include species that use open habitats such as non-forested areas and very young forest stands.

REFERENCE CONDITION

Natural edges are formed where forested plant associations meet non-forested areas such as meadows, talus slopes or rock gardens. Transitional edges also occur where stand replacing fires (early-seral) adjoin underburned or unburned patches (late-seral) within fire areas. Some fires are relatively small, have irregular edges, or have varying levels of crown mortality. Within those areas contrast habitat is abundant, and if appropriate habitat for reproduction and feeding are both present, one would expect populations of contrast species to respond favorably to patchy or variable wildfires. Other areas within the watershed that did not host frequent patchy fires would have had contrast habitat mainly in association with non-forested inclusions in forested stands or along the edges of large natural openings. The map of terrestrial large home range contrast (TLC) guild habitat (Figure 3.5-1) displays the largest tracts of edges of fire mosaics with early-seral components in the early 1900's, as well as the larger natural meadow complexes with adjacent large live tree stands.

Aggregations of fire patches also provide short term benefits to species that use aggregated patches of early-seral habitat (early-seral mosaic guilds) and species that use combinations of early and mid seral habitat (generalist for early and mid seral guilds). The map of large home range mosaic early-seral (TLME) guild habitat during reference timeframe is displayed in Figure 3.5-3.

As coniferous regeneration becomes established in areas that have not been recently burned over, landscapes lose the contrast habitat. Fire regenerated stands transition to closed canopy sapling and pole stands. At this point in development the habitat becomes best suited for generalist guild species (those species that use a combination of various habitat types). As these fire stands mature, they provide habitat for mid and late-seral guilds depending on how long they developed prior to the next disturbance.

CURRENT CONDITION

Portions of the watershed, especially the western and central areas (Subwatersheds 20 1 and 20 2) have become highly fragmented as a result of intensive harvest, primarily clearcutting, within the past five decades. Within those areas contrast habitat is abundant. As long as habitat for reproduction and feeding are both present, populations of contrast species have responded favorably to recent management activities. Other areas within the watershed have had little clearcutting activity, resulting in less fragmentation and less contrast habitat (Subwatershed 20 3) and elsewhere in the watershed, unless numerous natural openings are interspersed among forested areas. The map of terrestrial, large home range contrast (TLC) guild habitat (Figure 3.5-2 of this section) shows the largest tracts of highly fragmented habitat along with the larger forest-meadow complexes with timbered edges.

Forest fragmentation and stand replacing fires may also provide short term benefits to species that aggregate patches of early-seral habitat (early-seral mosaic guilds) and species that use combinations of early and mid seral habitat (generalist for early and mid seral guilds). Compare current terrestrial, large home range mosaic early-seral (TLME) habitat (Figure 3.5-4) with reference TLME habitat (Figure 3.5-3).

Areas within the watershed that have not recently experienced regeneration harvest or wildfire have lost the contrast habitat as harvested areas transition into closed-canopy sapling and pole stands. At this point in development the habitat is best suited for generalist guild species (those species that use a combination of various habitat types). Although minimum fragmentation harvest strategies do not create as much edge habitat for contrast species, they do provide suitable habitat for many generalist guilds, and may promote medium and large home range mosaic and generalist habitats in the long term.

Interior Forest Habitat

REFERENCE CONDITION

Natural patterns of disturbance often involved large sections of the landscape. As these stands regenerated and developed into mature stands, suitable habitat for large and medium home range species in the late-seral mosaic, late seral patch, and generalist for mid and late-seral guilds was provided. Figure 3.5-5 displays a potential historic (1920 map for terrestrial large home range mosaic late-seral (TLML) guild habitat. This map depicts areas within the watershed that provided the highest amounts of the largest patches of late-seral and old-growth habitat.

CURRENT CONDITION

Forest fragmentation, tends to reduce habitat suitability for species in late-seral mosaic, late-seral patch, and generalist for mid and late-seral guilds for all home range sizes. Minimum fragmentation strategies tend to retain habitat suitability for these guilds in areas where harvest is avoided, but habitat is removed in harvested areas. Current habitat conditions for TLML guild is shown in Figure 3.5-6.

ELK HABITAT

Elk are large home range contrast species (Guild TLC, see Figure 3.5-1 and 3.5-2). They generally forage in open areas where preferred plant species are found and seek shelter in late-seral or old-growth forests. Elk populations tend to respond most favorably to habitats that contain an abundance of herbaceous and shrub forage species near thermal and hiding cover. The quantity and quality of forage species available will drastically affect where elk spend a majority of time. Open areas with an abundance of herbaceous forage tend to have more elk use (if the area is within their home range, accessible and proximate to cover) compared to areas with lower amounts of forage species. Meadows and forest stands less than approximately 20 years of age: tend to support relatively high quality foraging areas.

REFERENCE CONDITION

The historic distribution of high quality foraging areas within the Salt Creek watershed most likely was a combination of valley floors with open canopies, patches of windthrow and upland burn areas and meadows. The combination of valley floor foraging areas, meadows, and old burned areas that were so prominent more than 100 years ago, probably sustained elk populations. Road density and associated disturbance were not present in reference timeframe though animals were exposed to human activity and hunting pressure at much lower levels than in current condition.

CURRENT CONDITION

During the early 1900's fire control reduced the amount of foraging areas available from fire effects, however clear-cut silvicultural practices that began in the mid 1900's increased the amount and distribution of elk foraging areas. Elk habitat capability can be generally enhanced by increased forest fragmentation if other factors such as disturbance (road densities) and cover are considered. When cover becomes limiting and edge habitat decreases through continued cover removal in heavily harvested areas, elk habitat capability declines. The current condition of elk habitat within the watershed varies with land management practices such as harvest intensity, silvicultural practices, fuels treatments, and road building. Naturally occurring features such as meadows and other non-forested areas also affect elk habitat quality. Habitat effectiveness may also have been altered by fire suppression which may have changed the abundance and arrangement of natural foraging areas.

Big game are negatively affected by high open road densities. Animals may avoid areas with numerous roads or may be exposed to additional stress and energy expenditure triggered by escape response to disturbance. Table 3.4-3 displays landscape area in proximity to roads within this watershed.

Current Habitat Effectiveness Indices for the 10 Elk Emphasis Areas in this watershed are summarized in Table 3.5-3.

Table 3.5-3. Current Elk Habitat Effectiveness

BGEA	Emphasis	Individual Indices (*)				Overall Index (*)
Name	**Level**	**HEs**	**HEr**	**HEc**	**HEf**	**HEI**
Abernathy	Moderate	.71	.48 (.43)	.63	.37	.53 (.52)
Basin	High	.76	.43	.61	.47	.55
David Douglas	Moderate	.76	.56	.75	.28	.55
Eagle Head	High	.88	.42	.60	.54	.59
Fall Creek	High	.62	.55	.59	.46	.55
Hatchery	Moderate	.90	.39	.62	.41	.55
Noisy	Low	.84	.44	.63	.38	.55
Salt Head	Low	.64	.86	.64	.19	.51
Skyline	High	.68	.86	.86	.27	.61
Wicopee Fields	Moderate	.83	.36	.52	.43	.51

Emphasis Ratings: (from Willamette National Forest Land Management Plan)
Standards & Guidelines: ***High** from S&G FW-148, **Moderate** from S&G FW-151, **Low** from S&G FW-153*

Individual Index:
High > 0.5
Moderate > 0.4
Low > 0.2

Overall Index:
High > 0.6
Moderate > 0.5
Low - increase if any variable is below 0.2

Index Definitions:
HEs - size & spacing of cover and forage areas
HEr - open road density
HEc - cover quality
HEf - forage quantity and quality
HEI - overall

(*) ATM Method

HABITAT CONNECTIVITY AND DISPERSAL

REFERENCE CONDITION

Connectivity of habitat on the landscape varied with historic fire intensity and extent. However, higher order riparian areas typically served as key connectors between unburned or underburned patches within more fire-prone areas. Late-seral habitats were contiguous primarily on north slopes of lowest reaches and in glacial valleys and slopes on the highest reaches of the watershed. Figure 3.4-1 displays a potential map of historic (1920) late-seral and old-growth forest blocks.

CURRENT CONDITION

Landscape connectivity of habitat varies depending on the previous or current management allocation. Areas that have been included as Spotted Owl Management Areas (SOMAs), later replaced by Spotted Owl Habitat Areas (SOHAs), combined with Habitat Conservation Areas (HCAs), presently known as Late-Successional Reserves (LSRs) are relatively less fragmented and often have better connectivity than areas within allocations available for harvest. Areas within wilderness, roadless areas, and other relatively inaccessible areas normally have the highest potential level of connectivity.

Areas that have been historically managed as general forest and scenic management areas typically have lower levels of forest habitat connectivity. Figure 3.4-2 displays a map of areas that are currently unharvested late-seral and old-growth forests. Figure 3.5-8 of this section displays current condition of areas presently under no-harvest allocation including harvested portions by age class.

The current connectivity and riparian habitat condition is presented in Table 3.5-4. The current condition of lands presently under harvest allocation within this watershed is presented in Table 3.5-5.

Table 3.5-4. Landscape Connectivity and Amount of Harvest Activity by Decade by Subwatershed

Subwatershed 20 1

Decade of Harvest	Harvest in Riparian (acres)	Harvest in Upland (acres)	Harvest Total (acres)
1940-49	81	80	161
1950-59	452	748	1,200
1960-69	549	957	1,506
1970-79	497	900	1,397
1980-89	693	1,208	1,901
1990-95	63	134	197
TOTAL	**2,335**	**4,027**	**6,362**

Subwatershed 20 2

Decade of Harvest	Harvest in Riparian (acres)	Harvest in Upland (acres)	Harvest Total (acres)
1940-49	167	265	432
1950-59	51	23	74
1960-69	400	903	1,303
1970-79	433	867	1,300
1980-89	985	1,720	2,705
1990-95	117	540	657
TOTAL	**2,153**	**4,318**	**6,471**

Subwatershed 20 3

Decade of Harvest	Harvest in Riparian (acres)	Harvest in Upland (acres)	Harvest Total (acres)
1940-49	0	0	0
1950-59	0	0	0
1960-69	9	67	76
1970-79	206	597	803
1980-89	974	1,464	2,438
1990-95	613	1,154	1,767
TOTAL	**1,802**	**3,282**	**5,084**

Total Harvested = 17,917 Acres

Table 3.5-5. Current Condition of Lands Available for Programmed Harvest

Subwatershed 20 1

		Seral Stage			
Management Allocation	**Total acres**	**SI (0-30 yrs)**	**SE (31-80 yrs)**	**UR (81-200 yrs)**	**LS/OG (201+ yrs)**
11A	2,883	128	16	1,909	831
11C	1,209	42	0	937	229
11E	194	34	0	89	72
11F	742	52	21	261	409
14A	724	48	6	512	157

Subwatershed 20 2

		Seral Stage			
Management Allocation	**Total acres**	**SI (0-30 yrs)**	**SE (31-80 yrs)**	**UR (81-200 yrs)**	**LS/OG (201+ yrs)**
10A	153	6	16	88	46
11A	808	65	22	559	163
11C	2,417	222	18	1,736	441
11F	769	23	15	558	174
14A	3,968	268	26	2,138	1,536

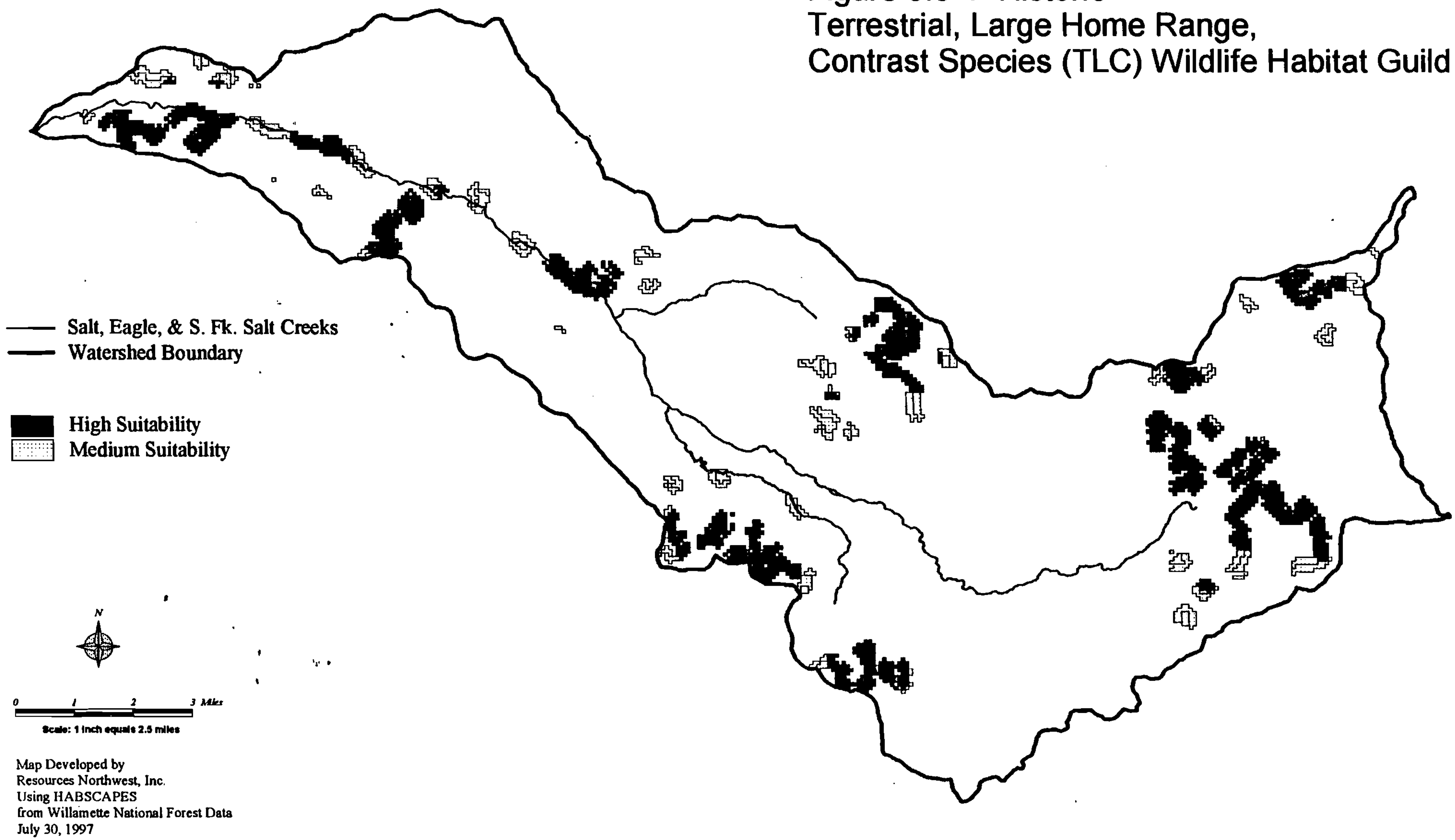
Subwatershed 20 3

		Seral Stage			
Management Allocation	**Total acres**	**SI (0-30 yrs)**	**SE (31-80 yrs)**	**UR (81-200 yrs)**	**LS/OG (201+ yrs)**
11C	2,051	116	12	932	992
11F	933	171	0	420	341

SI = stand initiation (0 - 30 year old stand) *SE = stem exclusion (31 - 80 year old stand)*
UR = understory reinitiation (81 - 200 year old stand) *LS/OG = late-successional/old-growth (201+ year old stand)*

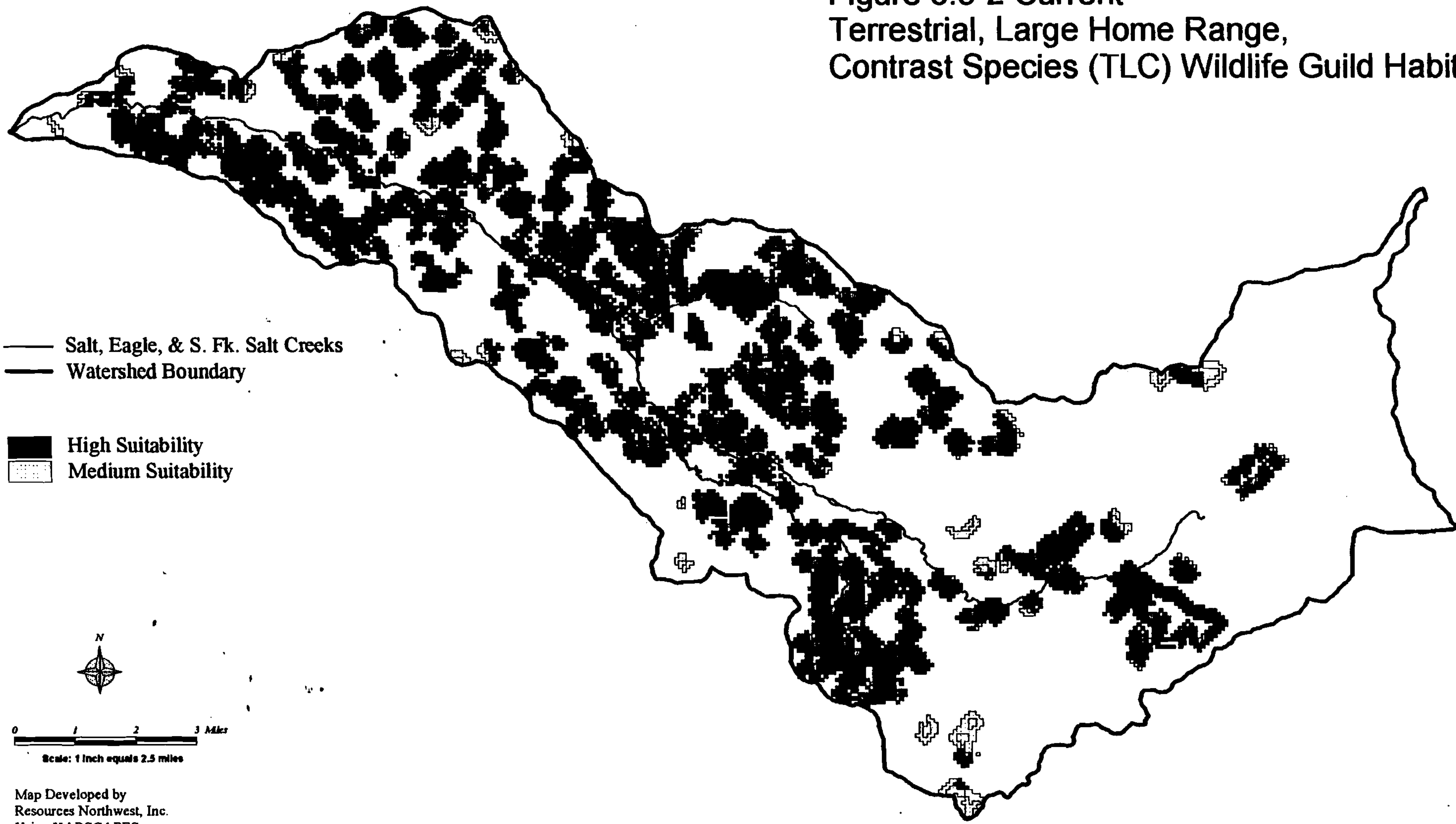
Salt Creek Watershed Analysis

Figure 3.5-1 Historic
Terrestrial, Large Home Range,
Contrast Species (TLC) Wildlife Habitat Guild

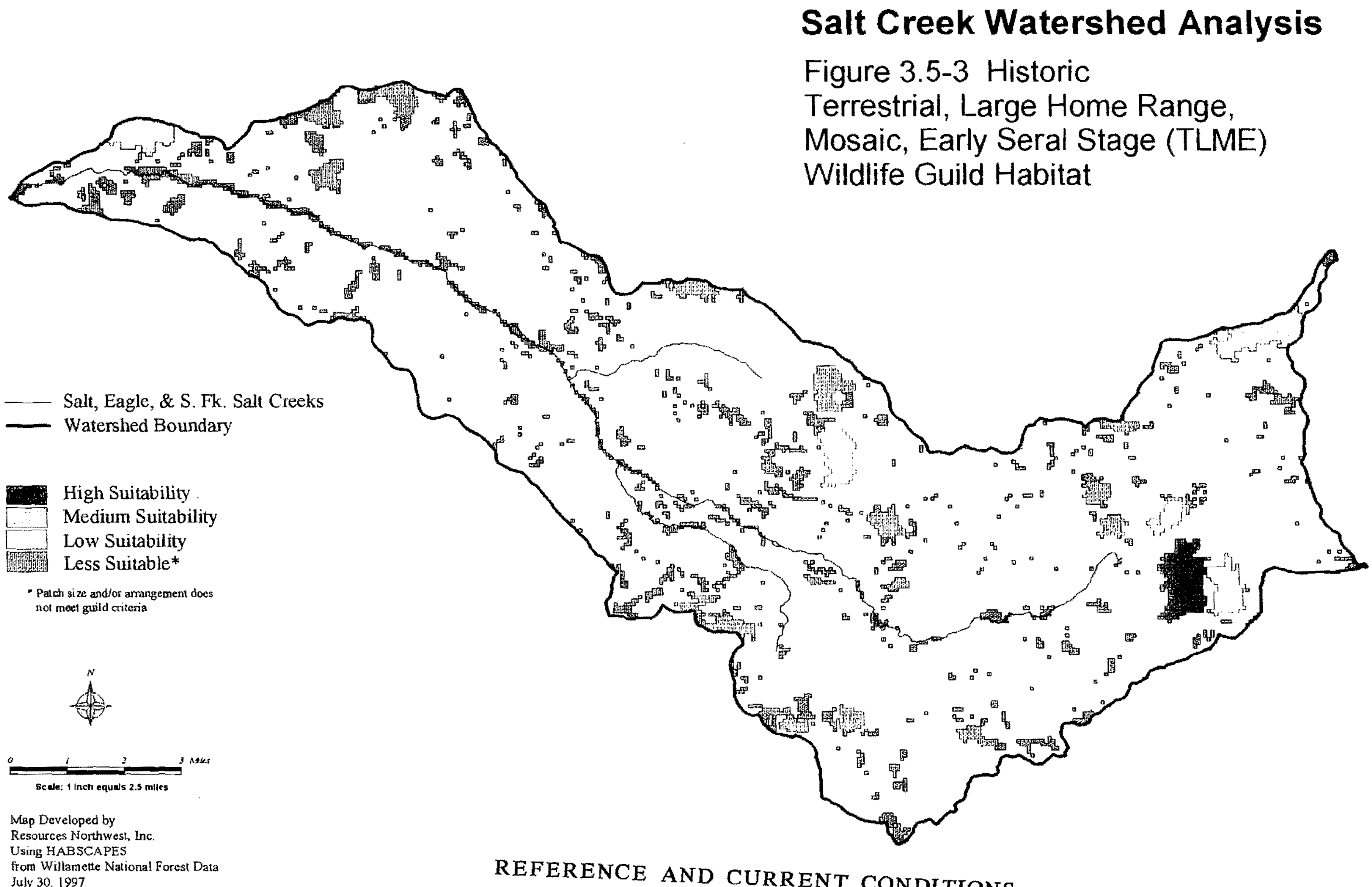


Salt Creek Watershed Analysis

Figure 3.5-2 Current
Terrestrial, Large Home Range,
Contrast Species (TLC) Wildlife Guild Habitat

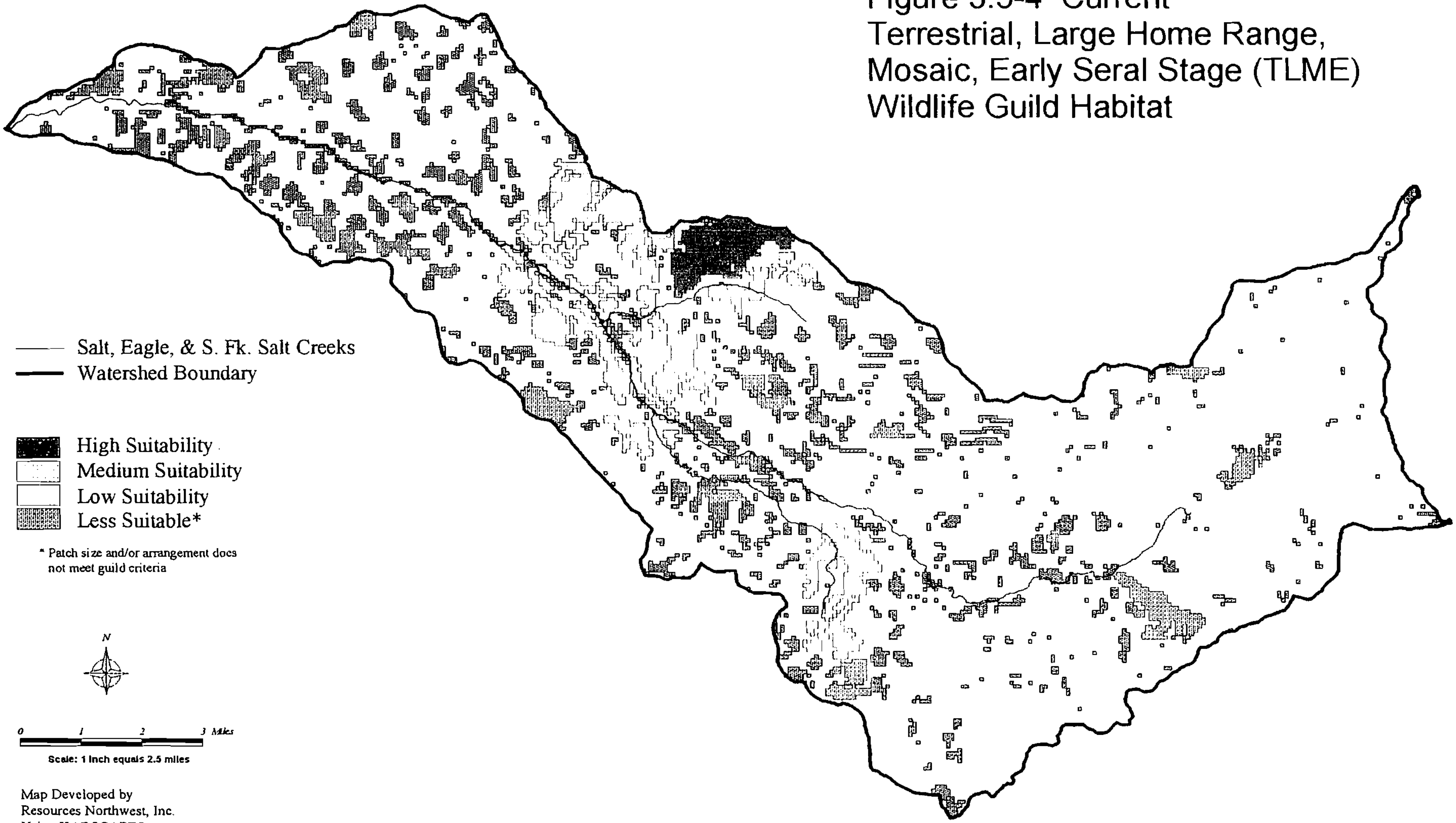


Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997


Salt Creek Watershed Analysis
Figure 3.5-3 Historic Terrestrial, Large Home Range, Mosaic, Early Seral Stage (TLME) Wildlife Guild Habitat
Salt, Eagle, & S. Fk. Salt Creeks
Watershed Boundary
High Suitability
Medium Suitability
Low Suitability
Less Suitable*
* Patch size and/or arrangement does not meet guild criteria
N
0 1 2 3 Miles
Scale: 1 inch equals 2.5 miles
Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

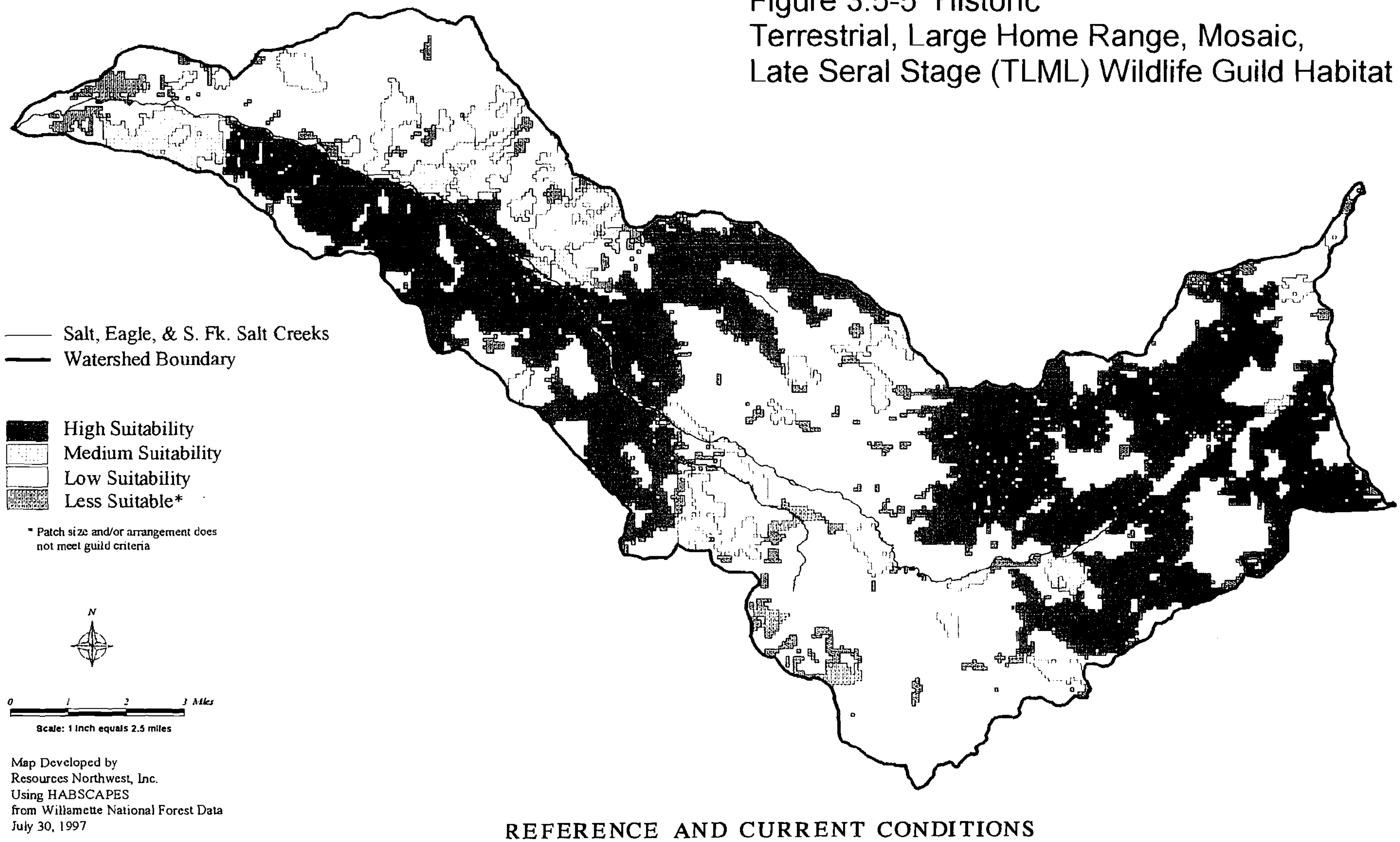
Salt Creek Watershed Analysis

Figure 3.5-4 Current
Terrestrial, Large Home Range,
Mosaic, Early Seral Stage (TLME)
Wildlife Guild Habitat



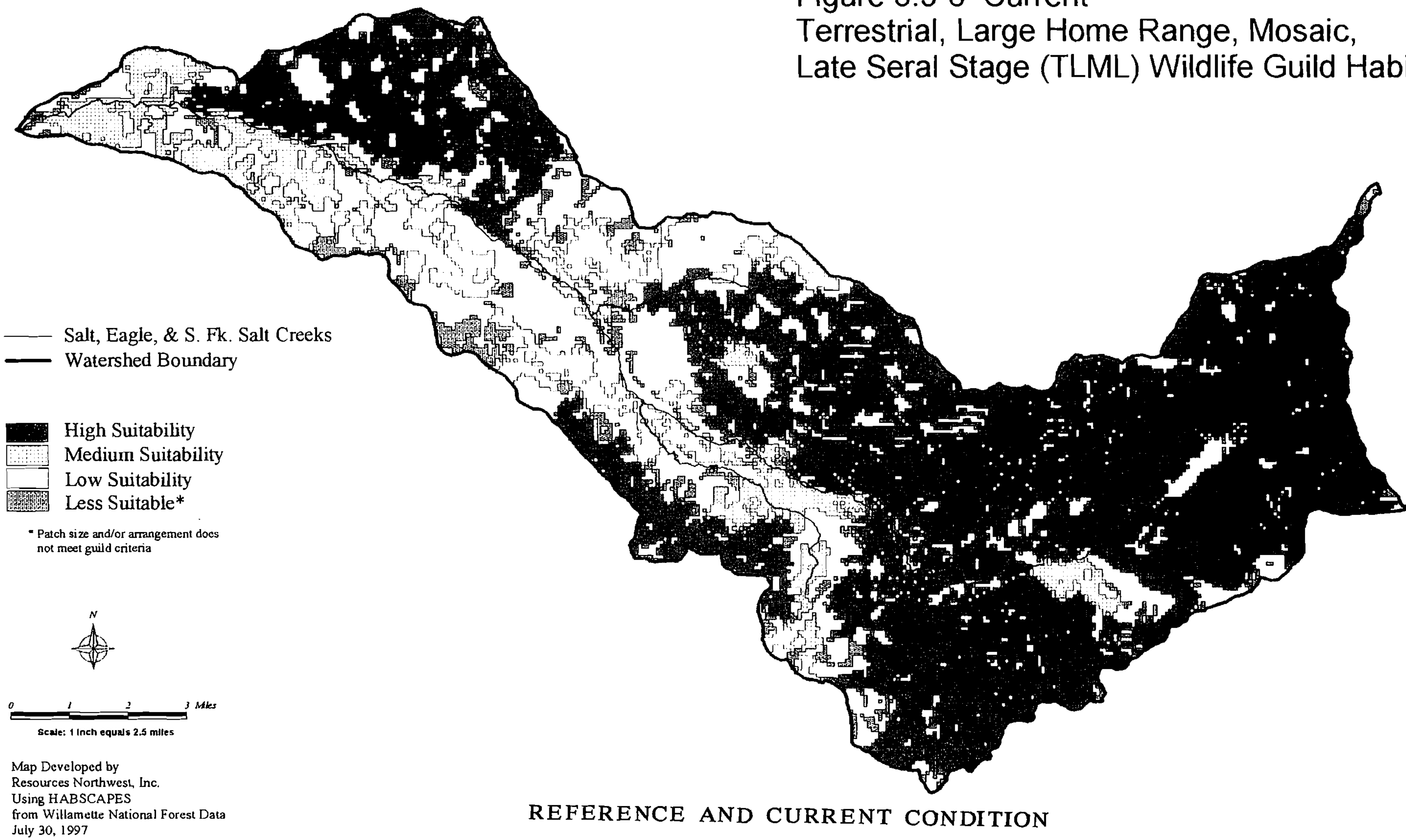
Salt Creek Watershed Analysis

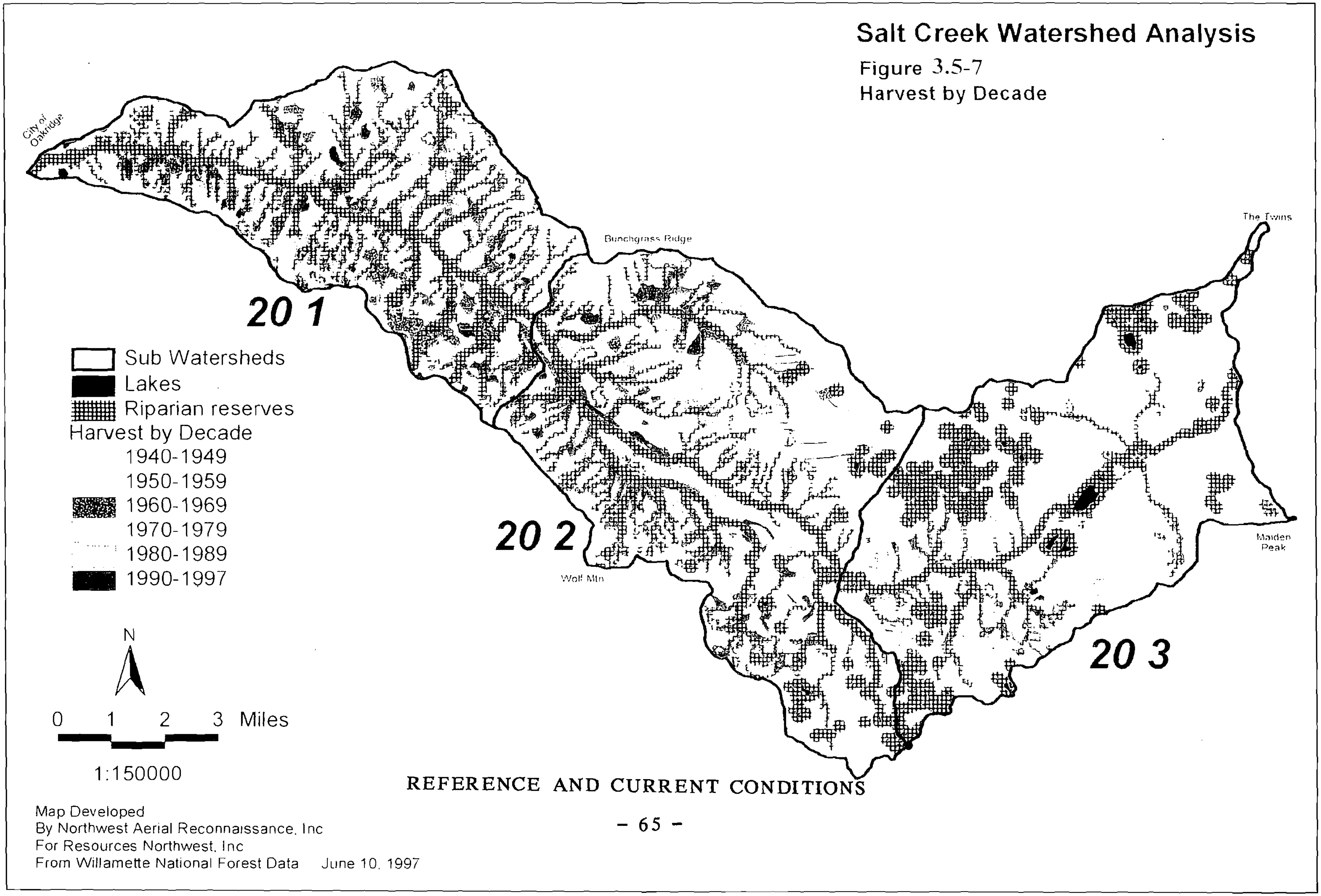
Figure 3.5-5 Historic
Terrestrial, Large Home Range, Mosaic,
Late Seral Stage (TLML) Wildlife Guild Habitat

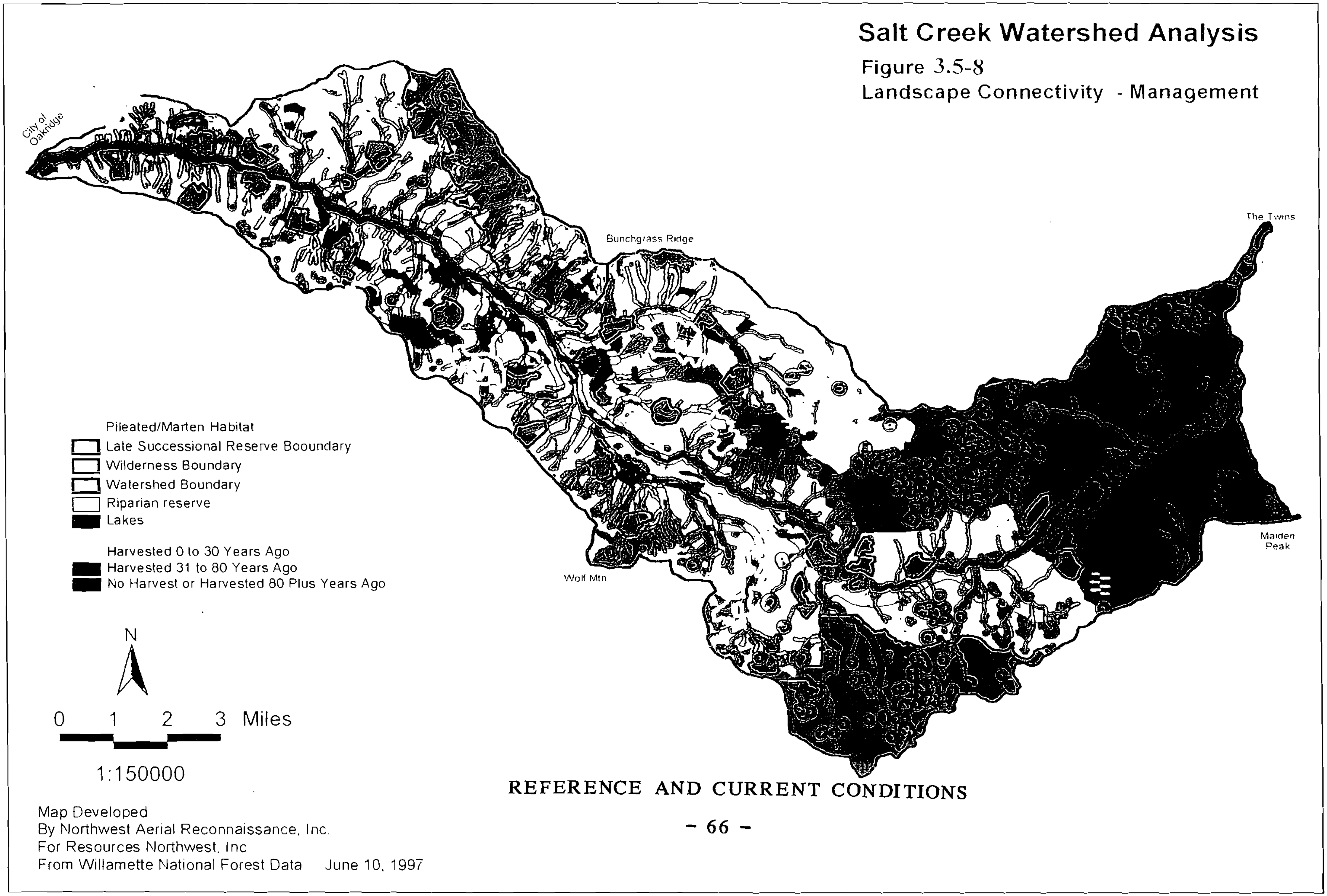


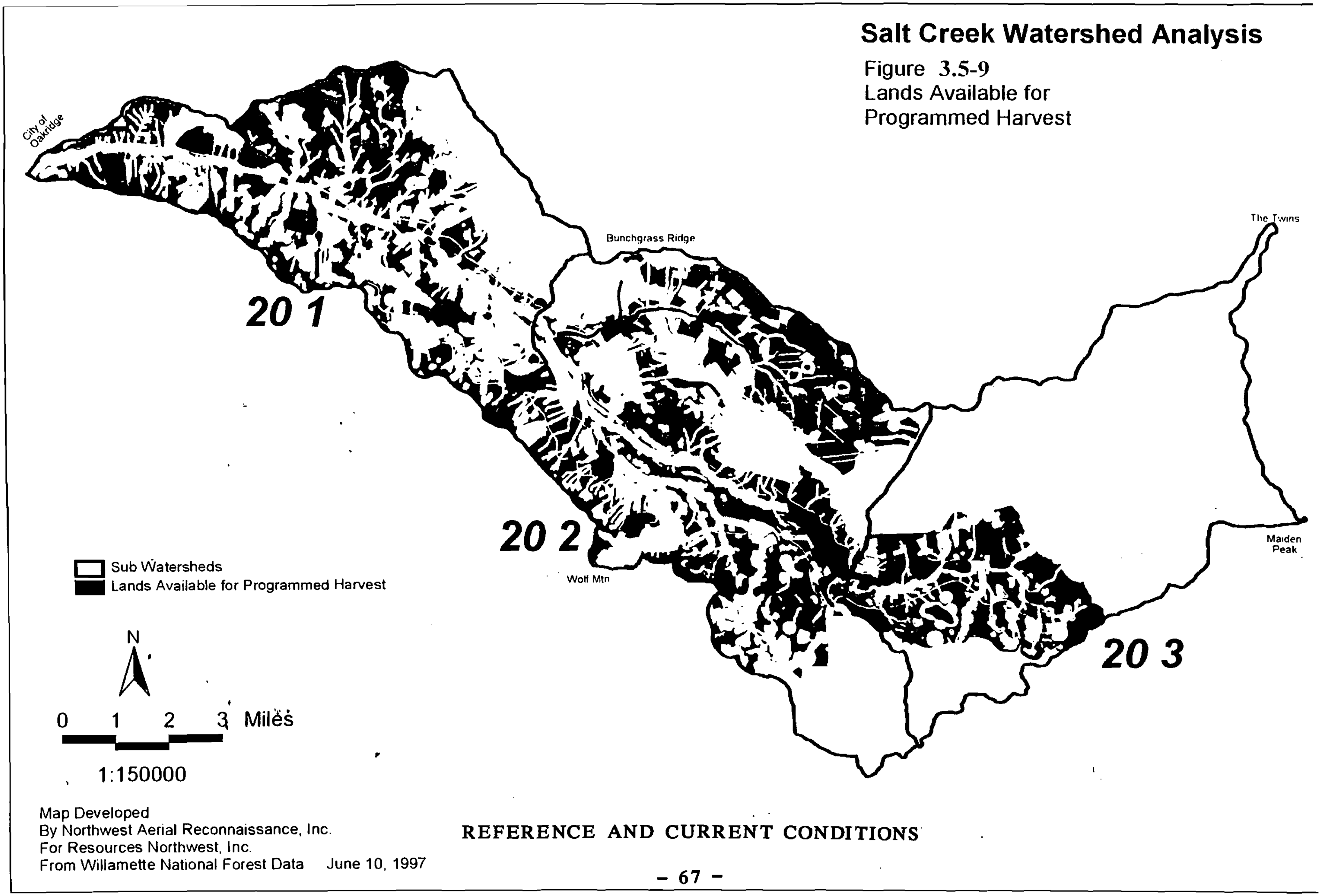
Salt Creek Watershed Analysis

Figure 3.5-6 Current
Terrestrial, Large Home Range, Mosaic,
Late Seral Stage (TLML) Wildlife Guild Habitat



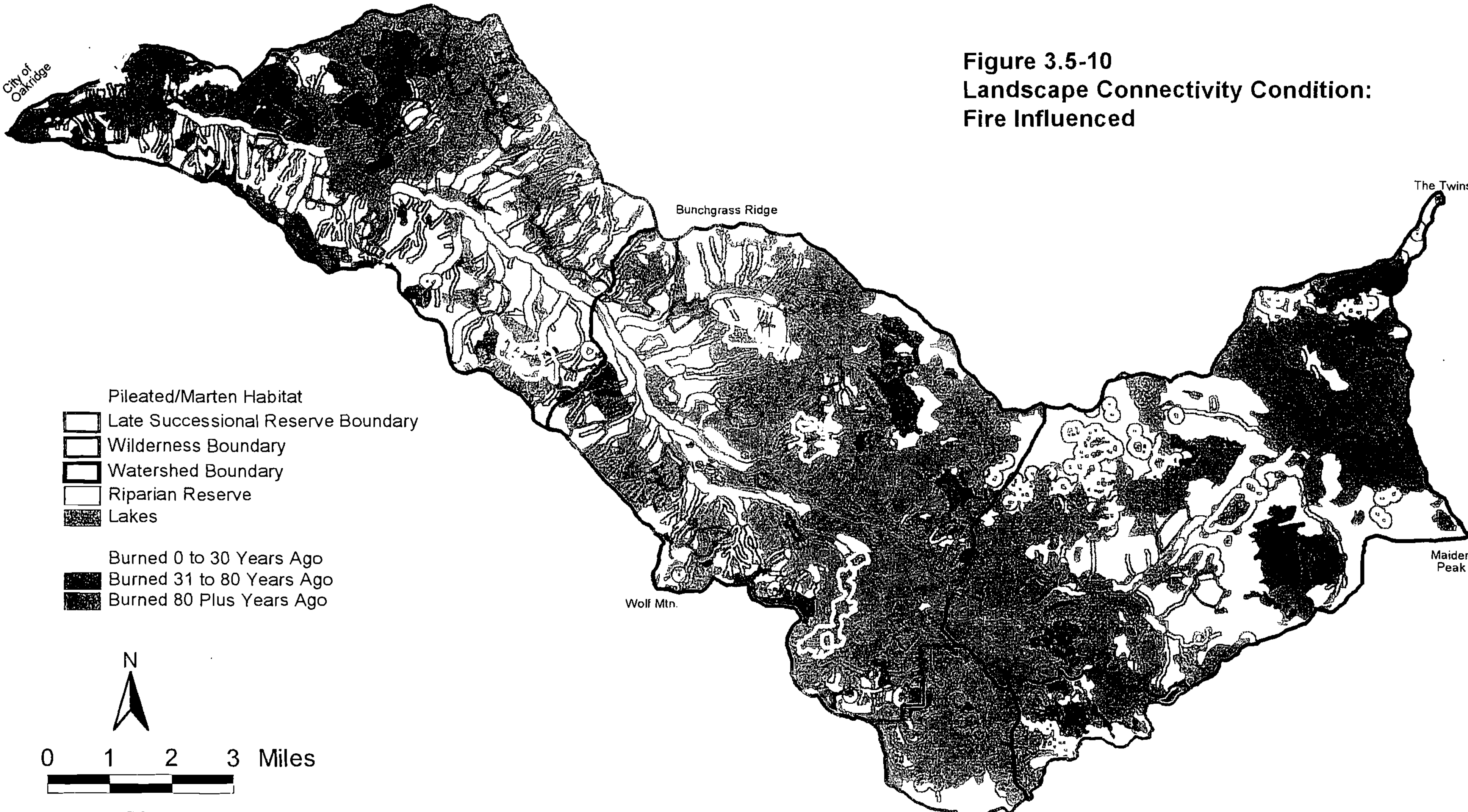

Salt Creek Watershed Analysis
Figure 3.5-7
Harvest by Decade
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn
20 1
20 2
20 3
Sub Watersheds
Lakes
Riparian reserves
Harvest by Decade
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1997
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc
For Resources Northwest, Inc
From Willamette National Forest Data June 10, 1997


Salt Creek Watershed Analysis
Figure 3.5-8
Landscape Connectivity - Management
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn
Pileated/Marten Habitat
Late Successional Reserve Booundary
Wilderness Boundary
Watershed Boundary
Riparian reserve
Lakes
Harvested 0 to 30 Years Ago
Harvested 31 to 80 Years Ago
No Harvest or Harvested 80 Plus Years Ago
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc
From Willamette National Forest Data June 10, 1997


Salt Creek Watershed Analysis
Figure 3.5-9
Lands Available for
Programmed Harvest
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn
20 1
20 2
20 3
Sub Watersheds
Lands Available for Programmed Harvest
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Salt Creek Watershed Analysis

Figure 3.5-10
Landscape Connectivity Condition: Fire Influenced



Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

AMPHIBIANS AND REPTILES

REFERENCE CONDITION

There is no historical information regarding amphibians and reptiles. Amphibian populations were presumed abundant and stable at the landscape level during reference timeframe. However, large scale fire events may have significantly influenced localized populations by altering shade, humidity and cover within burned areas and by triggering sediment and ash transport into aquatic habitats.

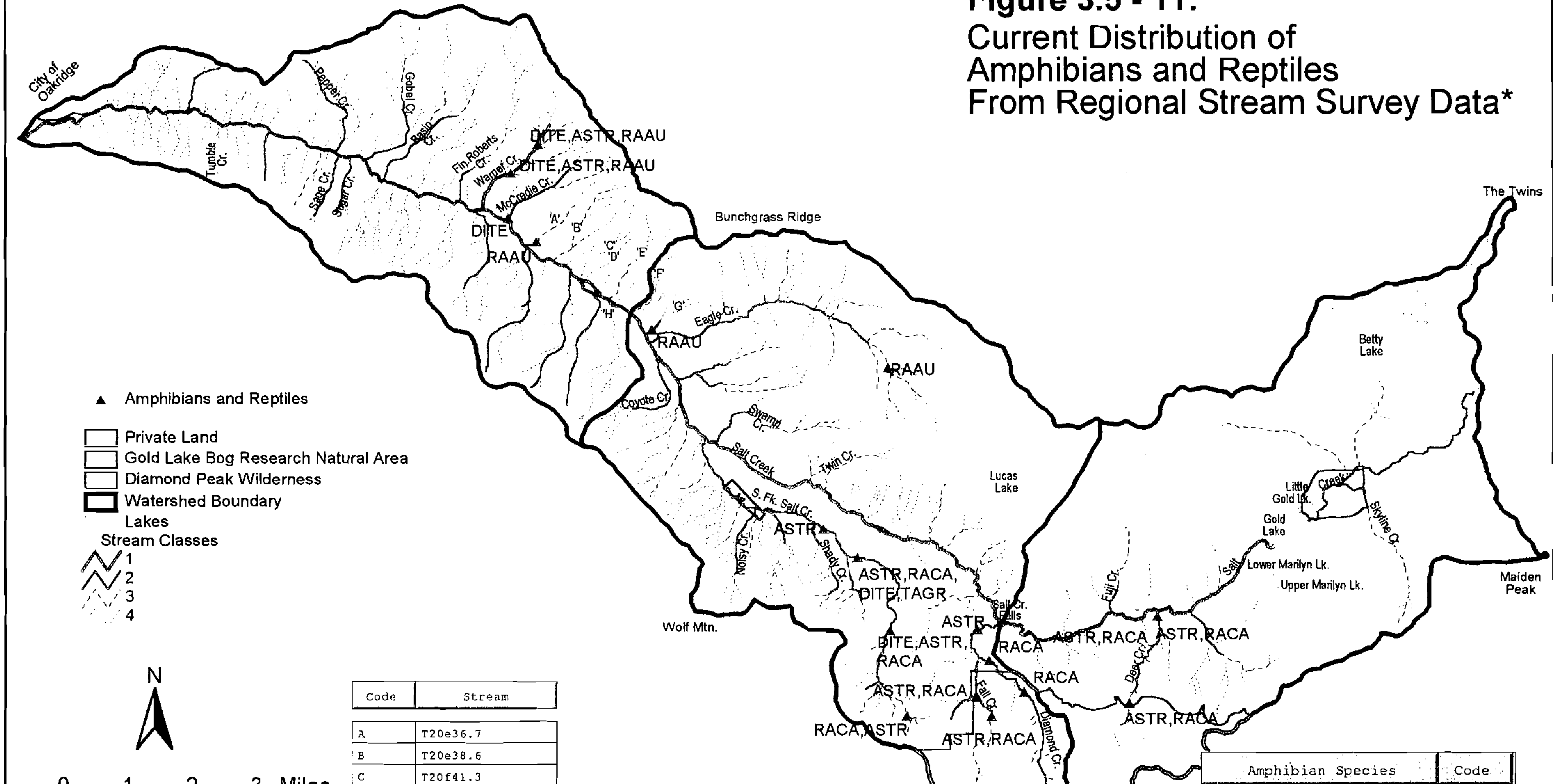
CURRENT CONDITION

Comprehensive surveys for amphibians and reptiles have not occurred in this watershed. Current amphibian distribution data comes from Region 6 stream inventories conducted from 1992 and 1996 (Table 3.5-6). This table does not reflect all species or locations known or potentially occurring in the watershed. Additional information on probable habitat is provided in Appendix G. Current land management practices and fish stocking in naturally fishless lakes from the early 1900's through the 1980's has likely affected native amphibian populations.

Table 3.5-6. Amphibian Distribution in the Salt Creek Watershed (Stream Survey Data)

Common Name	Species Code	Location	Elev. (feet)	Stream Class	Valley Segment Type	Rosgen Channel Type
Pacific Giant Salamander	DITE	Warner Creek	1950-3300	I	V2, H2	Aa+
		S.Fork Salt Creek	4500	I	U1	C
Cascades Frog	RACA	Deer Creek	4330-5130	II	M1, V2, H1	Aa+, A
		Fall Creek	4500-5000	II	V1, U2	A, G
		S. Fork Salt Creek	4360-5320	II	U1, V2	C, Aa+
Red-legged Frog	RAAU	Trib 20e 36.7	2050	III	Valley code 1	NA
		Trib 20f 46.3	2250	III	H1	A
		Eagle Creek	4720	II	H2	Aa+
		Warner Creek	2640-3300	I	V2, H2	Aa+
Tailed Frog	ASTR	Deer Creek	4330-5130	II	M1, V2, H1	A, G
		Warner Creek	2640-3300	I	V2, H2	Aa+
		Fall Creek	4280-5000	II	V1, U2	A, G
		S. Fork Salt Creek	3000-5400	II	U1, V2	C, Aa+
Rough-skinned Newt	TAGR	S. Fork Salt Creek	3000-3860	II	U1, V2	C, Aa+
Spotted Frog	RAPR	Gold Lake	4813	II		

Salt Creek Watershed Analysis
Figure 3.5 - 11: Current Distribution of Amphibians and Reptiles From Regional Stream Survey Data*



Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8

Amphibian Species	Code
Tailed Frog	ASTR
Pacific Giant Salamander	DITE
Red-legged Frog	RAAU
Cascades Frog	RACA
Rough-skinned Newt	TAGR

* This map does not reflect all species or locations known or potentially occurring in the watershed. See Appendix G for additional information on probable habitat.

AQUATIC WILDLIFE AND HABITAT, TES SPECIES

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

REFERENCE CONDITION

There were no aquatic TES species prior to land management activities in the Salt Creek watershed.

CURRENT CONDITION

There are no current aquatic TES species that occur in the Salt Creek watershed. Bull trout (*Salvelinus confluentus*), currently listed as sensitive by the State of Oregon, are extirpated from the watershed.

ANADROMOUS AND RESIDENT SALMONIDS

REFERENCE CONDITION

Anadromous Salmonids

Existing data reveal the presence of adult chinook salmon (*Oncorhynchus tshawytscha*) during 1937 ground surveys within Salt Creek mainstem (Appendix H). Hatchery spring chinook have been periodically released into the Middle Fork of the Willamette Drainage since 1917. Steelhead trout (*O. mykiss*) an anadromous form of the rainbow trout, are also believed to have occurred in Salt Creek, as steelhead were collected below Dexter Dam on the Middle Fork of the Willamette River between 1957 and 1966 (Hutchinson 1966).

Historically anadromous salmonids were able to use approximately 25 miles of habitat within the mainstem of Salt Creek (up to Salt Creek Falls), South Fork Salt Creek and Eagle Creek as well as the lower reaches of some of the larger tributaries in the basin (Figure 3.6-1).

Noted in the 1937 survey of Salt Creek was a State fish rack (weir) operated by the Oregon State Fish Commission and located on the Middle Fork Willamette river downstream from the confluence of Salt Creek. The fish rack was an adult chinook collection point intended for hatchery propagation, thus this weir prevented upstream migration of chinook adult spawners. The date when the fish rack was operational is unknown. The 1937 surveyor observed adult spawners in Salt Creek because the rack had washed out the previous Spring. The 1937 late August/early September survey counted 87 adult chinook spawners, with the majority observed in the first 13 miles (86 percent of the fish sighted). When the rack was operational, chinook were probably excluded from the entire Salt Creek drainage.

Resident Salmonids

Native resident salmonids that evolved in streams of the western Cascades and were present in the Salt Creek watershed include: Char (*Salvelinus spp*); bull trout (*S. confluentus*); Trout (*Oncorhynchus spp*): cutthroat (*O. clarki*) and rainbow (*O. mykiss*); Whitefish (*Prosopium spp*): mountain whitefish (*P. williamsoni*); and sculpin (*Cottus spp*); dace (*Rhinichthys spp*); large scale suckers (*Catostomus spp*); squawfish (*Ptychochellos spp*); and redsided shiners (*Richardsonus balteatus*).

Bull trout are presumed to have inhabited the Salt Creek watershed, though historical data available to verify this assumption is limited to a photo from the 1930's (Oakridge R.D.) of anglers holding a presumed bull trout or dolly varden. Bull trout were known to inhabit nearby Salmon Creek, a tributary to the Middle Fork of the Willamette River (Salmon Creek Watershed Analysis) as well as the mainstem Middle Fork of the Willamette River.

CURRENT CONDITION

Anadromous Salmonids

Currently there are no anadromous runs of salmon or steelhead in the Salt Creek drainage. A limited number of spring chinook juvenile fingerlings were released (by ODFW) at the confluence of Salt Creek and the Middle Fork Willamette River in June of 1996 and January of 1997 (ODFW, pers. comm). Numbers of fish released in 1996 were one stocking with 93,779 fish (966 lbs) and another with 97,480 fish (1026 lbs). The 1997 release totaled 101,890 juvenile fingerlings (ODFW, pers. comm). Currently, the Salt Creek watershed is managed for anadromous fish with the idea that in the future passage over the dams may be possible.

It is not known historically to what extent or volume Chinook salmon permeated the drainage. It is estimated that a total of 215 miles of stream historically accessible to salmon and steelhead were blocked by the construction of Dexter and Lookout Dams. This estimate includes Salmon Creek, the North Fork of the Middle Fork of the Willamette Rive Salt Creek, Hills Creek, and the Upper Middle Fork of the Willamette River (Willamette Basin Task Force, 1969). Approximately 25 miles of this habitat was available in the Salt Creek basin. The Lookout and Dexter Dams were erected on the Middle Fork Willamette River downstream from the confluence of Salt Creek in the 1950's by the Army Corps of Engineers to provide water supply and regulate flooding. Lacking passage facilities, both structures prevent upstream migration of salmon and steelhead.

Resident Salmonids

Currently, bull trout are thought to be extirpated from the Salt Creek drainage although anglers have reported catching bull trout in 1992 & 1996 in the lower. Data collected does not reveal the presence of bull trout in any of the streams surveyed from 1937 to the present in the Salt Creek watershed. Suitable habitat (low gradient, cold water streams) for bull trout still exists in the upper watershed and many of the tributaries (especially Eagle Creek and the upper reaches of South Fork Salt Creek).

Native resident salmonids currently present in the watershed include cutthroat trout (*O. clarki*) & rainbow trout (*O. mykiss*), and mountain whitefish (*Prosopium williamsoni*) (Figure 3.6-2). Brook trout (*Salvelinus fontinalis*), is the only known non-native resident fish species currently inhabiting the Salt Creek drainage.

Ranges of fish presence are varied throughout the watershed. Typically, rainbow trout populate lower reaches of Salt Creek and its tributaries though they are observed in the upper reaches above Salt Creek Falls. The lower part of Salt Creek and Gold Lake has been stocked with rainbow trout by ODFW. Cutthroat trout typically inhabit upper reaches of streams but as with the rainbows, can be found throughout stream sections.

Many lakes have been stocked with brook trout, rainbow trout and cutthroat trout. Some lakes contain naturally reproducing populations of trout while others are stocked regularly of ODFW. There are known populations of brook trout in the upper reaches of Salt Creek above the falls as well as in Fall Creek, Diamond Creek, and Deer Creek.

SALMONID HABITAT CONDITIONS

Salmonid Limiting Factor Analysis - Physical Habitat Requirements

The Limiting Factor Analysis: an Overview

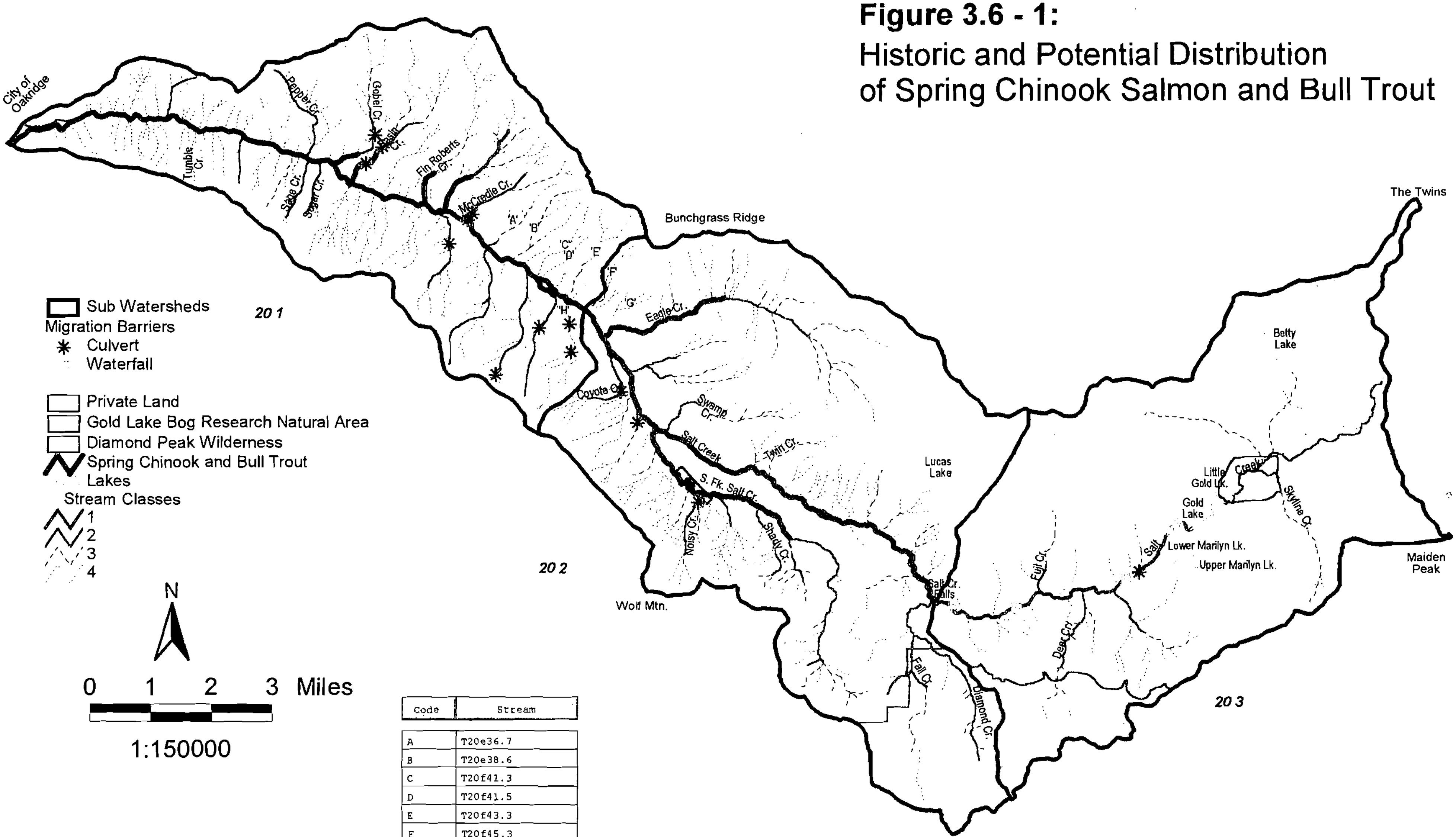
The purpose of a limiting factor analysis is to determine the physical habitat parameters that are thought to be currently limiting to resident salmonid populations. Restoration objectives can then be identified for the improvement of habitat conditions.

In general, salmonids require four kinds of habitat throughout their lifetime. These include adult, spawning, rearing and overwintering habitats (Behnke, 1992). All of these habitats are important, and a lack of any one of these may be sufficient to limit the potential size and overall health of the population. Temperature and large wood are also included in this analysis, as temperature may be a limiting factor for salmonids during various life stages. Large wood provides cover and is a major forming factor of many of the habitat types necessary for healthy salmonid populations. Parameters other than habitat, such as food, may also limit populations. However, it is thought that physical habitat is often more limiting than food (Behnke, 1992). It should be noted that limiting factors differ between species and life stages. Limiting factors are also temporal and spatial in nature and if the factor that is currently the most limiting is improved, the next most limiting factor will limit salmonid production (Bjornn and Reiser, 1991). Refer to Table 3.6-1 for current aquatic objectives in relation to large pools, large wood, width:depth ratios, and temperatures.

Salt Creek Watershed Analysis

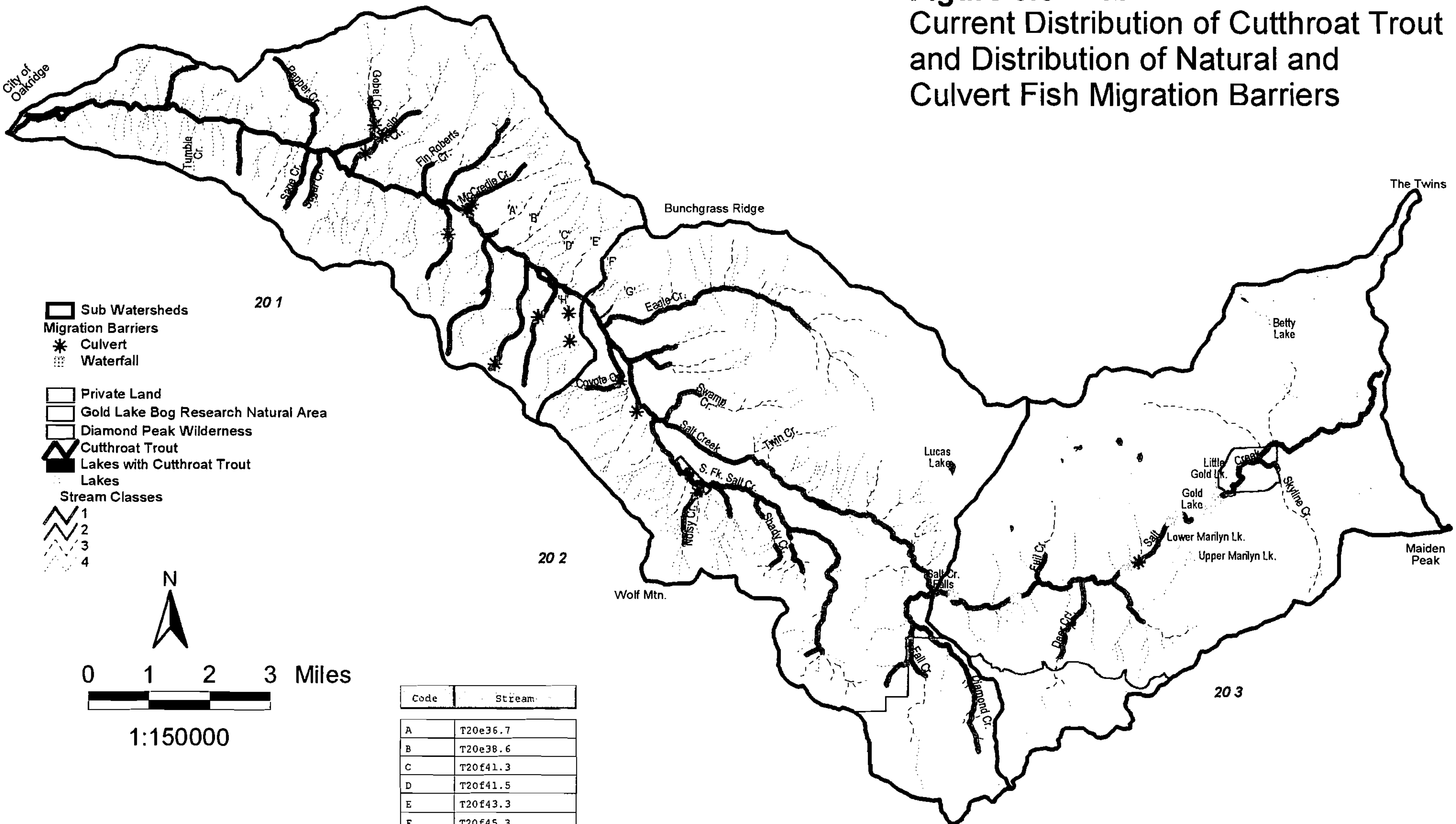
Figure 3.6 - 1:

Historic and Potential Distribution of Spring Chinook Salmon and Bull Trout



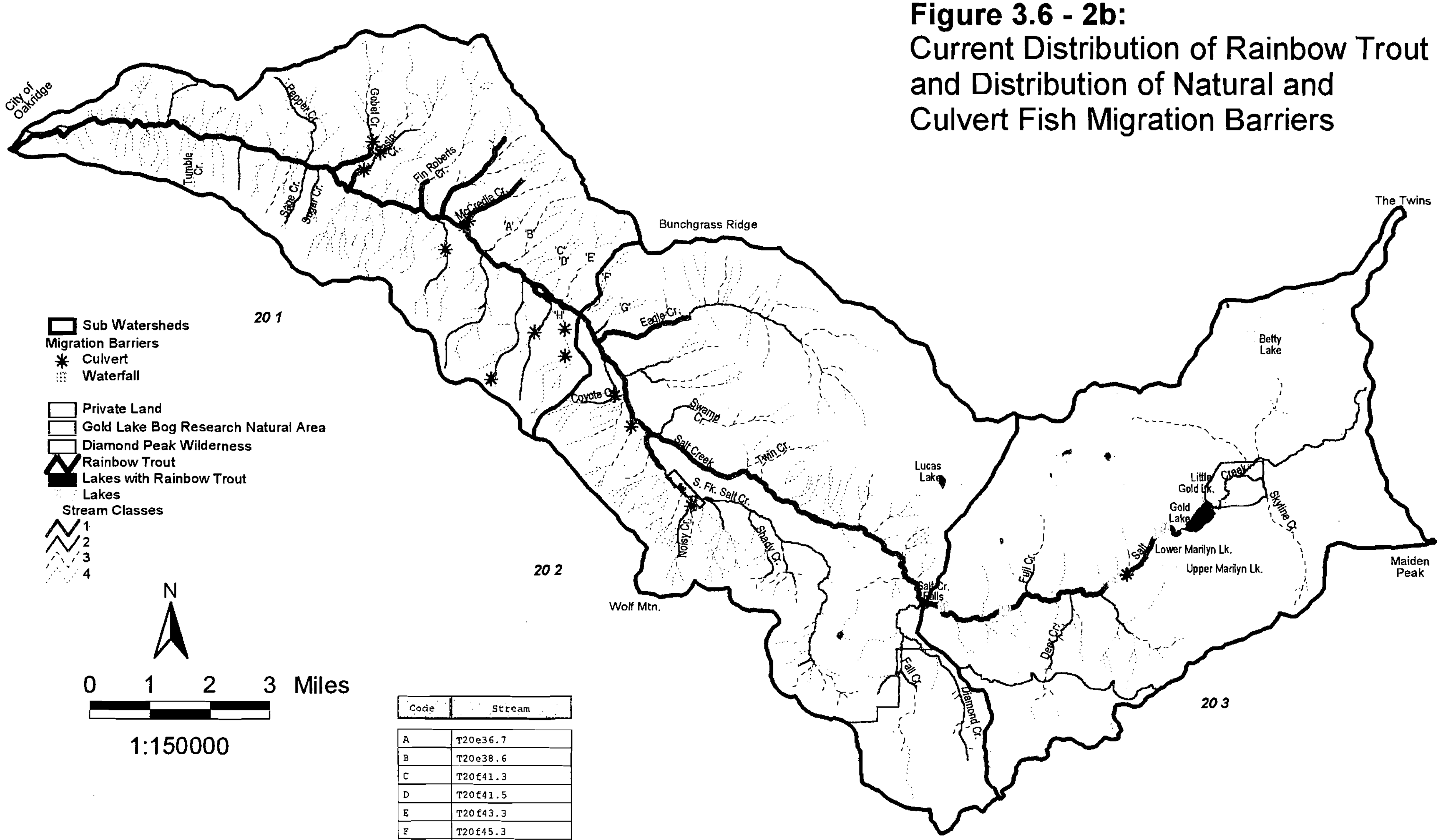
Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8

Salt Creek Watershed Analysis
Figure 3.6 - 2a:
Current Distribution of Cutthroat Trout and Distribution of Natural and Culvert Fish Migration Barriers

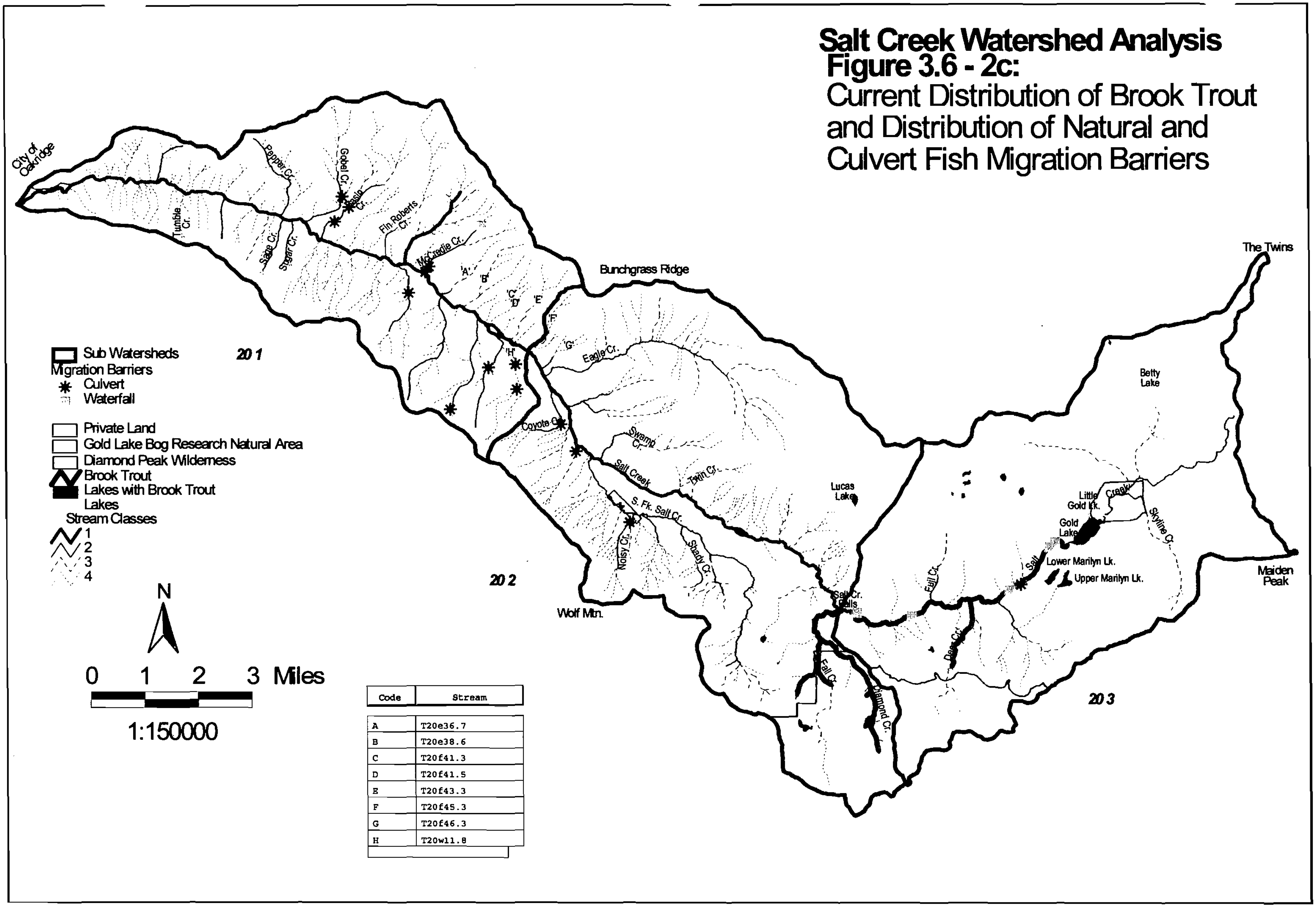


Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8

Salt Creek Watershed Analysis
Figure 3.6 - 2b:
Current Distribution of Rainbow Trout and Distribution of Natural and Culvert Fish Migration Barriers



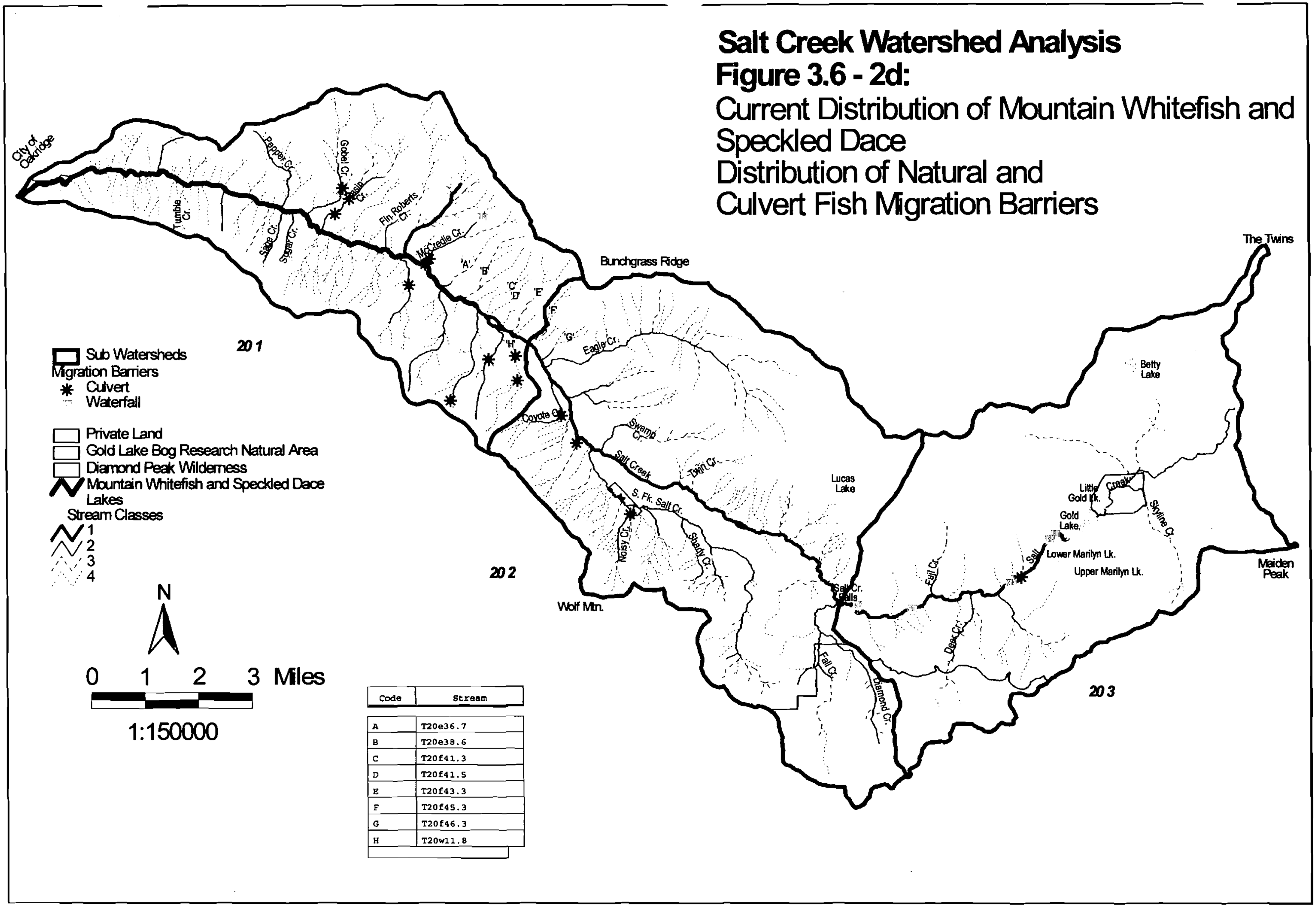
Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8



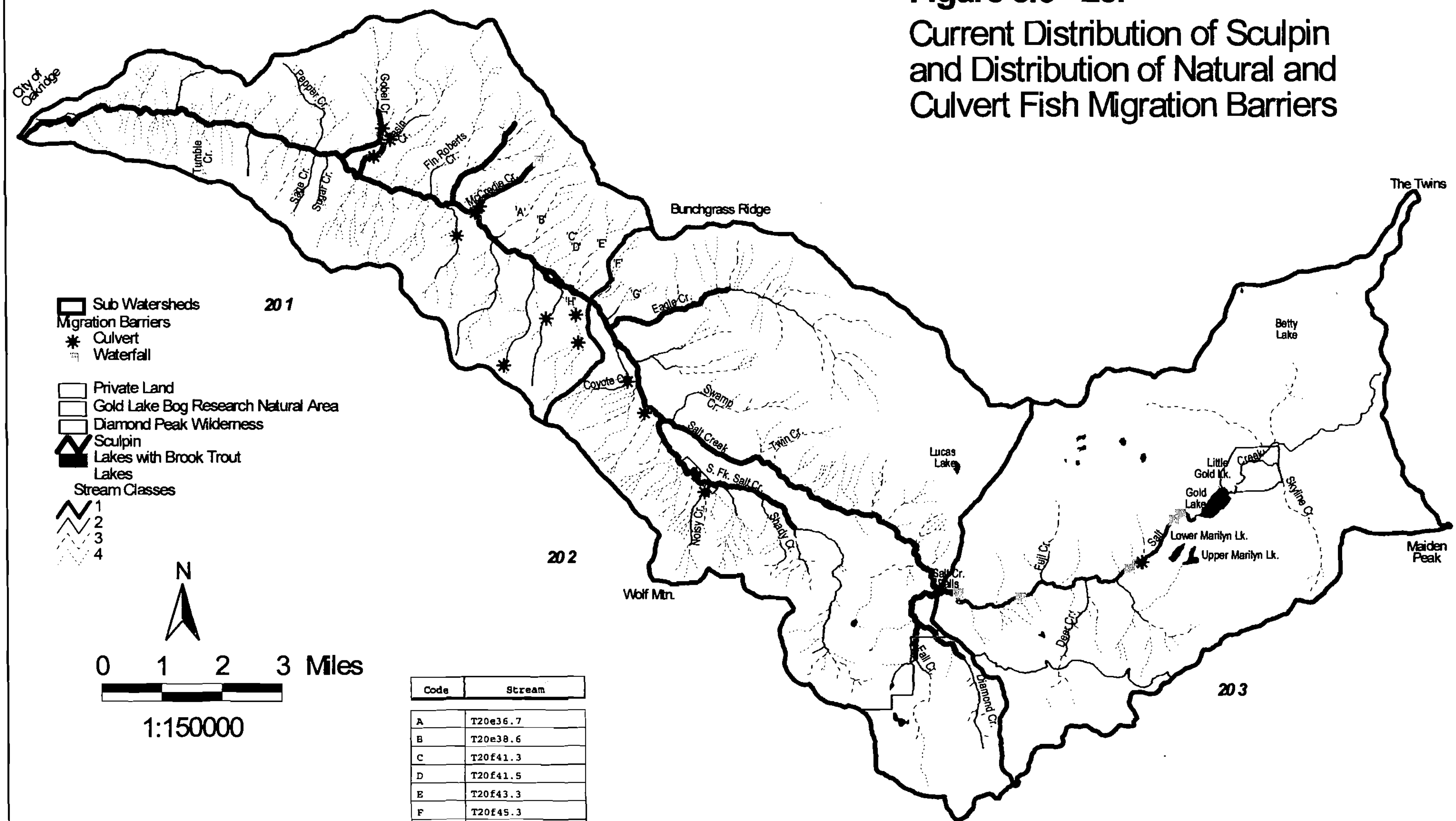
Salt Creek Watershed Analysis
Figure 3.6 - 2c:
Current Distribution of Brook Trout and Distribution of Natural and Culvert Fish Migration Barriers

Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8

Salt Creek Watershed Analysis
Figure 3.6 - 2d:
Current Distribution of Mountain Whitefish and Speckled Dace
Distribution of Natural and Culvert Fish Migration Barriers



Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8



Salt Creek Watershed Analysis
Figure 3.6 - 2e:
Current Distribution of Sculpin and Distribution of Natural and Culvert Fish Migration Barriers

Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8

Table 3.6-1. Objectives for Aquatic Habitat Variables

Habitat Variable	Definition or Range	Objective	Source
Large Pools	<2% Gradient	1 pool/5-7 channel widths	Willamette NF Plan
	2-8% Gradient	1 pool/3-5 channel widths	Willamette NF Plan
	Channel Width	See below (*)	PACFISH*
Large Wood	Undefined	80 pieces over 24" dbh & 50' length per mile	PACFISH*
	Low Gradient Streams	105 pieces longer than stream width w/pieces >25' per mile	Willamette NF Plan
	High Gradient Streams	50% of channel length should be influenced	Willamette NF Plan
Width:Depth Ratio	All Streams	<10	PACFISH*
Water Temperature	Streams (salmonids)	Meet State standards (58^0 F)	State Standards

(*) PACFISH Objective for Pools per Mile by Wetted Stream Width in feet (USDA, USDI, 1994c)

Wetted Stream Width	10	15	20	25	50	75	100	125	150	175	200
Pools/Mile	96	70	56	47	26	23	18	14	12	10	9

Instream Large Wood Material

Large wood is an important component in stream channels, influencing them by affecting bed profiles, channel patterns, and channel geometry (Bisson et al. 1987). Instream large wood material is critical in the formation of large pools, which in turn is critical for adult and overwintering habitat. Large wood provides cover for both adult and juvenile salmonids during summer and winter. Additionally, large wood is important for the maintenance of suitable spawning areas and providing nutrient input and potential forage material for aquatic macroinvertebrates.

Adult Habitat (Large Pools)

Large pools provide thermal refuge for aquatic organisms dependent on cold stream temperatures and protective cover for rearing, and act as holding areas for LWM flowing through the system. The quality of pool habitat is based on several factors including: pool depth, stream width, amount of LWM in place, and the complexity of sub-habitats within the pool. The number of pools increases as the stream size decreases. Channel morphology influences where pools are formed and determines the hydraulic controls that create pools. Adult habitat is thought to limit trout populations in most high gradient western streams (Behnke 1992).

Rearing Habitat

Rearing habitat is another potentially limiting factor for salmonid populations. Suitable rearing areas typically have a low water velocity and large amounts of cover. Areas such as stream margins, spring seeps, side channels, and small tributaries generally make suitable rearing areas (Behnke, 1992). High gradient areas in the upper reaches may lack suitable rearing habitat due to high water velocities, especially in reaches lacking in large wood. In addition to the formation of areas with low water velocity and large wood also provides the cover necessary for juvenile salmonids.

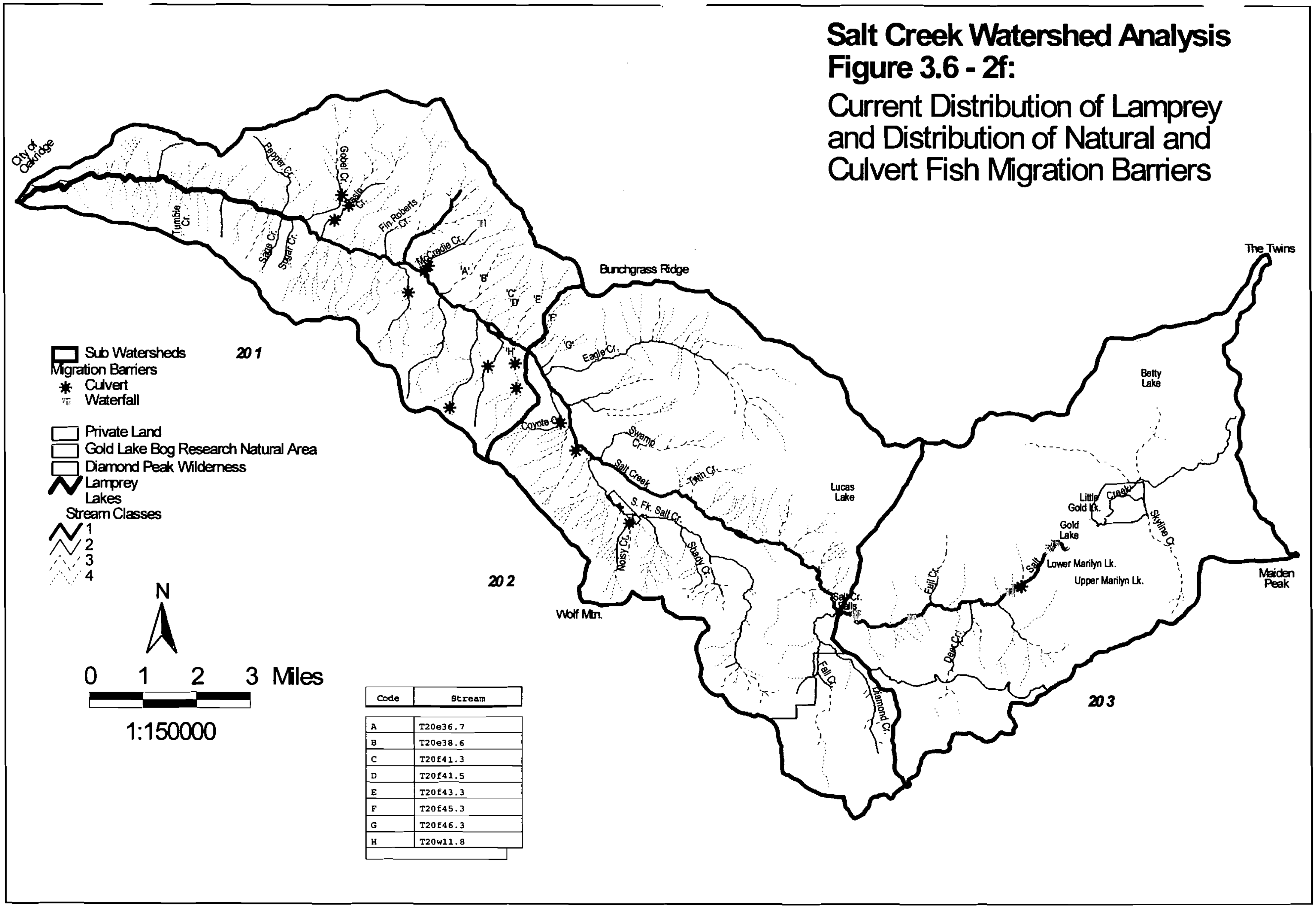
Spawning Habitat

Suitable spawning areas are also important for maintaining healthy salmonid populations. Spawning success may be poor if areas of silt-free gravel are not available (Behnke, 1992). Large wood is also an important component of maintaining suitable spawning areas as it allows the sorting and storage of spawning gravels, especially in high gradient streams where the water velocities are sufficient to carry gravels downstream.

Overwintering

Overwintering habitat is also important for salmonids. Overwintering habitat for adult salmonids typically consist of deep water habitat with low velocities and high amounts of cover (Behnke, 1992). In addition to large pools, side channels and tributaries may also be used by overwintering salmonid populations, especially juveniles (Bjornn and Reiser, 1991). In small tributary streams with high winter water velocities, trout may migrate downstream to overwinter in larger deeper areas (Behnke 1992). Many of these small tributaries have impassable culverts, making migration back up in the spring impossible, and thus depleting already isolated populations of resident salmonids.

Salt Creek Watershed Analysis
Figure 3.6 - 2f:
Current Distribution of Lamprey and Distribution of Natural and Culvert Fish Migration Barriers



Code	Stream
A	T20e36.7
B	T20e38.6
C	T20f41.3
D	T20f41.5
E	T20f43.3
F	T20f45.3
G	T20f46.3
H	T20w11.8

Water Temperature

Water temperature is a major factor influencing the composition and productivity of aquatic ecosystems. Fish, aquatic macroinvertebrates, and other aquatic organisms are affected directly and indirectly by changes in water temperatures. Specifically stream temperature influences the timing of salmonid migration, spawning, incubation rates, growth, distribution, resistance to parasites, food supply and quality, and tolerances to diseases and pollutants (Bjornn and Reiser 1991).

Water temperature can also be a limiting factor for salmonids especially during the critical times of egg incubation, fry emergence, and juvenile rearing. Table 3.6-2 shows the lethal temperatures of salmonid species historically and presently found in the Salt Creek watershed.

Table 3.6-2. Upper lethal and preferred temperatures (F) for selected species of salmon and trout (After Bjornn and Reiser 1991).

Species	Upper lethal temp (deg F)	Preferred temp (deg F)
Chinook salmon	79	53.6 - 57.2
Steelhead	75	50.0 - 55.4
Rainbow trout	77	N/A
Bull trout	--	40-55
Brook trout	78	53.6 - 60.8
Cutthroat trout	73	N/A

Figures 3.6-3 and 3.6-4 show the critical temperatures, by life stage, for spring chinook salmon and bull trout.

Figure 3.6-3. Spring Chinook Temperature Requirements by Life History Stage

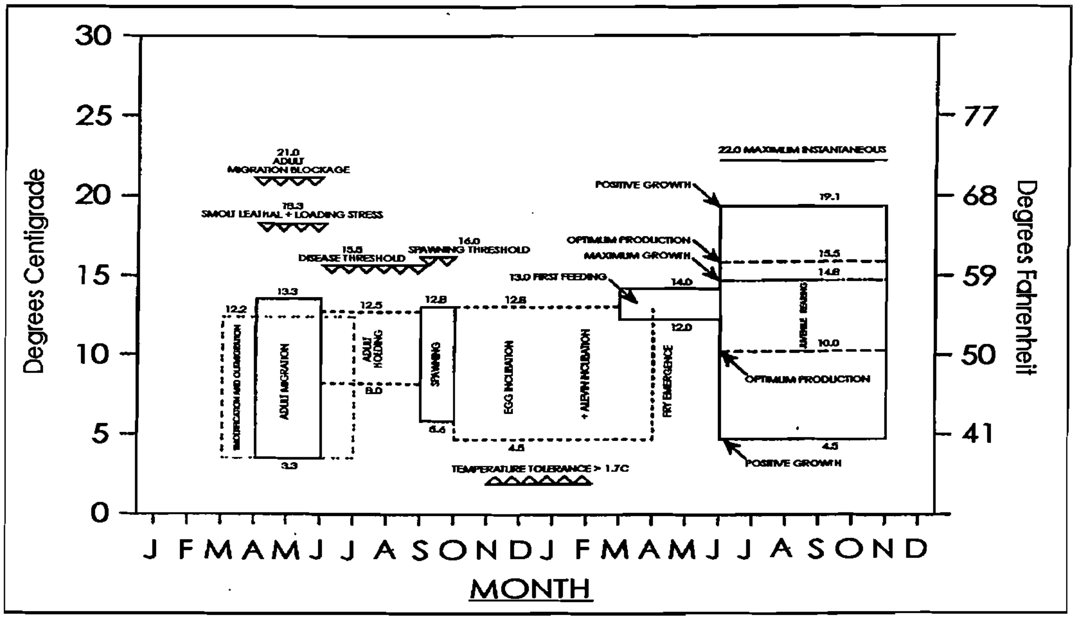
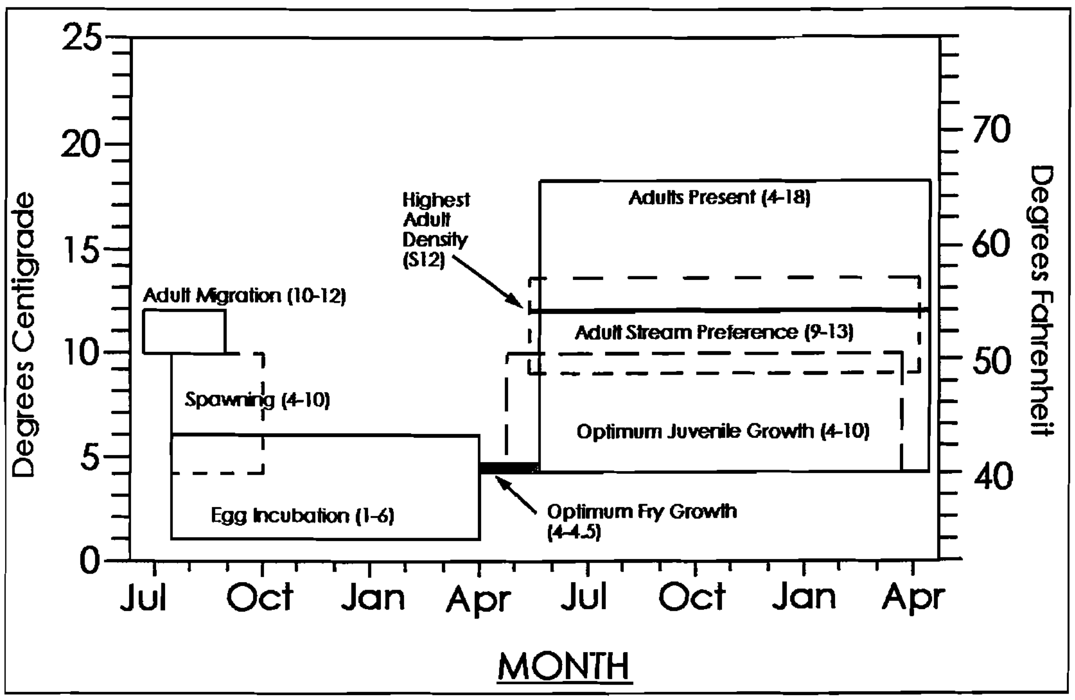


Figure 3.6-4. Bull Trout Temperature Requirements by Life History Stage



Large Woody Material

REFERENCE CONDITION

The reference condition is considered to have had a higher incidence of instream Large Woody Material (LWM) due to available large seral vegetation habitat for recruitment, and the presumed lack of riparian harvest when compared to current conditions.

Salt Creek - 1937

Salt Creek mainstem was surveyed in 1937. Large Woody Material data collected for Salt Creek are not available in complete form (i.e. number of pieces and sizes per Reach and subsequent totals). The riparian area of Salt Creek was "heavily wooded with second growth conifers" and there was "no erosion in stream" (McIntosh et al. 1992). Only twice were instream large woody material mentioned in the 1937 survey, and both refer to LWM jams in the channel. At approximately 2.5 miles and 12.8 miles upstream from the mouth, a small and old log jam was observed and determined "passable [to fish] with difficulty" (McIntosh et al. 1992).

CURRENT CONDITION

Currently, large wood objective levels are below PACFISH & Willamette National Forest Plan - WNF objectives for the majority of stream surveyed in the Salt Creek Watershed (Table 3.6-3). The percent of streams in each subwatershed that meet the WNF forest plan large woody material objectives are shown in Table 3.6-4

Table 3.6-3. Streams within the Salt Creek watershed that meet PACFISH and/or WNF Forest Plan Objective Values for Large Woody Material.

Stream	Reach	Meet PACFISH Objectives	Meet WNF Forest Plan Objectives
McCredie Creek	2, 8	Yes	Yes
Warner Creek	2	Yes	No
T20f 45.3	1	Yes	Yes
T20f 46.3	1	Yes	Yes

Table 3.6-4. Percent of Streams Meeting WNF Forest Plan Objective Values (105 pieces/mile) for Large Woody Material

Subwatershed*	Total Stream Miles Surveyed	Percent of Streams That Meet PACFISH LWM Objective Values
20 1 (lower)	16.03	5.3
20 2 (middle)	30.3	1.5
20 3 (upper)	7.31	0

** Mainstem Salt Creek reaches were apportioned into their respective Subwatersheds.*

Mainstem Salt Creek - 1964

Woody material is available in varying sizes, locations and concentrations within the three subwatersheds of Salt Creek. A 1964 survey of the entire Salt Creek mainstem (from the mouth upstream to Gold Lake) reveals LWM in several sections of the stream. Within Reach 1 (0 - 5.0 miles) there were no LWM that created "obstructions to fish passage" (Hutchinson et al. 1966). In Reach 2 (5.0 -10.5 miles) data reveal "log and debris accumulations [that] altered the flow in some places and improved fish habitat by forming holes and pools [however] these accumulations have not obstructed fish passage" (Hutchinson et al. 1966). There is no mention of LWM jams or accumulations in Reach 3 (10.5 - 17.4 miles) and no obstructions to fish passage were noted. From miles 17.4 - 22.4 (Reach 4) data reveal eight log jams, three of which "are impassable at the current flow" (Hutchinson et al. 1966). Large woody material is not available until the final section (Reach 6) between 25.9 and 27.5 miles where 11 log jams were recorded, four impassable (Hutchinson et al. 1966). Stream cleanout following the 194 flood resulted in the removal of much of the LWM within and adjacent to the channel of Salt Creek.

Mainstem Salt Creek - 1990 and 1996

The valley segment types for lower Salt Creek (Reaches 1 - 4) dictate a situation where large woody material would be expected to be available in small debris jams and single pieces within a moderate slope bound valley. The upper reaches

(6 - 10) of the stream reflect a more varied geomorphology and gradient regime in relation to the potential LWM input and movement within the channel. Steeper gradient, reaches, such as those flowing through V-shaped valleys, would be expected to have less frequent, large debris jams. Other regions of upper Salt Creek display lower gradients and les constrainment where smaller accumulations and single pieces may be expected. The longitudinal profile for Salt Creek is shown in Figure 3.6-5.

All reaches of mainstem Salt Creek, including those in which large wood would be expected to be abundant, are below large woody material objective values (Figure 3.6-8). Large wood is most abundant in the upper reaches of Salt Creek, although current levels of wood are lower than the objectives and possibly historic values. No woody debris jams were observed on Salt Creek during stream surveys in 1990 and 1996.

It should be noted that the LWM now available (1997) in the lower and middle sections of the Salt Creek drainage may be quite different in number, complexity, frequency and placement from that observed during the 1990 stream survey. The reason for this shift in LWM is due to the addition of large woody material during restoration projects as well as the November 1996 flood events which rearranged many of the added structures and recruited new large woody material. Salt Creek from the mouth to the Eagle Creek railroad trestle was resurveyed during the 1997 field season to understand the effects of the 1996 flood events. Data analysis was not available in time for this watershed analysis.

Lower Salt Creek Subwatershed 20 1
Many of the streams surveyed in this section have little or no data available. Of those, McCredie and Warner Creeks have usable information.

McCredie Creek - 1992
Data collected from McCredie Creek in 1992 show five different valley segment types over the course of 1.33 miles. Assessing the expected abundance of LWM throughout this stream, one would expect to find both frequent and infrequent large jams and individual pieces, and abundant single pieces and occasional jams. Only 1 woody debris jam was observed during a 1992 stream survey. Calculated large LWM/mile for all eight reaches reveal two reaches where the number per mile exceeds both the PACFISH and WNF standards (Figure 3.6-9). All but one of the remaining reaches are within 50 percent of the standards.

Warner Creek - 1996
Data collected from Warner Creek in 1996 show two different valley segment types over the 1.9 miles. A longitudinal profile of Warner Creek is displayed in Figure 3.6-7. Warner Creek currently exceeds the PACFISH standard in Reach 2 but falls short in Reaches 1 and 3 (Figure 3.6-9). However, LWM numbers are within the 50 percent margin. Surveyors noted greater than 29 debris jams over the course of three Reaches.

Middle Salt Creek Subwatershed 20 2
Streams surveyed in this section with applicable data include tributaries T20f 45.3, T20f 46.3, T20w 11.8, Eagle Creek, Coyote Creek, South Fork Salt Creek, Fall Creek, and Diamond Creek.

T20f 45.3 - 1992
The valley segment type for tributary T20f 45.3 should reveal a LWM situation where small debris jams and single pieces are common. A 1992 survey reveals this tributary to Salt Creek exceeds both PACFISH and WNF standards (Figure 3.6-10). One debris jam was noted by surveyors.

T20f 46.3 - 1992
The valley segment type for tributary T20f 46.3 should reveal a LWM situation where infrequent large jams yet abundant small jams and single pieces are present. A 1992 survey reveals this tributary exceeds PACFISH and WNF in the first reach and falls short in the second reach (Figure 3.6-10). Data are not available for the other two reaches.

T20w 11.8 - 1992
The valley segment type for tributary T20w 11.8 should reveal a LWM situation where large jams are infrequent. A 1992 survey reveals this tributary falls well short of the two standards (Figure 3.6-10).

Eagle Creek - 1992

The valley segment types for Eagle Creek reveal a varied geomorphology and potential LWM arrangement. From these valley segment types one would expect to find abundant large jams on channel margins as well as infrequent large jams, small debris jams and single pieces, and frequent jams and single pieces creating pools. The LWM/mile data is suspect but Eagle Creek was resurveyed during the 1997 field season, but it was not yet available for inclusion in to the watershed analysis. Ten debris jams were noted by surveyors in Eagle Creek.

Coyote Creek - 1992

The valley segment codes for Coyote Creek reveal a situation where large jams are infrequent and beaver are important. A 1992 survey reveals this tributary falls well short of the two standards (Figure 3.6-10).

South Fork Salt Creek - 1996

The valley segment types for South Fork Salt Creek are varied and reveal an assortment of differing landforms and potential LWM placement and movement. A longitudinal profile of South Fork Salt Creek is displayed in Figure 3.6-6. A 1996 survey reveals that South Fork Salt Creek falls well short of the targeted PACFISH and WNF standards (Figure 3.6-8), however 125 debris jams were recorded in 1996. The 1964 South Fork Salt survey also noted four dense log jams between 0.9 and 2.9 miles.

Fall Creek - 1996

A 1996 survey of Fall Creek revealed that this stream fell short of the two standards (Figure 3.6-10). Seven debris jams were recorded by surveyors in 1996 for Fall Creek.

Diamond Creek - 1996

LWM data for Diamond from a 1996 stream survey showed that it also was below PACFISH and WNF standards (Figure 3.6-10).

Upper Salt Creek Subwatershed 20 3

The only stream surveyed in this subwatershed is Deer Creek.

Deer Creek – 1996

The valley segment types for Deer Creek are varied and reveal an assortment of differing landforms and potential LWM placement and movement. A 1996 stream survey shows that this stream is below PACFISH and WNF standards (3.10-10). Surveyors noted 6 debris jams.

Figure 3.6-5. Longitudinal Profile Salt Creek

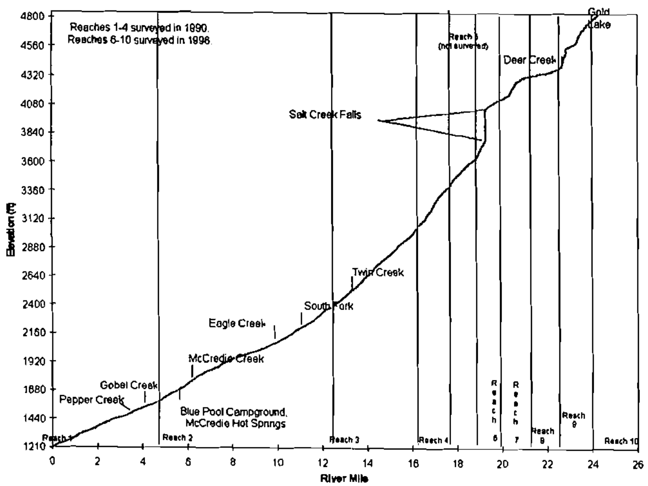


Figure 3.6-6. Longitudinal Profile South Fork Salt Creek

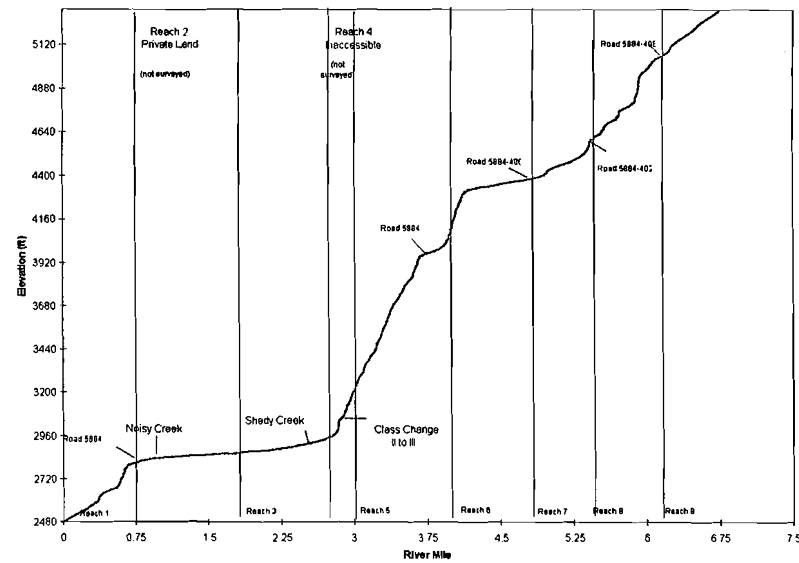


Figure 3.6-7. Longitudinal Profile Warner Creek

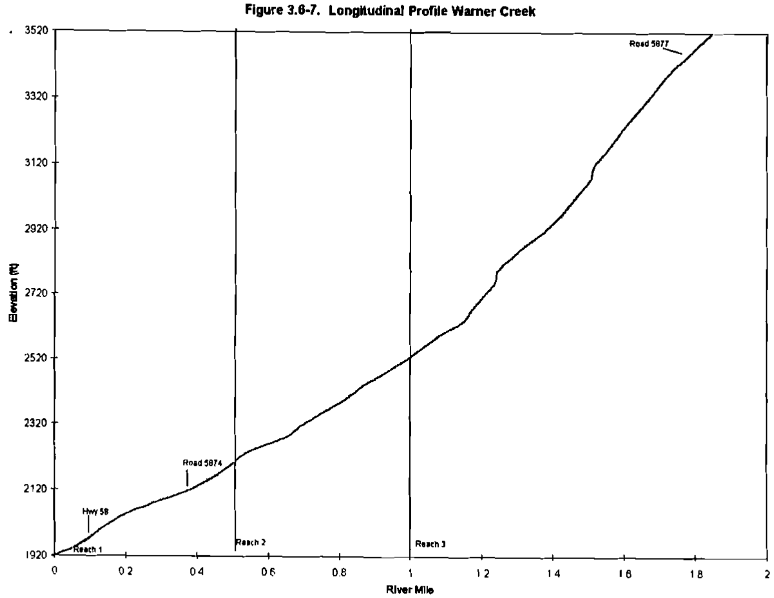


Figure 3.7A. Longitudinal Profile Eagle Creek

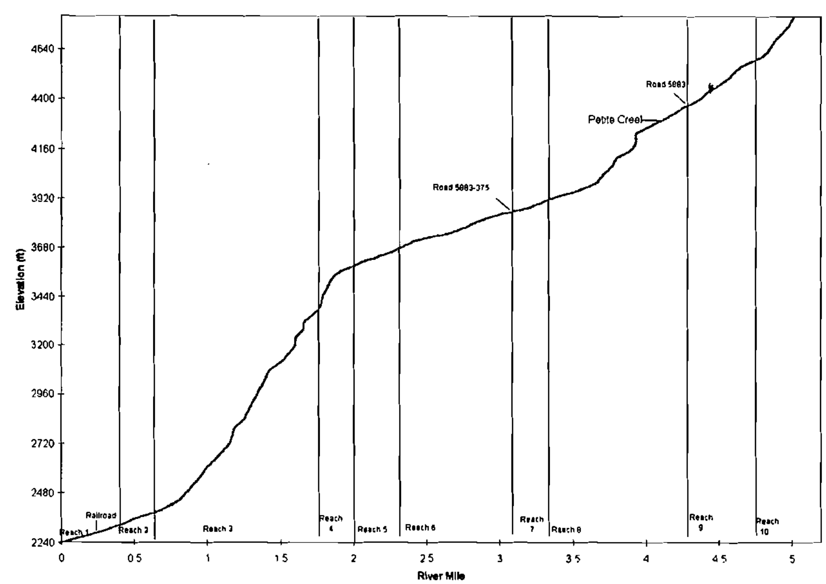


Figure 3.6-8. Salt Creek and South Fork Salt Creek - Medium + Large Woody Material

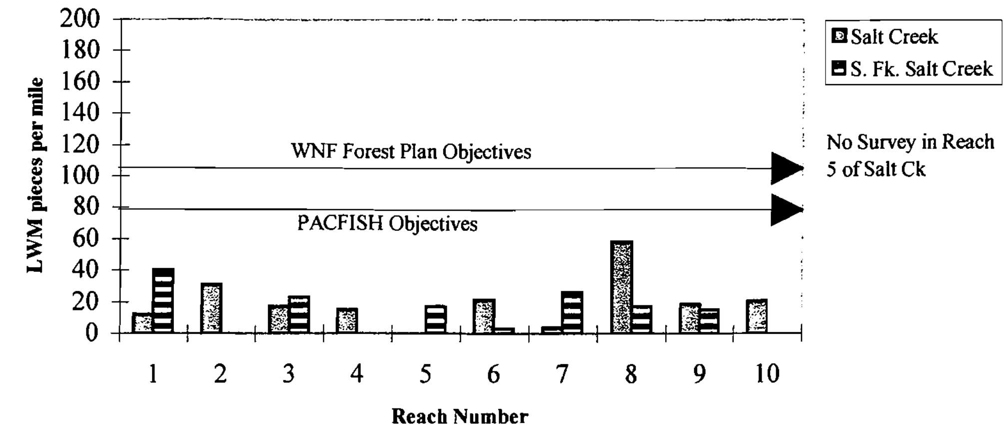


Figure 3.6-9. Streams in Subwatershed 20 1 - Medium + Large Woody Material

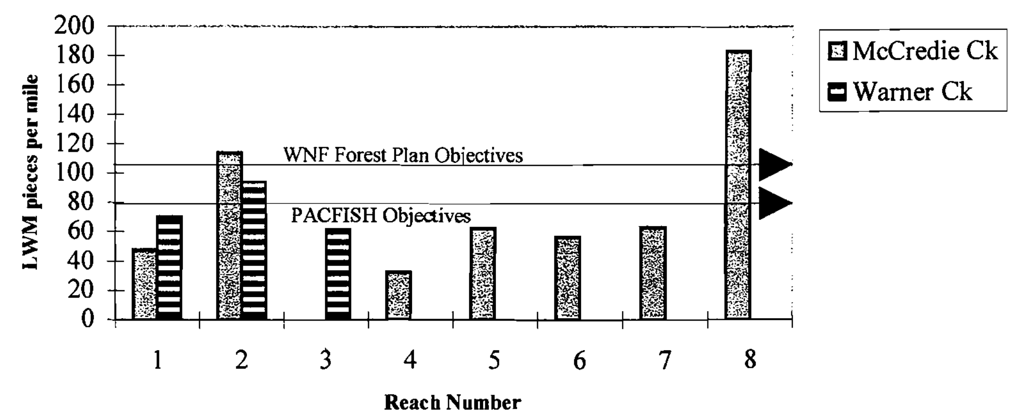
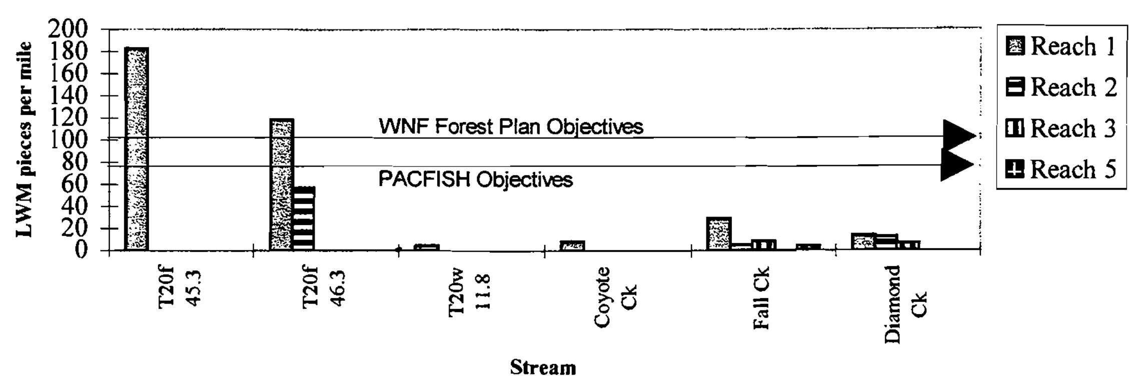


Figure 3.6-10. Streams in Subwatershed 20 2, Med + Large Woody Material



Adult Habitat (Large Pools)

REFERENCE CONDITION

Historically, large pools were probably more frequent due to the presence of large sized (channel spanning) woody debris which typically create plunge pools by a scouring action as well as enhancing gravel retention. Reference data is available from the 1937 mainstem Salt Creek survey where stations were delineated and measurements recorded. Pools were placed into size and depth categories (Table 3.6-5), the totals tallied as "resting pools," and percentages broken out in relation to size and depth per station interval as well as resting pools per mile (McIntosh et al. 1992). The resultant data show large pools per mile were greatest between stations C and D from Eagle Creek to South Fork Salt Creek, and stations E and F, 1.5 miles above railroad trestle to Salt Creek Falls; and least between stations D and E, South Fork Salt Creek to 1.5 miles above railroad trestle (Appendix H). The 1937 survey of Salt Creek resulted in two reaches meeting today's standards from the mouth of Salt Creek to the confluence with Eagle Creek. The lower reaches of Salt Creek, from the mouth to Salt Creek falls, contained many large and deep pools with numerous resting pools of all sizes" (McIntosh et al. 1992).

Table 3.6-5. 1937 Pool Classifications (From McIntosh et al. 1992)

Pool Type	Pool Depth (feet)	Pool Size (sq. yards)
S1	6	>50
S2	3-6	25-50
S3	< 3	<25
S4	> 6	25-60
S5	< 3	25-50
S6	Pocket Pools	

CURRENT CONDITION

Presently, there are no streams in the Salt Creek watershed which meet the PACFISH or WNF Forest Plan objectives for large pools using Region 6 stream inventory protocol. For those streams surveyed within the Salt Creek watershed, large pools are generally lacking in frequency.

Pools of varying size and complexity are available to some degree and were recorded by stream survey crews from 1964 to the present for the mainstem and several tributaries. Geomorphology, channel characteristics, and LWM all play important roles in the formation and maintenance of pool habitat. In lower, alluvial sections, LWM and channel scour around meandering bends are central to the formation of large, deep and long lateral scour pools often with long tails comprised of fine spawning materials. In middle reaches where gradient is often a bit higher, pools can be formed by plunging action or straight scouring of mid channel regions. Off channel pool habitat in the form of isolated pools and pockets is very important and acts as refugia for young of the year (YOY) salmonids in many systems. In the higher gradient regions where the valley form has a constrained channel, stair-step and pocket pools are common (though usually smaller) interspersed with some larger plunge pools.

Salt Creek - 1964, 1990, 1996

Presently, there are no reaches in the mainstem of Salt Creek which meet the PACFISH or WNF Forest Plan objectives for large pools using Region 6 stream inventory protocol.

Current pool data for mainstem Salt Creek are available from three different years (1964, 1990, 1996). The 1964 survey encompassed the entire stream length of 27.5 miles to Gold Lake. The 1990 survey covered the lower subwatersheds (Reaches 1-4) and terminated downstream of Salt Creek falls, a distance of 19.93 miles. In 1996, only the upper Subwatershed, above Salt Creek Falls (Reaches 6-10) was surveyed for a total of 5.3 miles. Pool and riffle habitat percentages for mainstem Salt Creek are displayed in Figure 3.6-11.

Table 3.6-6 compares the changes in large pool numbers between 1937 and 1990, for reaches below Salt Creek Falls, and Table 3.6-7 compares the changes in pools/mile between 1964 and 1996 for reaches above Salt Creek Falls Subwatersheds 20 1 and 20 2 lost considerable pool habitat when the 1990 survey is compared to the 1937 survey, both covering the same area. Table 3.6-7 reveals an increase in the frequency of pools/mile between 1964 and 1990 between the falls and Deer Creek and a decrease between Deer Creek and Gold Lake. Differences in protocol between the years could have a considerable effect on identifying a large pool.

Table 3.6-6. Changes in the Number of Pools/Mile for Mainstem Salt Creek from 1937 to 1990 (Subwatersheds 20 1, 20 2)

1937 Survey*		1990 Survey**		% Difference from 1937 to 1990
Location	**pools/mile**	**pools/mile**	**Reaches**	
Mouth to 2nd Salt Creek. Hwy bridge	15.3	2.7	1	-82.3
Eagle Creek to South Fork Salt Creek.	20.6	7.5	2	-63.6
1.5 mi. above trestle to the Falls	20	6.65	3 and 4	-66.8

* *McIntosh et al. 1992*

** *Oakridge Ranger District stream surveys 1990*

(Note: location description was used rather than river miles for the mainstem Salt Creek comparisons.)

Table 3.6-7. Changes in the Number of Pools/Mile for the Upper Mainstem of Salt Creek from 1964 to 1996 (Subwatershed 20 3)

1964 Survey*		1996 Survey**		% Difference from 1964 to 1996
Location	**pools/mile**	**pools/mile**	**Reaches**	
Upstream of the Falls to upstream of Deer Creek	8	14.4	6,7,8,9	+44.4%
Upstream of Deer Creek to Gold Lake	<16	8.3	9,10	-50%

* *Hutchinson 1966*

** *Oakridge Ranger District stream surveys 1996*

(Note: location description was used rather than river miles for the mainstem Salt Creek comparisons.)

Despite recording many pools, the 1964 large pool data would not meet any of today's standards (PACFISH or WNF). The 1990 stream survey covered the lower two subwatersheds below Salt Creek Falls (20 1, 20 2). Observed large pool/mile results for all 4 reaches are very low, and fall well short of the current standards (Appendix H). The 1996 survey was broken out into 5 reaches beginning upstream of Salt Creek falls and terminating near Gold Lake. None of the reaches meet the PACFISH or WNF standards. The reduced numbers of LWM may in part explain the low pool frequencies overall for both the years. Reach 8 of the 1996 survey displayed the greatest frequency of pools and had the highest LWM/mile (Figure 3.6-5). This trend is observed for nearly all the 1990 and 1996 surveyed reaches, except Reach 7 of the 1996 survey where the LWM was much reduced but the occurrence of pools was second highest. It should be noted that a distinct difference in protocol between the 1990 and 1996 surveys exists in reference to determining pool habitat. In 1990, surveyors did not classify a pool unless it was longer than wide thus potentially eliminating many plunge pools where frequently they are very wide but short. The 1996 protocol adjusts for this and classifies all channel spanning plunge pools as well as pools that are longer than they are wide.

Lower Salt Creek Subwatershed 20 1

Very little pool data exist for this subwatershed. Warner Creek was the only creek surveyed with this information available.

Warner Creek

A short but high gradient stream of only 1.9 miles in length, Warner Creek contains very few large pools in Reaches 1 & 2 (Figure 3.6-13) despite nearly meeting the PACFISH LWM standards (Reach 2 does exceed the standard) (Figure 3.6-9). A 1996 modified survey protocol was employed in Reach 3. In the modified survey the pools are classified in the same way as the Regional Level II protocol. The higher numbers are simply indicative of a step pool morphology. The high number of pools/mile in Reach 3 is due to the step pool morphology of this reach.

Middle Salt Creek Subwatershed 20 2

Streams containing pool data include Eagle Creek, South Fork Salt Creek, Fall and Diamond Creeks.

Eagle Creek - 1992

Eagle Creek contains very few large pools, none of which meet the two standards (Figure 3.6-12). The LWM data are suspect (either from computer software problems or errors in data entry) therefore it is difficult to speculate the effects c LWM on pool habitat.

South Fork Salt Creek - 1964, 1996

Data from 1964 in Reach 3 nearly meets both pool objectives. Region 6 protocol surveys in 1996 for reaches 1 and 3 show pools/mile well below the objectives (Figure 3.6-14). The final five reaches of the South Fork Salt Creek, surveyed with the modified protocol exceeded or come close to meeting objective values in Reaches 5, 6, 8 and 9. The high pool values in Reaches 5-9 are due to the seop pool morphology of these reaches.

Fall Creek - 1996

Fall Creek contains few large pools and with the high gradient it is presumed that many smaller step and pocket pools exist. Reach 5 is the only reach nearing objective values for large pools.

Diamond Creek - 1996

Diamond Creek falls below objective pool levels for all reaches.

Upper Salt Creek Subwatershed 20 3

Deer Creek - 1996

Deer Creek is the only stream surveyed in this section. Observed pool values are very low for Reach 1. Reach 3 met objective values for pools.

Rearing and Overwintering Habitat (Side Channels)

REFERENCE CONDITION

Reference data for rearing and overwintering habitat are generally lacking for Salt Creek. It is presumed that at the time of the 1937 survey, habitat conditions were sufficient to produce viable and sustainable runs of salmon and resident native trout populations (as well as non-salmonid species). Salt Creek most likely contained suitable off channel rearing and overwintering habitat in the form of side channels, tributary mouths, and isolated and alcove pools. LWM, intact riparian conditions and occasional bank undercutting further complemented habitat conditions.

CURRENT CONDITION

Within the Salt Creek watershed there is currently a reduced amount of large pool habitat, thus limiting the availability of adult overwintering habitat. In addition, the lack of side channel habitat and large wood for cover in many reaches of the Salt Creek watershed makes overwintering habitat a potentially limiting factor for juvenile salmonids. Quality habitat is essential for YOY rearing and YOY, juvenile and sub-adult overwintering. Suitable areas such as stream margins with ample vegetative cover and complex side channels (LWM and hydrology) are favorable conditions.

Side channel habitat is available in many of the surveyed streams within the Salt Creek basin. The percentage of available side channel habitat in Salt Creek and its larger tributaries is between 0.9 and 10%, relatively small overall when compared to the total area of each stream's habitat. Those streams with less than 3% available side channel habitat include upper Salt Creek (20 3), McCredie Creek (20 1), Coyote Creek (20 2), Deer Creek (20 3), Warner Creek (20 1), Diamond Creek (20 2), and Fall Creek (20 2).

Salt Creek - 1990, 1996

Within Salt Creek mainstem, side channel habitat is available in every reach. The lower reaches below the falls (1-4) contain more side channel area than the upper reaches above the falls (6-10), most likely due to the low gradient, wider floodplain and general landforms. Figure 3.6-15 displays the availability of side channel habitat as it compares to riffle and pool habitat. Off channel habitat such as isolated pools are not recorded for these surveys.

Lower Salt Creek Subwatershed 20 1

Warner Creek - 1996

Warner Creek is a high gradient stream with limited areas of side channel habitat (Figure 3.6-17). Pocket pools in boulder systems can act as a form of refugia for fishes during higher waters when side channels are lacking, and when coupled with stable LWM formations survival is enhanced.

McCredie Creek - 1992

McCredie Creek is lacking overall in side channel habitat except for Reach 4 where side channels comprised 14% of the habitat. A high degree of stream cover was noted (4 out of a possible 4), and streambanks are armored with bedrock and cobbles.

Middle Salt Creek Subwatershed 20 2

Eagle Creek - 1992

Eagle Creek contains several reaches where side channels are the dominant habitat characteristic (Reaches 1, 2, 4, 5 with 49.2%, 83.1%, 67.1%, and 10.8% respectively). The fish cover ratings were primarily 4's (out of 4) with turbulence being the dominant cover type. Bank armoring is a mixture of cobbles, small boulders and gravels.

South Fork Salt Creek - 1996

South Fork Salt Creek contained 4.2% side channels of the 2 surveyed reaches with the primary protocol (Figure 3.6-16). The remainder of the stream was surveyed with the modified protocol which does not record such habitat characteristics.

Fall Creek - 1996

Fall Creek is a high gradient stream ranging from 6 to 16 percent for reaches 1-5. Side channel habitat therefore was low for the stream (2.5%). Reaches 5 and 6 are within the Diamond Peak Wilderness.

Diamond Creek - 1996

Approximately 90 percent of Diamond Creek is within the Diamond Peak Wilderness. This stream is moderate to high in gradient ranging from 4 to 7 percent. Side channel habitat was low at 0.9%.

Figure3.6-11. Salt Creek Riffle/Pool Percentages

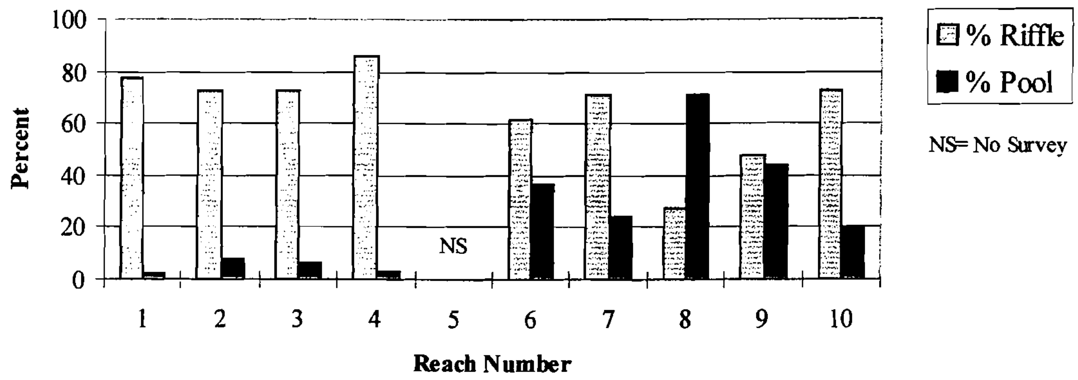


Figure 3.6-12. Eagle Creek (Subwatershed 20 2) Riffle/Pool Percentages

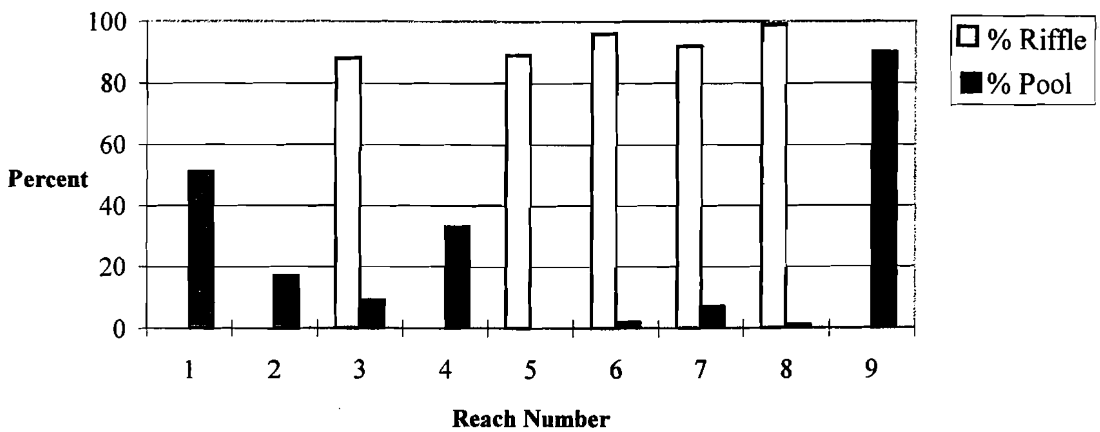


Figure 3.6-13. Warner Creek Riffle/Pool Percentages

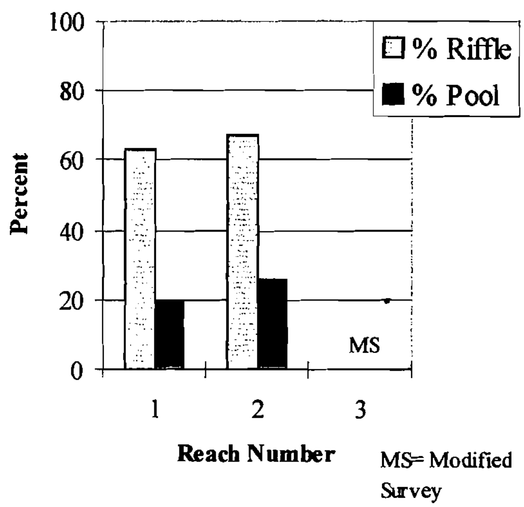
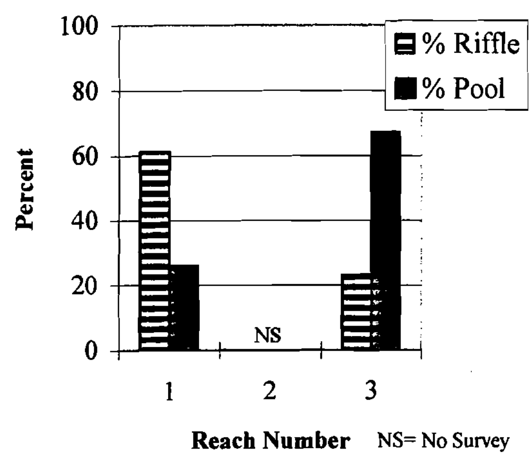


Figure 3.6-14. South Fork Salt Creek Riffle/Pool Percentages



Upper Salt Creek Subwatershed 20 3

Deer Creek - 1996

Deer Creek is a high gradient stream ranging from 6 to 10 percent. Side channel habitat accounted for 1 percent of the habitat in Reach 1 and 2 percent in Reach 2 (Figure 3.6-18).

Spawning Habitat (Substrate)

REFERENCE CONDITION

In 1937, the lower reaches of Salt Creek, from the mouth to Salt Creek falls, contained "good spawning riffle is abundant with numerous resting pools of all sizes" (McIntosh et al. 1992). Spawning gravels were readily available from the mouth to the falls, occupying 58.9% of the substrate composition. The 1964 stream survey of South Fork Salt Creek noted that between river mile (RM) 0.9 and 2.9 miles (Reaches 1 and 2), excellent spawning areas for salmon and trout were available. "All of the spawning gravel is found in this section" (Hutchinson 1966). This segment of stream flows through private land.

CURRENT CONDITION

Classification of bottom substrates in stream surveys has been a subjective measurement, it has evolved from a two category (dominant/subdominant) system to a method in 1995 where percentages of sand/silt, gravels, cobbles, boulders and bedrock are recorded. More recently a quantitative method has been used (since 1995?) that predicts a median substrate particle size (Wolman 1954). Wolman substrate counts have been conducted on Salt Creek (Reaches 6-10), South Fork Salt Creek, Deer Creek, Diamond Creek, Fall Creek and Warner Creek (Appendix H).

Salt Creek - 1990, 1996

The lower sections of Salt Creek below the falls (20 1, 20 2) in 1990 contained cobbles as the dominant substrate and small boulders as subdominant. The upper reaches of Salt Creek above the falls (20 3) in 1996 contained predominantly gravel and cobble substrate. Reach 8 however, was predominantly sand (44 percent) (Figure 3.6-19).

Lower Salt Creek Subwatershed 20 1

Surveys conducted in 1964 for the following creeks found boulder as the dominant substrate and cobble or gravel as subdominant: Tumble, Sage, Pepper, Sugar, Gobel, Basin, Fin Roberts, and McCredie.

McCredie Creek - 1992

Cobble and small boulder substrate made up most of this stream, with gravel being subdominant in Reaches 5-8.

T20e 36.7, T20f 41.3, 41.5 and 43.3 - 1992

Sand was recorded as the dominant substrate and gravel subdominant for Reach 1 of all tributaries except T20f 43.3 which had a cobble and small boulder substrate.

Figure 3.6-15. Salt Creek Riffle/Pool/Side Lengths

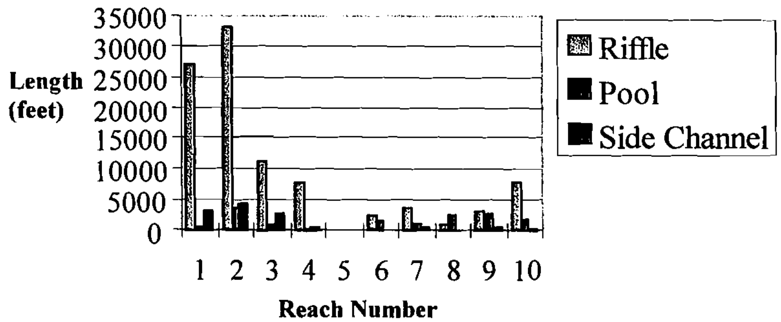


Figure 3.6-16. South Fork Salt Creek Riffle/Pool/Side Lengths

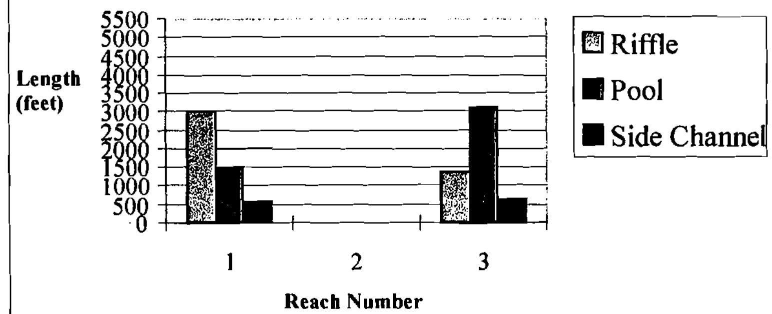


Figure 3.6-17. Warner Creek Riffle/Pool/Side Lengths

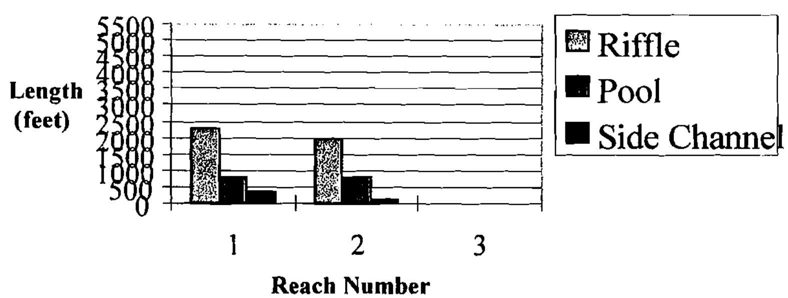
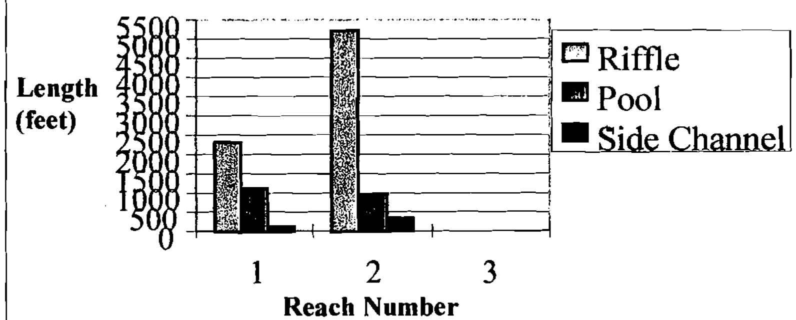


Figure 3.6-18. Deer Creek Riffle/Pool/Side Channel Lengths



Warner - 1964, 1996
The mouth of Warner Creek was surveyed in 1964 and found to have a dominant substrate of boulder with some gravel. The 1996 surveys showed an even distribution between gravel, cobble and boulder (Figure 3.6-22).

Middle Salt Creek Subwatershed 20 2

South Fork Salt Creek - 1964, 1996
In 1964, dominant substrate ranged from cobble/bedrock from the mouth to RM 0.9 (Reach 1), gravel from RM to 2.9 (Reach 2) and bedrock from RM 2.9 to 3.9 (Reach 3). Surveys in 1996 found that gravels and cobbles were the dominant and subdominant substrates respectively (Figure 3.6-20).

T20f 45.3, 46.3 and T20w 11.8 - 1992
Sand was the dominant substrate type followed by cobble for these streams during these surveys.

Eagle - 1964, 1992
Surveys in 1964 and 1992 found similar substrate types: cobble/boulder dominant, and gravel subdominant.

Coyote - 1964, 1992
A 1964 survey found boulder and cobble as the dominant substrate type and gravel as subdominant. A more recent survey in 1992 showed sand and gravel dominant and subdominant respectively in Reach 1, and cobble dominant, small boulder subdominant in Reach 2.

Fall - 1996
Reaches 1-2 were composed of cobble (dominant) and gravel (subdominant). Reach 3 was dominated by bedrock and an even percentage of boulder and cobble (Figure 3.6-20). Reach 4 was not surveyed. Reach 5 found bedrock as the dominant substrate followed by boulder. Reach 6 found sand as the dominant substrate with gravel subdominant. This reach was a low gradient wetland area. Approximately 70 percent of Reach 2 and all of Reaches 3-6 are within the Diamond Peak Wilderness.

Diamond - 1996
Gravel was the dominant substrate and cobble subdominant for most Reaches (Figure 3.6-20). Approximately 80 percent of Diamond Creek is within Diamond Peak Wilderness.

Upper Salt Creek Subwatershed 20 3

Deer- 1996
Cobble substrate was dominant for Reach 1 with bedrock dominant in Reach 2 (Figure 3.6-21).

Water Temperature
Stream temperatures in the mainstem of Salt Creek in subwatershed 20 3 are lower than downstream subwatersheds. Stream survey temperature data for tributaries to Salt Creek show cold water temperatures that are adequate for salmonids (Appendix C and pages 24-25 of this chapter).

Natural And Human Caused Migration Barriers
Salt Creek falls has been a migration barrier to salmonids since its formation. There are currently 21 known migration barriers (prior to November 1996 flood), 14 are due to culverts and 7 are natural (Figure 3.6-2).

On April 1993, culverts on state Highway 58 were inspected for fish passage. Seven culverts on six streams were identified as blocking fish passage. The following streams with problem culverts were identified: Sage Creek, Sugar Creek, Fin Roberts Creek, Warner Creek, McCredie Creek, two unnamed tributaries to Salt Creek (east and west of Eagle Creek), and Salt Creek near the pass of state Highway 58. Priorities for correcting culvert problems were given to Warner Creek, McCredie Creek and Salt Creek near the pass. These streams were chosen due to the amount of fish habitat that is located upstream of culverts.

Fish Habitat Restoration

There were 15 fisheries habitat restoration projects within Salt Creek between 1987 and 1995 (Table 3.6-8). The status of these structures since the flood in November 1996 is unknown. It is suspected that many have moved from thei original positions by the flood event. A survey during the 1997 field season will determine to what extent these structures were impacted by the 1996 flood event. This data was not yet available for inclusion in this watershed analysis.

Table 3.6-8. Fish Habitat Restoration Projects on Salt Creek, 1987 to 1995

Project Name	Year	Start Location	Num. of Structures	Num. of LWM
Swamp Creek Culvert	1987	T22S, R5E, S21	N/A	N/A
Log Bridge	1987	T22S, R5E, S26	N/A	N/A
Wicopee Bridge	1987	T21S, R4E, S36	22	4
MP 46 - Salt Creek Side Channel	1988	T22S, R5E, S6	6	20
Elk Salvage # 1	1989	T22S, R5E, S8	11	12
Blue Pool	1990	T21S, R4E, S35	6	8
Sage	1990	T21S, R4E, S28	N/A	N/A
Wicopee	1990	T22S, R5E, S6	10	8
Squaw Butte I	1991	T21S, R4E, S20	7	5
Squaw Butte II	1992	T21S, R4E, S20	9	12
Salt Creek Section 6	1993	T22S, R5E, S6	N/A	N/A
Tumbler # 1	1993	T21S, R4E, S19	10	34
Tumbler # 2	1994	T21S, R4E, S19	12	13
Elk Salvage # 2	1994	T21S, R4E, S36	86	125
Tumbler # 3	1995	T21S, R4E, S19	61	132
		Total	**240**	**373**

Figure 3.6-19. Wetted Channel Substrate Percentage for Salt Creek

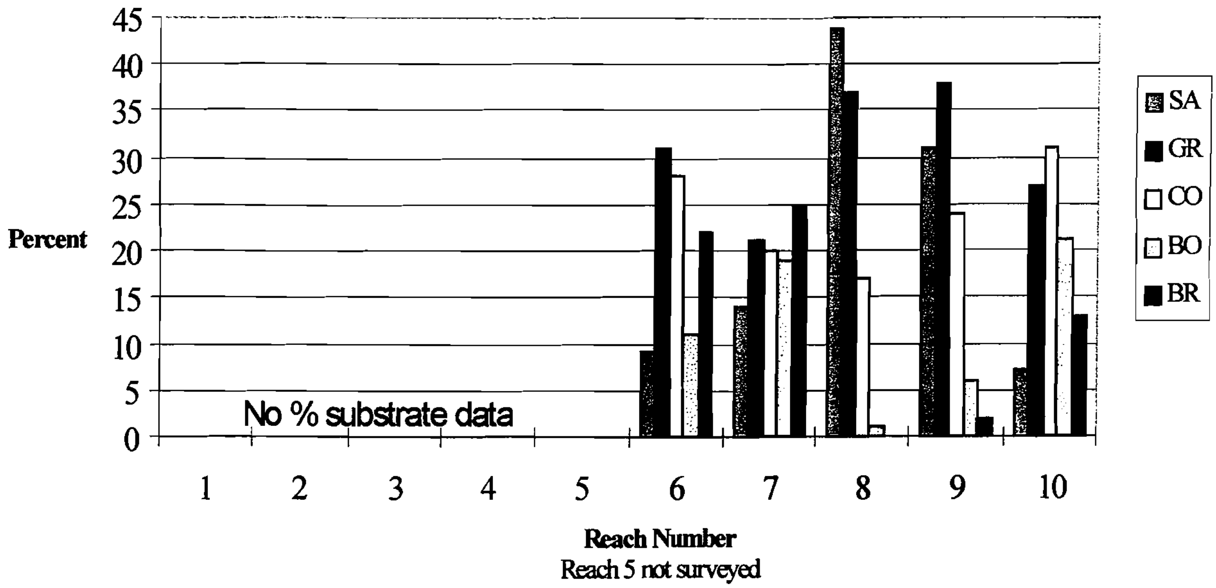


Figure 3.6-20. Wetted Channel Substrate Percentage for Streams in Subwatershed 20 2

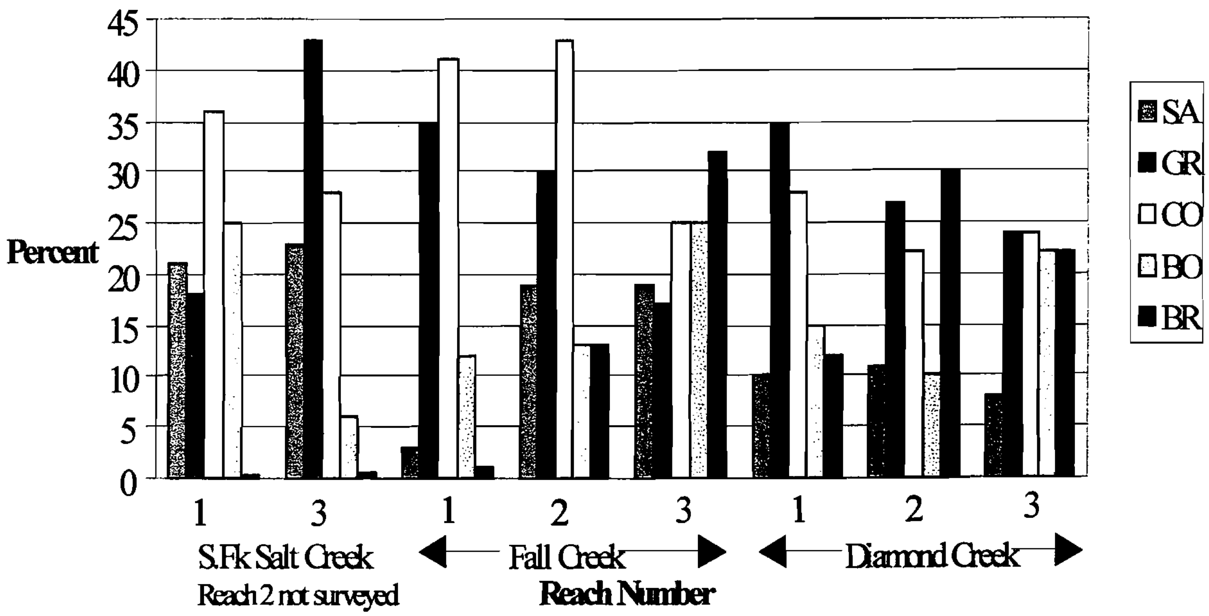


Figure 3.6-21. Wetted Channel Substrate Percentage for Subwatershed 20 3

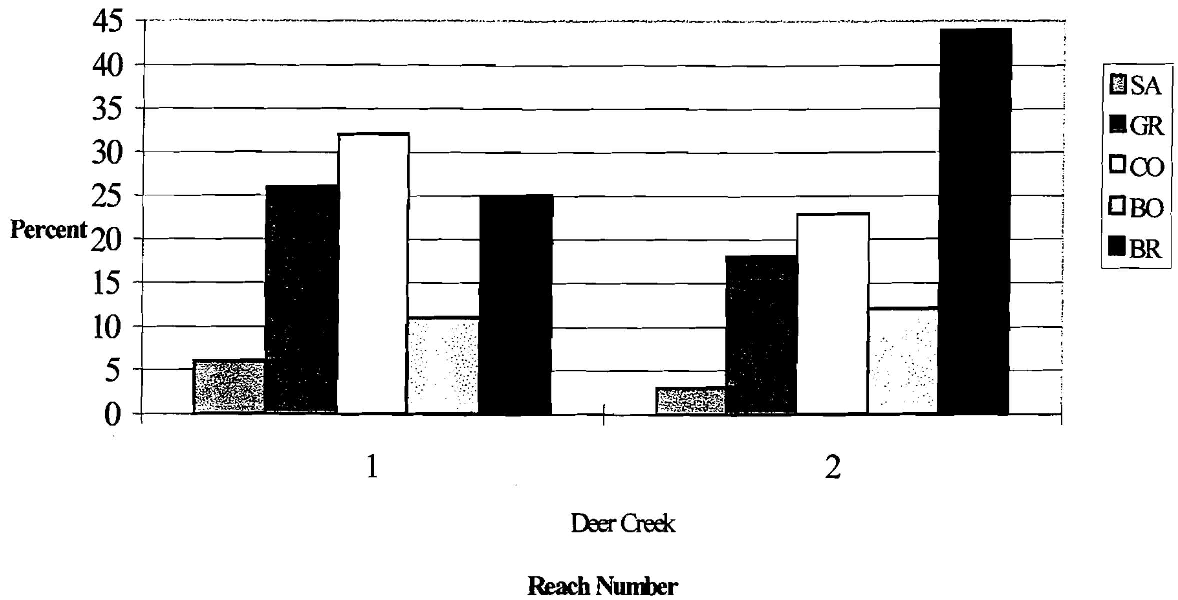
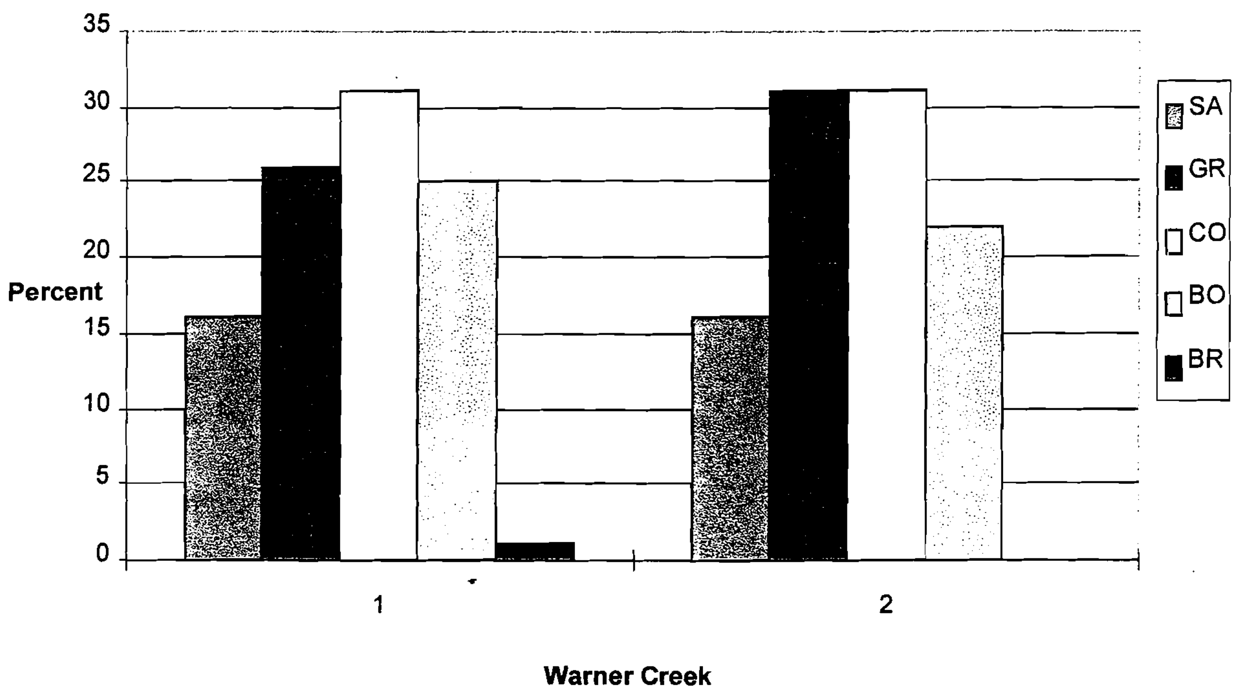


Figure 3.6-22. Wetted Channel Substrate Percentage for Subwatershed 20 1



NON-SALMONID SPECIES

REFERENCE CONDITION

Historical references and data do not exist for non-salmonid species but it is assumed that native species existing today existed historically in the Salt Creek Watershed.

CURRENT CONDITION

Non-salmonid species exist within Salt Creek watershed. Three genera of fish have been observed either visually, or via electroshocking since 1964. Salt Creek mainstem contains sculpins (*Cottus spp.*) in the lower reaches of the system (Reaches 1 & 2 of 20 1), lamprey (*Lampetra spp.*) in Reach 1 (20 1), and speckled dace (*Rhinicthys osculus*) in the lower reaches (Appendix H). Others streams containing non-salmonids include Eagle Creek (Reach 1 of 20 2) and South Fork Salt Creek (Reaches 1 & 2 of 20 2). Both Eagle Creek and South Fork Salt Creek contained only cottids. Other non-salmonid species in the Salt Creek watershed include largescale suckers (*Catostomus spp*), squawfish (*Ptychocheilus spp*), and redsided shiners (*Richardsonius balteatus*).

NON-NATIVE SALMONID SPECIES

REFERENCE CONDITION

Non-native salmonid species did not exist in the watershed prior to European habitation.

CURRENT CONDITION

It is unknown when non-native species were introduced into the watershed. Currently the only known non-native salmonid species occurring in the Salt Creek watershed is brook trout.

Brook trout have colonized several streams in the upper Salt Creek watershed by moving downstream via lake outlets. Brook trout are native to eastern North America and currently occur in Upper Salt above the falls, Fall and Diamond Creeks (Subwatershed 20 2), and Deer Creek (Subwatershed 20 3). They also occur in 16 lakes (Table 3.6-10) due to stocking which has occurred since the early 1900's.

In 1964 cutthroat in Salt Creek were the only fish sighted throughout the Upper Salt Creek subwatershed (20 3) and the upper portion of the Middle Salt Creek subwatershed (20 2). By 1980 brook trout and rainbow were the only species observed. However, sampling techniques differed for the two sample years. Visual observances were employed for the 1964 survey whereas electroshocking was used in 1980.

AQUATIC MACROINVERTEBRATES

REFERENCE CONDITION

No information exists about historic macroinvertebrate populations but it can be assumed that native species existed in the Salt Creek watershed.

CURRENT CONDITION

Macroinvertebrate surveys were conducted on nine streams within the Salt Creek watershed from July to September 1995. No sensitive species were located during these surveys (Table 3.6-9). Information gathered on macroinvertebrates will be useful as baseline surveys, but few conclusions can be drawn at this time.

Table 3.6-9. Federal Status of Aquatic Macroinvertebrates within Willamette National Forest

Common Name	Species	WNF status	Federal Candidate Category
Beer's false penny beetle	*Acneus beeri*	D	2
Mt. Hood Primitive Caddisfly	*Eobrachycentrus gelidae*	D	2
Tombstone Prairie Caddisfly	*Farula reaperi*	D	2
Ft. Dick Limnephilus Caddisfly	*Limnephilus atersus*	D	2
Tombstone Prairie Caddisfly	*Oligophlebodes mosthento*	D	2
One-spot Caddisfly	*Rhyacophila unipunctata*	D	2

LAKES, WETLANDS, AND PONDS

REFERENCE CONDITION

Prior to European habitation, lakes that were not connected to streams did not contain fish populations. Many of the larger lakes within the watershed have been stocked with native and non-native fish since the early 1900's.

CURRENT CONDITION

There are 16 named lakes within the watershed, most stocked with resident salmonids (Table 3.6-10). A history of lake stocking can be found in Appendix I. Lakes are stocked because most introduced fish populations do not naturally reproduce in a lake environment. In addition, the shallow lakes will freeze over in the winter and cause mortality (winterkill).

Table 3.6-10. Physical and Biological Information on Lakes within the Salt Creek Watershed

Lake Name	Elevation (feet)	Acreage	Depth (feet)	Fish Species
Abernathy, Lower	4950	2	8	BT, RB, CT, BR
Abernathy, Upper	4960	16	20	BT
Betty, Lower	5440	9	17	RB
Betty	5500	40	28	RB
Birthday	6100	3	11	BT
Boo Boo	5400	3	18	CT
Gold	4800	104	25	BT*, RB*
Horsefly	5450	7	13	RB, BT
Howkum	?	?	?	CT
Island, Lower	6400	7	16	BT, CT
Island, Upper	6450	9	19	BT, RB
Jo Ann	6000	12	22	BT, CT
Le May	4500	5	12	BT, RB
Little Gold	4815	3	4	BR*
Lopez	5000	6	4	BT*
Lorin	6000	10	17	BT, CT, RB
Lucas	5500	15	27	BT, CT, RB
Marilyn, Lower	4950	22	18	BT
Marilyn, Upper	5000	23	25	BT
Verde	6100	2	12	BT, CT
Vivian	5500	24	15	BT

* = *natural production*

HUMAN USES

PRE-HISTORIC

REFERENCE CONDITION

Native American inhabitants of the Salt Creek watershed are believed to have had their winter dwellings in the Oakridge area, perhaps in the lower portions of the watershed. The upper watershed was used on a seasonal basis for hunting, fishing, huckleberry gathering, and other social and economic activities.

HISTORIC

REFERENCE CONDITION

Euro-American subsistence and recreational activities, mainly hunting and fishing, occurred on a limited basis from the 1840s until the 1920s. During this same period, commercial hunting and trapping for meat, firs, and bounties targeted a wide variety of species, including elk, deer, cougar, bear, wolf, bobcats, coyotes, mink, beaver and fisher.

The Oregon Central Military Wagon Road started in 1864, provided early access to Salt Creek and the Willamette Pass. Rigdon Meadows was an important camping site.

SCENIC VALUES

CURRENT CONDITION

Management to preserve or retain visual quality has resulted in fairly natural appearing views along Salt Creek and State Highway 58. Under the Willamette National Forest Plan this stream and highway corridor is allocated 11f, Scenic with retention in the foreground. Most of the upper watershed, including the road corridor to Waldo Lake, is allocated to dispersed recreation with scenic values preserved or retained.

Much of the remainder of the Salt Creek stream viewshed is managed for partially retained or modified scenic values in combination with scheduled timber harvest. Here forest visitors see a landscape mosaic of various stand ages as the result of timber harvest. Union Pacific Railroad is an Amtrak passenger route where railroad travelers also see this mosaic of various stand ages.

Since 10% of the watershed is in Late-Successional Reserve allocations, this situation will change over time as previously harvested areas develop into late-successional forest. However, forest harvest will still affect views in many areas of the watershed, particularly those areas allocated to intensive timber management (13% of the watershed).

Currently, the most popular scenic areas are Salt Creek Falls and the Willamette Pass area lakes and trails.

RECREATIONAL RESOURCES

REFERENCE CONDITION

Early recreational developments and attractions in this area include McCredie Springs and Salt Creek Falls. McCredie Springs, originally called Winino Springs, was developed as a resort around 1914.

Modern recreational use began with improved road access for automobiles to McCredie Springs before 1920 and then east across the mountains. The Southern Pacific Railroad was completed over Willamette Pass in 1925 and the Willamette Highway (Oregon 58) was completed in 1940. The area's trail system had little use, except for administrative purposes, until Civilian Conservation Corps trail improvements of the 1930s.

Skiing started in the Willamette Pass with construction of the railway and became even more popular with completion of the Willamette Highway. By 1941 skiers had a rope tow and warming hut at the present site of Willamette Pass Ski Area. Snowmobile and cross-country ski trail development started in the 1970s.

CURRENT CONDITION

Nearly two-thirds of the watershed (65.5 percent) is allocated to some form of recreation or scenic management (Table 3.7-1). An additional 11 percent is allocated to wilderness, wildlife habitat, special interest, and research natural areas. Old-growth groves and late successional reserves make up another 10 percent of the watershed.

The lower two-thirds of Salt Creek watershed is generally quite accessible by motor vehicle except for a few small restricted or closed areas. A considerable part of the upper watershed has motor vehicle restrictions or closures in the form of nonmotorized dispersed recreation areas and designated wilderness. The upper watershed includes part of the Diamond Peak Wilderness.

Table 3.7-1. Land Use Allocations

	Allocation	Acres	Percent of total
10a	Dispersed Recreation - Roaded Natural	337.7	0.5
10b	Dispersed Recreation - Semiprimitive Motorized	1054.6	1.5
10e	Dispersed Recreation - Semiprimitive Nonmotorized	14294.1	19.9
10f	Dispersed Recreation - Lakeside Setting	224.9	0.3
12a	Developed Recreation - FS Site	81.8	0.1
12b	Developed Recreation - Special Use Permits	1223.4	1.7
	Recreation subtotal	***17216.5***	***24.0***
11a	Scenic - Modification Middleground	10520.7	14.7
11c	Scenic - Partial Retention Middleground	11893.1	16.6
11e	Scenic - Retention Middleground	300.6	0.4
11f	Scenic - Retention Foreground	7045.6	9.8
	Scenic subtotal	***29760***	***41.5***
1	Wilderness	4920.8	6.8
9d	Wildlife Habitat - Special Areas	611.3	0.9
5a	Special Interest Areas	1862.4	2.6
4	Research Natural Areas	414.8	0.6
	Late Successional Reserves	3745.8	5.2
	Late Successional Reserves - 100 acre	3277.1	4.6
7	Old-growth Groves	496.1	0.7
14a	General Forest - Intensive Timber Management	9290.1	12.9
	Private Land	175.1	0.2
	Other subtotal	***24793.5***	***34.5***
	Overall Total	**71770**	**100.0**

Developed and Dispersed Camping

There are about 300,000 visits each year to developed recreational sites in the Salt Creek watershed (Tables 3.7-2 and 3.7-3). Except for an apparent increase in visits to Salt Creek Falls, use of developed recreational sites had remained relatively stable over the past three years. About 20,000 of these visits were for purposes of camping at two developed sites.

Table 3.7-2. Recreational Use of Developed Sites

Activities by developed site	1994 Occasions	1994 RVDs	1995 Occasions	1995 RVDs	1996 Occasions	1996 RVDs
Gold Lake Campground						
All camping	8,313	8,050	8,800	7,925	12,805	10,880
Picnicking	1,574	472	1,511	453	1,735	521
Viewing scenery	320	43	307	41	355	47
Nordic skiing	1,020	349	1,167	399	585	200
Boat launching	2,300	226	2,300	226	2,180	218
Blue Pool Campground						
All camping	12,870	12,354	15,340	12,730	7,250	6,652
Picnicking	3,000	900	2,400	720	2,400	720
Viewing scenery	27,812	3,708	22,250	2,967	22,250	2,967
Fishing	775	278	620	222	450	150
Salt Creek Falls						
Viewing scenery	143,325	19,110	146,732	19,564	151,880	20,251
Fishing	350	125	351	126	370	133
Nordic skiing	595	203	595	203	400	137
Viewing exhibits	140,400	45,630	143,208	9,547	151,888	10,126
Hiking and walking	11,700	3,510	11,934	3,879	12,630	4,105
Gold Lake Sno-Park						
Viewing scenery	2,875	383	32,775	4,370	400	53
Snow play	510	383	581	136	300	70
Trailhead activities	20,080	6,860	22,890	7,820	11,000	1,100
Waldo Lake Sno-Park						
Viewing scenery	572	76	650	86	450	60
Trailhead activities	1,145	122	1,335	135	1,500	150
Willamette Pass Ski Area						
Downhill skiing	76,050	31,055	86,793	35,440	45,886	18,737
Nordic skiing	9,128	3,115	10,403	3,554	5,201	1,777
Snow play	1,445	337	1,647	384	825	193
Viewing exhibits	11,700	780	11,700	780	9,000	600

Table 3.7-3. Total Visitors at Developed Sites

	1994	1995	1996
Gold Lake Campground	13,525	11,294	12,988
Blue Pool	27,810	32,700	30,000
Salt Creek Falls	40,400	146,730	155,535
Gold Lake Sno-Park	21,000	24,302	12,395
Waldo Lake Sno-Park	3,500	3,914	1,920
Willamette Pass Ski Area	92,900	98,793	60,910
Totals	**199,135**	**317,733**	**273,748**

There are 62 identified dispersed recreation sites in the watershed: 28 of these are on roads, 23 are non-road sites, and 11 are wilderness sites (Figure 3.7-1). Half of these dispersed sites are on or near high elevation lakes and most of the rest are in the State Highway 58 corridor. The majority are used for camping, especially during the summer fishing season and the fall deer and elk hunting seasons. Dispersed camping can degrade water quality and riparian or littoral habitat, particularly around high lakes.

Trail System

There are a total of 60.5 miles of summer recreation trails in Salt Creek Watershed (Table 3.7-4 and Figure 3.7-2). There are 15 trails ranging in length from 0.5 to 22 miles. Most of the trails and trail visits are in the upper part of the watershed. Concentrated use occurs on the short 0.5 mile trail at Salt Creek Falls but there were about 9,000 visits on the other trails in 1996. About 2,650 of these visits were on trails associated with high lakes. There are 102 miles of marked winter recreation trails, all in the upper watershed.

Table 3.7-4. Summer Recreation, Trail Mileage, and Use

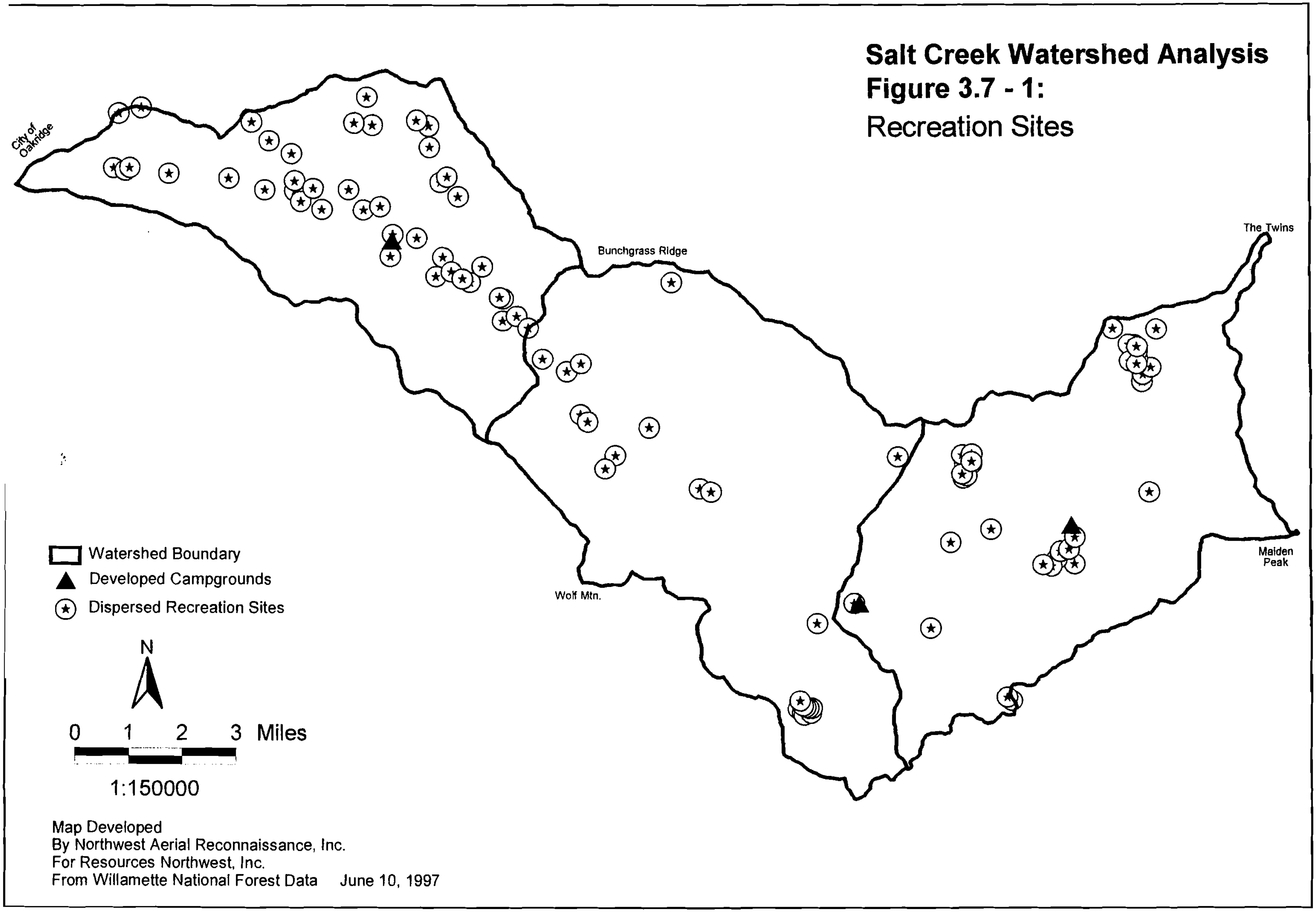
Trail	Type of use*	Miles in watershed	Estimated visits, 1996
2000 Pacific Crest National Scenic Trail	N/H	1.5	1,000
3554 Aubrey Mountain	N/H/B	1.5	30
3559 Eugene to Crest	N/H/B	22.0	--
3586 South Waldo	W/N/H/B	1.5	200
3598 Diamond Creek Falls	N/B	2.5	6,000
3662 Vivian Lake	W/H	7.0	700
3665 Devils Garden	N/H/B	1.1	20
3672 Deer Creek	W/N/H	1.7	30
3673 Salt Creek Falls	N	0.5	140,400
3674 Fuji Mountain	N/H/B	5.6	500
3677 Gold Lake	N/H/B	3.8	500
3681 Maiden Peak	N/H/B	5.8	200
3682 Mount Ray	W/N/H/B	2.5	450
3686 Verdun	N/H/B	2.5	60
3689 Marilyn Lakes	N/H/B	1.0	300
Totals		60.5	150,390

** N = Non-Wilderness hiking* *W = Wilderness hiking*
B = Mountain bike *H = Horse*

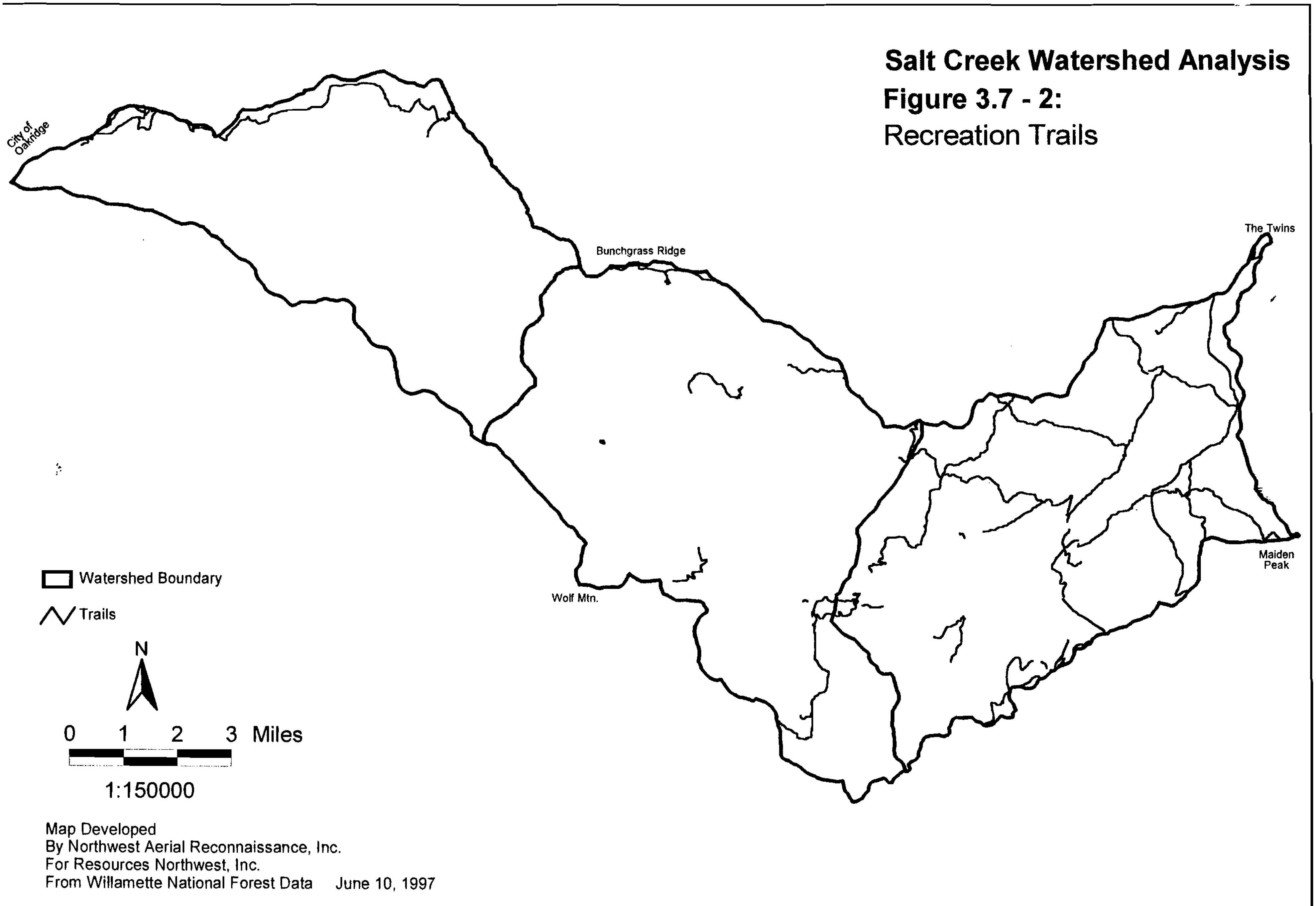
Swimming and Boating

Several high lakes are used for swimming, e.g., Betty, Island, Midnight, and Marilyn lakes. Gold Lake is used for boating (no motors allowed) and the dock is wheelchair accessible.

The mainstem of Salt Creek is used for white water kayaking and rafting however, use is infrequent due to the high skill level required and numerous hazards.



Salt Creek Watershed Analysis
Figure 3.7 - 1:
Recreation Sites
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Developed Campgrounds
Dispersed Recreation Sites
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997


Salt Creek Watershed Analysis
Figure 3.7 - 2:
Recreation Trails
City of Oakridge
Bunchgrass Ridge
The Twins
Wolf Mtn.
Maiden Peak
Watershed Boundary
Trails
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

Hunting and Fishing
This is a popular elk hunting area and this recreational use is increasing. Considerable elk hunting takes place in the Squaw Butte area of the lower watershed and the Shady Gap area of the upper watershed. There is a special elk hunt with road closure in the Eagle Creek area.

The upper watershed is popular for deer hunting during the High Cascades buck season and the archery season, particularly in areas around Gold Lake and upper Salt Creek. There are also some mountain quail hunting opportunities and activities.

Most of the angling is for rainbow trout in Salt Creek and for rainbow trout and brook trout in the high lakes. There is also some fishing for native cutthroat trout. Catchable rainbow trout are stocked in Salt Creek and rainbow trout, cutthroat trout and brook trout have been planted in many of the high lakes. Gold Lake has a self-sustaining population of rainbow trout and brook trout. Some ice fishing occurs at Marilyn Lakes.

Winter Recreation
Besides the Willamette Pass Ski Area (a special use permit development) there are 102 miles of winter recreation trails, three snoparks, five shelters and one proposed shelter near Lower Island Lake, all in the upper watershed (Table 3.7-5). There were over 124,100 estimated winter recreation visit occasions in 1994; about two-thirds of these were downhill skiers, one-quarter were nordic skiers, and the remainder were for snowmobiling and snow play. Winter recreation use varies from year to year depending on weather and snow conditions. Overall, there has been about a three to five percent increase per year.

Table 3.7-5. Winter Recreation, Trail Mileage, and Use

Type of trail	Miles	1994 Occasions
Marked nordic ski trails	89.0	30,350
Groomed nordic ski trails (Willamette Pass Ski Area)	7.0	
Marked snowmobile trails	6.0	7,280

Proposed Recreation Developments
In 1993 the Forest completed a winter recreation plan for the Willamette Pass area. This plan addressed needs for additional or improved trails, shelters, snoparks, and snow play areas. The Waldo Sno-Park would relocated to flatter ground just .2 mile northwest of the Waldo Lake Road/Highway 58 junction. The new facility would provide additional parking, vault toilets and a safe place to snowplay. Possible effects resulting from implementing this plan include improved sanitation and safety, increased user conflicts, impacts to riparian reserves, and some possible increases in wildlife disturbance.

The Forest also prepared a 1985 Environmental Impact Statement to address a proposed Willamette Pass Ski Area expansion. The selected alternative has not been fully implemented. Facilities still not implemented include two new triple chair lifts, a summit lodge, and a one-mile access road.

McCredie Springs, currently a dispersed recreation area, had an estimated 21,600 visitors in 1996.

COMMERCIAL RESOURCES

REFERENCE CONDITION
Early settlers had free use of forest timber for firewood, fencing, buildings, mining, and other domestic purposes. This free use continued under early Forest Reserve provisions although there were also provisions for timber sales (Organic Administration Act of 1897).

The lower end of the watershed is rather steep and inaccessible. Little or no timber harvesting occurred until the 1940s, except for partial cutting along the railroad right-of-way in the 1920s for firewood and bridge and tunnel timbers. During World War II and the post-war years clearcutting became standard practice. The first commercial sales were probably in the Heather area.

Special forest products have long been gathered for traditional native American and folk use, as well as commercial use. This area has also been a source of firewood for settlers and residents of nearby communities, as well as the Eugene-Springfield metropolitan area.

CURRENT CONDITION

Timber

Peak levels of timber harvest occurred in the 1980's. Previous harvest in the lower two-thirds of this watershed was generally well-dispersed. Roads were constructed to all harvest areas now classified as LSR's. As trees mature in these harvest areas, access may be needed for commercial thinning to promote and enhance LSR values. Existing roads would provide this access if retained, with no maintenance necessary on many until they are needed.

There has been little timber harvest activity in the upper Salt Creek watershed. Much of it is currently allocated to wilderness or recreation areas.

Firewood

Since the 1970s, demand for firewood has gone down due to more efficient wood stoves and pellet stoves, availability of natural gas in the Eugene-Springfield area, reduced timber harvests, and air pollution issues. Over 90 percent of these permittees are residents of the Oakridge and Westfir community. Salt Creek provides a relatively small portion of the total firewood gathered on this part of the Forest. Of the 120 firewood permits issued by the District in 1996, only 9 were for the Salt Creek watershed.

Changes in land allocation and harvest intensity have drastically reduced firewood availability in recent years. With the reduction in timber harvest and an increase in relative utilization of harvested trees, firewood availability has been reduced by two-thirds in this area. Now most firewood permits are issued for individual trees which still meets the local community need. From November 1996 to September 1997 there were 146 permits issued on the Oakridge Ranger District with 21 (14%) being issued for the Salt Creek drainage. Most of those permits issued served the local community of Oakridge and Westfir.

SPECIAL FOREST PRODUCTS

REFERENCE CONDITION

Special Forest Products have long been gathered for traditional native American and folk use.

CURRENT CONDITION

Many miscellaneous non-convertible special forest products found in the watershed are the basis for frequent personal and commercial use requests by local and non-local collectors. There is a growing interest in special forest products as a source of alternative income. These products will continue to be an important part of future forest resource use.

A 1993 Forest-wide programmatic environmental assessment on special forest products provides the framework for decisions on the collection of these products (Willamette National Forest special forest products environmental assessment, 1994). Willamette Forest Plan Amendment 23 allows commercial collection on all lands open to commercial timber harvest.

The Forest has not formally inventoried species having economic potential as special forest products. Information is limited on specific locations, quantities, qualities, and accessibility for these species. Several plant communities in the watershed contain products of marketable quality as ornamental cuttings, transplants, boughs, and florist greenery. The following is a list of those products identified in the watershed that may occur in quantities sufficient for commercial collection, while remaining abundant enough to maintain plant populations as prescribed in the Forest's special forest products standards and guidelines:

- mushrooms
- florist greens (salal, sword fern, dwarf Oregon grape, beargrass, scotch broom)
- landscape transplants (vine maple, rhododendron, manzanita, etc.)
- Christmas trees
- huckleberries

- nuts
- ornamental cuttings/crafts (willow, vine maple, ceanothus, mádrone, chinquapin, Pacific yew)
- boughs (fir, western red cedar, incense cedar)
- pitchwood
- cones
- conks
- botanicals (prince's-pine, wild ginger, wildflowers, etc.)

Lichens are not currently made available for commercial collection on Oakridge Ranger District. "Vine maple moss" (a collective term for several species of moss) has been harvested on the district — several thousand pounds were sold in the 1980s.

Beargrass, fir boughs, and matsutake mushrooms have elevational relationships, at least with regards to their relative value and availability. This relationship is shown in Figure 3.7-3.

Because of easy access via State Highway 58, the Salt Creek watershed has had a number of special forest products harvested. This is especially the case for personal use Christmas tree harvest in the Pinto Mountain and Abernathy areas. Also, there were two recent commercial bough sales near Pinto Mountain; several more of these are planned for 1997.

CULTURAL RESOURCES

REFERENCE CONDITION

Salt Creek watershed has been visited by people for perhaps 10,000 years. At the time of European exploration (1820 1840) at least three tribes are thought to have used the watershed: The Molala and Kalapuya on the Willamette Valley side seasonally visited the watershed and the Klamath on the Central Oregon side made trading trips through the watershed.

CURRENT CONDITION

Archeologists have recorded over 80 sites representing seasonal and temporary campsites in the Salt Creek watershed. Native Americans established routes that later became the Salt Creek and Bunchgrass trail systems.

Historic sites and features found in the watershed include:

- six lookouts (1920 1966)
- Cottonwood Ranger Station on Bunchgrass Trail (1920's)
- Beamer Ranch homestead site (a current inholding)
- campgrounds established in the 1930's as Blue Pool, Salt Creek Falls, and Diamond Creek (the first two still exist as developed campgrounds)
- McCredie Springs resort (ca. 1914)
- Willamette Pass Ski Area (1930's)
- several railroad section stations and sidings (1920's)

AIR QUALITY

REFERENCE CONDITION

Prior to forest management, air quality was pristine during late fall, winter, and spring. Since fires were not suppressed (and may have even been deliberately initiated by aboriginal inhabitants), air quality could often be quite degraded when wildfires burned during summer and early fall. These fires could burn for months as quickly moving or smoldering fires. Visibility was often very limited due to the large numbers of these fires, according to early observers.

A recently completed assessment compares presettlement smoke emissions and acres burned annually to current smoke emissions from wildfire and prescribed fire (A first approximation of ecosystem health on National Forest System lands, Pacific Northwest Region, June 1993). For western Oregon, this assessment estimates that historic particulate emissions from forest fires were more than double current estimates of PM10 emissions from wildfires and prescribed fires.

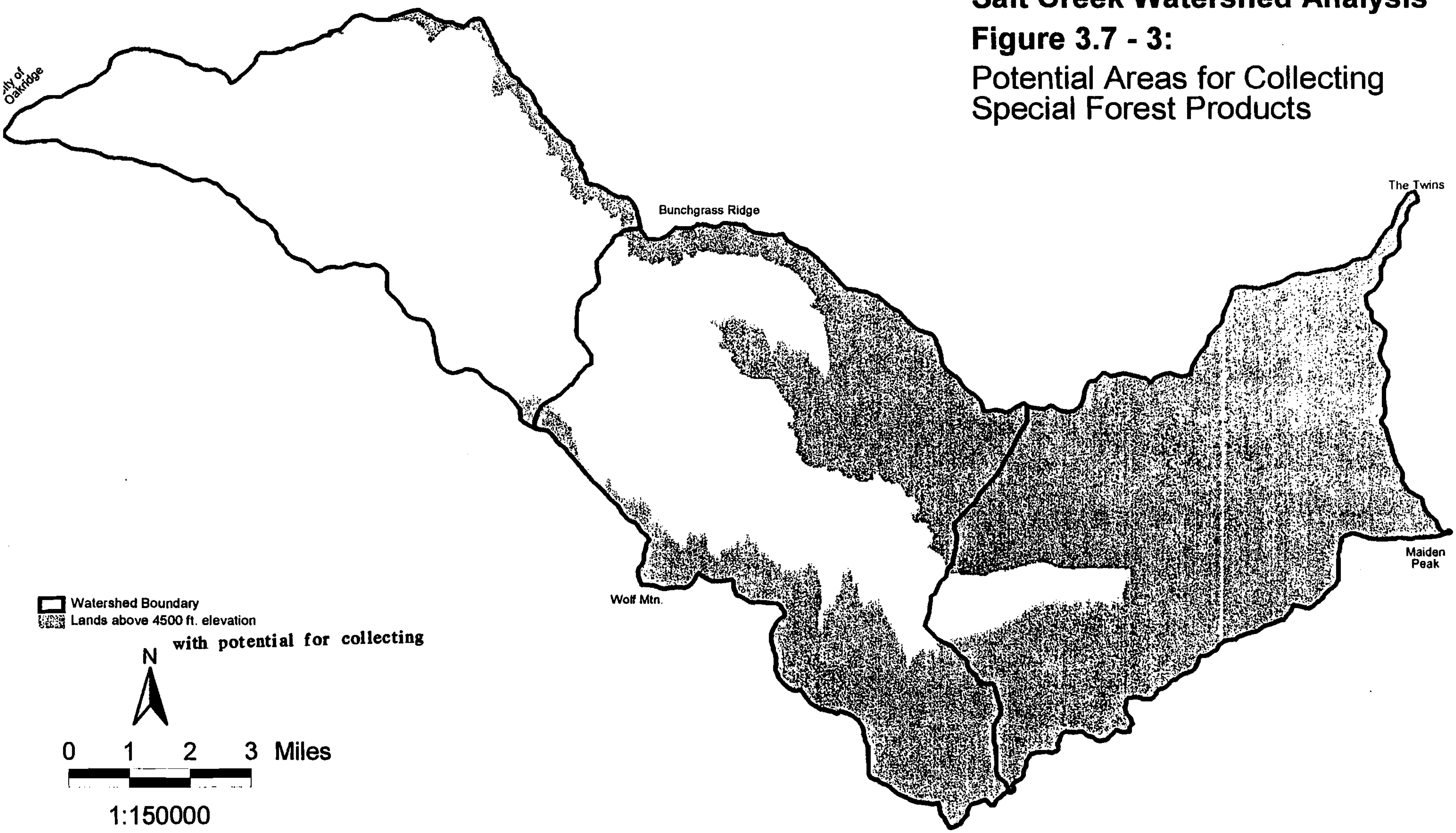
CURRENT CONDITION

The Northwest Forest Plan states that, under selected Alternative 9, PM10 emissions would drop to 26 percent of 1985 92 levels in this climatic province (Chapters 3&4, page 96). This emissions estimate was converted to a TSP (Total Suspended Particulate) emissions estimate and compared with Oregon's TSP baseline. The projected drop surpasses the state of Oregon goal of 50 percent reduction of these emissions by year 2000. It will allow for fire use and prescribed burning will not compromise achievement of emission reduction goals.

Salt Creek Watershed Analysis

Figure 3.7 - 3:

Potential Areas for Collecting Special Forest Products



Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

INTERPRETATION

CHAPTER IV

INTERPRETATION

This chapter is a synthesis and interpretation of the information presented in previous sections. It specifically resolves or interprets the importance of differences or similarities between current conditions and reference conditions, and gives some indication of current use and resource trends. This interpretation is presented by Issue and Key Questions, as presented in Section III of this analysis and constitutes the answers to the Key Questions.

ISSUE #1

INTENSITY AND PATTERN OF VEGETATION MANIPULATION RELATED ACTIVITIES

Timber harvesting has essentially replaced wildfire as a regenerative force in this watershed. The gross amounts of early, mid, and late-successional habitat have not changed appreciably as the result of this replacement but the configuration and distribution of these types of habitat have changed dramatically. Abundant late-successional habitat exists in the high elevation, eastern portion of the watershed where historically fires burned relatively frequently. In the lower elevation western portions, where stand replacement events were relatively few, far between, and small, harvesting has greatly reduced late-successional habitat and to a large extent fragmented that which remains.

Projecting current management into the future results in a continuation of habitat fragmentation. In portions of the watershed (the LSR and other non-harvest allocations) unfragmented late-successional habitat will slowly increase as young stands created by past harvest mature. Habitat connectivity will also improve as harvested riparian stands mature.

The intensity of past harvest has likely increased the magnitude of peak flow events and contributed to elevated sediment levels in streams during high water.

Issue #1 Key Questions
QUESTION 1:

Given current land allocations in the Willamette Forest Plan, as amended by the Northwest Forest Plan, what is the location and acreage of areas that are available for regeneration harvest for the next two decades and for commercial thinning, by decade, for the next 50 years?

Near-term regeneration harvest opportunities within the watershed are primarily limited to Subwatershed 20 1, south of Highway 58 and Subwatershed 20 3, north of Highway 58, due to recently planned harvest projects or reduced- and no-harvest allocations (such as scenic, LSR, semiprimitive rec, etc.). Approximate acres available for regeneration harvest in the next two decades are as follows: 5409 acres in subwatershed 20 1, 7439 acres in subwatershed 20 2, and 2685 acres in subwatershed 20 3. Subwatershed 20 1 is partially within Late-Successional Reserve 0220 and subwatershed 20 2 is partially within LSR 0220, wilderness and semi-primitive recreation; 20 3 is partially within wilderness and semi-primitive recreation.

Approximate areas available for commercial thinning, by decade, for the next 50 years, are as follows:

1995-2005: 1867 acres
2005-2015: 2885 acres
2015-2025: 3500 acres
2025-2035: 7044 acres
2035-2045: 2621 acres

QUESTION 2:

How has the intensity and pattern of vegetation manipulation affected native and non-native plant and animal habitat diversity, species composition, guild viability, amount of interior habitat, and habitat connectivity?

TERRESTRIAL WILDLIFE

INTERIOR FOREST VS. EDGE HABITAT - EFFECT ON HABITAT DIVERSITY AND FAUNAL SPECIES COMPOSITION

As timber harvest strategies were applied in the watershed, the overall abundance of late-seral and old-growth habitat increased. The size of retained habitat blocks was reduced as forest fragmentation progressed in the western half of the watershed. However, in the eastern half, late-seral habitat patch size increased as forest succession occurred. Just as edge habitat increases with moderate levels of fragmentation, interior habitat decreases. This has likely resulted in shifts in the biotic communities. In the western half, as interior late-seral forest habitat became more fragmented there may have been a decrease in large home range mosaic species and an increase in small home range guilds and contrast species. Generalist species likely gained occupancy to areas as they became less suitable for species that select for large blocks of interior habitat. As stands developed into late-seral forest in the eastern half, this trend may have been reversed. These effects have reduced the capability of late-successional Douglas-fir/western hemlock habitats within the western half of the watershed, while increasing habitat capability of late-successional true fire/mountain hemlock associations in the eastern half. Currently 1 of 4 spotted owl activity centers in the LSR (and also 7 of 32 activity centers in the watershed) have home ranges with less than 40% in suitable habitat condition. Under the Willamette Land and Resource Management Plan as amended by the ROD, late-seral habitat conditions in the LSR should improve over time.

As described in the Current Condition section of this document, forest fragmentation has played a significant role in development of edge habitat within the watershed. A comparison of seral stage maps (Figures 3.4-1 and 3.4-2 Reference/Current Condition chapter) reveals the distribution and amount of edge habitat has disproportionately increased in the western two-thirds and decreased substantially in the eastern third of the analysis area. The average patch size is small relative to reference conditions in the western half, whereas patch size is relatively large in the eastern half of the watershed. This trend may have resulted in a shift in the biological community, with a decrease in medium and large home range patch (e.g. rosy finch) and mosaic species (e.g. spotted owl and fisher), and an increase in small home range guilds and contrast species (e.g. mountain blue birds, California quail, and elk) in the western half. This condition has likely resulted in higher populations of elk and deer than existed prior to timber harvest activity.

On the eastern half of the watershed, forest fragmentation has been less prevalent and relatively more late-seral and old-growth habitat is present than in the reference example (compare Figures 3.4-1 and 3.4-2, Reference/Current Condition chapter). This has occurred as fire regenerated stands matured in the absence of intensive timber harvest or repeated large scale and frequent fires. Though it is difficult to speculate on how intensive and extensive fires might have been had they not been suppressed, it is possible that fire suppression may have contributed to the development of more late-seral habitat in these areas than what existed 75 years ago. The result of having large tracts of timber maturing into late seral and old-growth forests is a shift in the biotic community from early and early-to-mid-seral habitat users to mid-to-late-seral, late-seral and old-growth habitat users, with an increase in medium and large home range patch and mosaic species. However, much of this area that has matured into late-seral and old-growth habitat is not within the Douglas fir/western hemlock plant associations most suited to spotted owls, but is within the true fir/mountain hemlock plant associations best suited to a host of other species such as black-backed woodpecker and American marten.

The trend in edge habitat increasing with forest fragmentation is expected to plateau and then decline as late seral and old-growth forests continue to be removed in General Forest (matrix) under an 80 year rotation or in Scenic Partial Retention under a 100 year rotation where stands will not have the opportunity to return to late seral conditions. This scenario of edge habitat limitations is also expected to occur in the LSR as early and mid-seral stands mature since regeneration harvest (establishment of early seral habitat) no longer occurs in this area. Exceptions to this trend may be for small home range species which have relatively small minimum patch sizes and may be provided suitable habitat by prescriptions for timber harvest in matrix, and for areas of the watershed where high densities of riparian reserves will provide the late seral component of edge habitat along harvested stands in matrix. Though edge habitat may generally decrease across the landscape over time, edges would be concentrated along riparian reserves, along supplemental and larger LSRs, and occasionally along stand replacing disturbance patches within the larger LSRs.

As described above, habitat for edge dependent species has historically been on the increase, especially in the western two thirds of the watershed. In the western portions of the watershed, in response to arrangement of timber harvest units which strategically placed forage blocks in proximity to cover blocks, forage and size and spacing (index for forage/cover patch arrangement) variables have increased. In the eastern portions where harvest has not occurred and successional development has affected historic forage/cover ratios, forage and size and spacing variables have decreased.

Large home range generalist species such as the gray wolf and a sub-species of grizzly bear known as the Klamath grizzly were inhabitants of this watershed during the reference era. Although large home range generalist habitat is currently abundant, these historical inhabitants are absent from the present landscape. The Klamath grizzly was extirpated from the Cascades in the 1930's and is considered extinct. The gray wolf was declared extirpated from this portion of its historic range in the mid 1940's, however occasional reports of the presence of wolf-like canids in this watershed persist into the 1990's.

Two additional threatened or endangered generalist or special habitat species guild representatives of note that presently occupy habitat within this watershed are the bald eagle and peregrine falcon. Portions of five peregrine falcon nest site management areas (PFMA) exist within the watershed. These PFMA's encompass a primary, secondary, and tertiary management zone and average 18,300 acres in size. The actual nest sites for three of these areas (OE-22, OE-30, OE-51) are located in the watershed with the majority of these PFMA's within the watershed boundary. The other two nest sites, OE-36 and OE-14, are outside the watershed with 16% and 35% of these PFMA's located within this watershed respectively. Recent wildfire has affected the vegetative condition within two of the three primary zones around peregrine nest sites in this watershed. Historic and recent wildfire, combined with harvest activity has created a mosaic of seral conditions in PFMA secondary and tertiary zones. Present overall land use allocation differs between PFMA's, with most acres falling under scenic or late successional reserve allocations. OE-22 PFMA contains more general forest acres in this watershed than the others.

Resource concerns with respect to these areas focus on the potential for noise disturbance to peregrines from management activities during the nesting season (January 15 through July 31), and that management proposals within PFMA's recognize and address the needs of peregrine falcon prey species. Management plans should be completed for PFMA's and used to guide activities proposed within these areas.

There is not currently a bald eagle management area (BEMA) located in this watershed. However, bald eagles are known to forage in the eastern one third of the watershed and near the mouth of Salt Creek during breeding season. They have also been known to concentrate during winter in the watershed's central bottomlands. Management concerns with respect to this area focus on maintaining a viable prey base for foraging and wintering eagles.

HABITAT STRUCTURE

Approximately 4,750 acres (7% of the watershed) were intensively harvested prior to 1970. On these areas snag levels may be variable, but are generally well below the average natural range. Down woody debris may be abundant, but in some areas much of the larger pieces are likely to be in advanced stages of decomposition. In these areas large woody debris levels are also likely well below the natural range between the time existing logs decompose and existing regeneration stands begin contributing large woody debris to the forest floor. As a result, species that utilize snags and down logs as habitat may become less locally abundant until new snags and down wood become available for use. In other areas, very large logs were left during initial harvest operations, and given comparable environmental conditions, these logs will continue to provide suitable habitat for many species that utilize log habitat over a much longer period of time than would smaller logs of the same tree species.

Approximately 10,540 acres (15% of the watershed) were intensively harvested during the 1970's and 1980's. These areas generally have low levels of both snag and large woody debris as a result of higher utilization standards and unmerchantable log-yarding requirements that were employed during that period. These areas are below natural levels for these habitat components and will continue to be below natural levels until new snags and down wood become available for use.

Though approximately 2,620 acres (4% of the watershed) have been harvested between 1990 and present, many of these acres included prescriptions that were in place prior to 1990 and the adoption of the current Forest Plan as amended by the ROD. As a result, these areas may also be below natural levels of snag and large woody habitat. For sales implemented under recent prescriptions the trend is for wildlife trees to be generally smaller than what was left prior to 1990 though numbers of snags retained is generally higher. Smaller snags and logs will not persist as long and will not accommodate cavities as large as, or retain temperature and humidity as well as those with larger diameters. Thus the trend toward leaving smaller wildlife trees has resulted in habitat that will not provide for all cavity dwelling species (e.g. pileated woodpeckers and colony nesters). This habitat may not be as effective in providing shelter to temperature and humidity sensitive species (e.g. Oregon slender salamanders and ensatina salamanders), and will not provide habitat as long due to more rapid decomposition. Some colonial nesting birds and a variety of species of bats utilize large hollow snags and trees as roost sites. Management activities including sanitation salvage, hazard tree reduction and timber harvest have reduced the abundance of large hollow trees and snags within, or within striking distance of project areas, transportation systems, recreational facilities, special use areas and summer homes. Species that utilize snag and down wood habitat during reproduction are listed in Appendix A.

Some of the watershed (64%) affected by stand replacement fire in the past two centuries contained residual trees. Where these residual trees still exist, they will serve an important role as a future source of large snags and down wood in younger stands.

CONNECTIVITY / DISPERSAL

As Figures 3.4-6 and 3.5-8 in the Reference/Current Condition chapter show, many potential connective corridors associated with riparian reserves have been exposed to habitat altering activities. This decreases their ability to provide suitable linkages between various portions of the landscape for some species of plants and animals. Previously harvested areas within riparian reserves may not moderate solar radiation, temperature, and humidity as much as mature stands or may not provide enough cover to allow successful movement through these areas or across the landscape by some species. Stand connectivity provides for genetic exchange in species that do not migrate. Without adequate connectivity of suitable habitat across the landscape populations may become isolated. Isolated populations may ultimately be detrimentally affected by genetic drift.

Areas within this watershed where connectivity habitat has been most affected by harvest activity include portions of subwatershed 20 1 along streams in the Monteith Rock and Cougar Mountain area eastward, and portions of 20 2 along streams in the Verdun Rock and Beamer Ranch area westward. A comparison of Tables 3.4-2 and 3.4-4 (Reference/Current Condition chapter) shows that overall 33% of the riparian reserve acres in 20 1 have been harvested or are in road openings; 25% of the riparian reserves in each of 20 2 and 20 3 have been similarly affected. In addition, up to 42% in 20 1, 25% in 20 2 and 13% in 20 3 of riparian reserve acres may be included in road openings (refer to Table 3.4-4, Reference/Current Condition chapter). Some of the road opening acres may be represented in harvest acres (Table 3.4-2, Reference/Current Condition chapter) and visa versa.

Upland portions of the watershed also provide important connective habitat, especially when located along ridges, in saddles, or on topographic benches. Combination of Tables 3.4-3, 3.4-4 and 3.5-4 (Reference/Current Condition chapter) shows that 31% of the upland acres in 20 1 have been harvested, while 23% and 19% of upland acres have been harvested from 20 2 and 20 3 respectively. Wilderness acres within this watershed provide higher elevation upland connectivity of mostly true fir/mountain hemlock plant association habitat.

The westward extension of this higher elevation true fir/mountain hemlock habitat along Pinto Mountain and Bunchgrass Ridge has experienced some shifts in seral stage composition from reference conditions. Some areas have matured into late seral stands while early seral stands have been created as a result of harvest activity and fire. Much of the later seral stage acres along Bunchgrass Ridge have shifted into early seral conditions due to harvest activity and effects of the Warner Creek fire.

Within the LSR, both riparian and upland habitat connectivity should recover and improve in the long term under present management direction. Connectivity habitat in General Forest portions of the watershed should recover and improve within riparian reserves and upland areas that have been included in supplemental LSRs.

Table 4.1-1 displays the condition of the USFWS designated CHU (OR-19) within this watershed that is located outside LSR0220 and currently under harvest allocation. Seventy-four percent of these total acres are presently stands greater than 80 years old and serve as no less than dispersal habitat for northern spotted owls.

Table 4.1-1: Current Condition of CHU (OR-19) Acres Under Harvest Allocation

Subwatershed	Total Acres	SRI Unsuited	Seral Stage SI	SE	UR	LS/OG
20 1	6,292	518	1,764	176	2,756	1,595
20 2	18,419	2,205	5,579	899	8,024	3,918
20 3	368	26	56	0	158	154
Total	25,079	2749	7,399	1,075	10,938	5,667

Legend: SRI Unsuited = acres on soils unsuited for harvest activity
SI = acres in stand initiation (0-30 year old stands)
SE = acres in stem exclusion (31-80 year old stand)
UR = acres in understory reinitiation (81-200 year old stand)
LS/OG = acres in late-successional/old-growth (200+ year old stand)

On the landscape level, potential linkages between LSRs 0220, 0221, and 0222 are now, and should continue to be, best provided through riparian connectivity. Upland habitat connectivity may become compromised for some species under management of harvest allocation lands. Though this may not impede genetic exchange between more mobile species such as owls, goshawks, and pileated woodpeckers, it may reduce genetic exchange between less mobile species that rely on habitat characteristics not present in managed stands.

Analysis for dispersal habitat for northern spotted owls (50-11-40) may also have applications to other species that have good mobility, but that require visual cover, short term foraging habitat and some climatic moderation while moving across the landscape. Review of 50-11-40 analysis for this watershed indicates that, with one exception, all quarter townships are above the level considered to be adequate to provide for dispersal of northern spotted owls. The two quarter townships with the lowest dispersal conditions (34% and 57%) reflect habitat effects resulting from the recent Shady Beach and Warner Creek fires.

NON-NATIVE SPECIES

A variety of non-native animal species presently occur within this watershed. As discussed in Chapter III, the level to which these species have established populations and the overall effect they may be having on native species is not known. The barred owl is presently recognized as the only non-native terrestrial wildlife species of concern. The primary concerns are the known displacement and suggested potential for genetic dilution of spotted owl populations by barred owls. Bullfrogs may adversely affect native amphibian species at low elevation wetlands. Feral dogs, cats and opossums are not likely a significant impact on native species as they tend to be short-lived in the wild and/or limited in distribution to areas near the city of Oakridge.

Livestock grazing played a significant role in affecting habitat in portions of the watershed during the first half of this century. The Forest Service located a major livestock driveway into the eastern portion of the watershed to reach grazing areas that extended into adjacent watersheds. Sheep grazing peaked around 1910 and began a gradual decline into the late 40's when sheep grazing was largely discontinued on the Willamette NF. Horses and cattle were also grazed in the area during and after this period, but to a lesser extent. The decline was largely precipitated by encroachment of lodgepole pine and true fir on old burns and meadow in the high county. A study conducted in 1933 and 1934 indicated that reproduction was encroaching on range land at the rate of 2.5% per year. Encroachment was encouraged by both fire suppression and grazing activity since the hooves of sheep prepared a good seed bed. Figure 3.4-4 in the Reference/Current Condition chapter may show some areas in the central and western portions of the watershed that were also historically utilized for grazing. Sheep and cattle grazing on 10,000 acres was known to occur in this area that was known as the Salt Creek Game Refuge at the time

PLANTS

NATIVE AND NON-NATIVE HABITAT DIVERSITY; INTERIOR HABITAT; CONNECTIVITY; SPECIES COMPOSITION; VIABILITY

Late-successional species habitat in the watershed has shifted due to extensive harvest of old-growth stands and associated road building, and in response to fire suppression and resultant stand development. Remaining old-growth in the watershed is often at higher elevations or is in many cases highly fragmented. Many survey and manage species have limited dispersal capabilities, thus in fragmented habitat areas geneflow may be restricted between populations.

Single species management after harvest in riparian forests along with adjacent upland stands has contributed to a simplification of vegetational species richness in some areas (for example planting of Douglas-fir in sites previously dominated by cedar). This is especially true in stands planted more than 10 years ago, before interest in multiple species planting became more prevalent.

Management activities have over time accelerated the spread and establishment of non-native vegetation that can aggressively outcompete native species. Clear cuts and other disturbed openings are sites where invasion is rapidly occurring by noxious weeds and other non-natives. Scotchbroom is an example of such spread. Goat weed, tansy ragwort and bull thistle are also invasive weeds which are widely established in this watershed.

Though the extent of effects of previous management activities on special habitats is not well documented at this time, a number of specific cases are known. Many sites have been altered, degraded or created by past management actions. In some areas intensive timber harvest has been implemented up to the edges or across special habitat areas; quarry activities have altered rock habitats; roads have bisected meadows and wetlands.

QUESTION 3

How has the intensity and pattern of vegetation manipulation affected trails, recreation, aesthetics, special forest products, and firewood availability?

TRAILS

Hiking trail mileage has been reduced over the past 50 years.

RECREATION

Recreation opportunities related to roads, such as driving forest roads for pleasure, have increased. Non road related recreation opportunities on the other hand have decreased as a result of the road building related to vegetation manipulation. Big game populations are larger due to increased forage quantity and quality in some areas, resulting in hunters having a better chance of a successful hunt.

AESTHETICS

Most people feel that vegetation manipulation has reduced aesthetic value of the landscape.

SPECIAL FOREST PRODUCTS AND FIREWOOD

Road building associated with timber harvesting has over time allowed easy access to forest plant communities containing desirable products for collection, including beargrass and firewood. Vegetation management activities has enhanced the production of products such as huckleberries.

QUESTION 4:

Where and to what extent has the change in spatial and temporal distribution of vegetation influenced the potential for water yield, water quality (especially water temperature), and peak flow changes?

WATER YIELD

Water yield has varied over time due to changes in the vegetative condition as a result of wildfire and timber harvest. Following periods when vegetation over large portions of the watershed were reduced by large wildfires, water yield was likely higher due to a short term decrease in evapotranspiration. Due to the limited water storage capacity of lands within water yield Classes II and III, land types with high proportions of these classes would have a lower ability to store additional soil water input as a result of reduced evapotranspiration that would result from a wildfire event or timber harvest. Subwatersheds 20 2 and 20 3 have the highest proportion of their area in water yield class III.

Timber harvest in small watersheds has been shown to result in higher annual water yields. In two small watersheds logged in the H.J. Andrews Experimental Forest, annual water yield increased the most in the clearcut watershed. In the first year after logging, water yield increased 27 percent and averaged 30 percent over the first four years in the clearcut watershed (Harr et al. 1982). A decreasing trend in annual water yield will occur as the watershed is reforested. Harr (1983) estimated that after 27 years the increase in water yield from small watersheds will no longer be apparent.

In the case of large watersheds, it is likely that increases in water yield due to timber harvest does occur however it cannot be quantified due to the measurement error associated with discharge measurements from large watersheds. Harr (1983) estimated that a 70 year rotation on all commercial forest land in western Oregon would result in a six percent increase in water yield. Measurement errors on cumulative discharge from large watersheds however are generally on the order of 10 percent.

Within the Salt Creek watershed, management impacts on water yields would be expected to be highest following periods when relatively large portions of the watershed were clearcut harvested, particularly in those portions of the watershed with a low water storage capacity. Annual water yield from the Salt Creek watershed probably increased from approximately 1960 to the mid 1980's as the total number of acres of clearcut harvesting increased. Annual water yield is likely to decrease to some extent during the current decade when compared to the previous two decades due to the reduced rate of stand replacement timber harvest.

PEAK STREAMFLOW

Aggregate Recovery Percent (ARP) values are a method of quantifying the potential for an area to experience increases in peak streamflow as a result of changes in vegetative condition due to management activities combined with rain-on-snow events. Those areas with the lowest ARP values would be associated with areas most likely to have increased peak flows. Current ARP values by subwatershed are listed in Table 3.2-5 and by planning sub-drainage in Table 3.2-6 of the Reference/Current Condition chapter (see Appendix J for values by drainage). Because roadside ditches function as extensions of the intermittent stream network, those areas with a high road density are more susceptible to management related increases in peak flows. Those planning subdrainages with a high proportion of their area within the transient snow zone combined with high road densities may be particularly sensitive to this effect (see Table 3.1-3 in the Reference/Current Condition chapter for a summary of road densities by subwatershed and planning subdrainage).

Forest Plan mid-point ARP values represent thresholds of concern. This criteria is intended to address the potential for changes in peak flows during rain-on-snow events, and the associated potential change in the stability of the streambanks and streambed. All subwatersheds are currently above a weighted mid-point ARP value based on Forest Plan values for planning subdrainages and weighted by area that each contributes to the subwatershed. Planning subdrainages of highest concern are those below the mid-point ARP value or within 5 percentage points. Planning subdrainages in this category include 20D, 20E, 20H, 20I, 20U, 20V, and 20Y. See Appendix J for a list of ARP values and mapped location by drainage.

WATER QUALITY

STREAM TEMPERATURE

Stream temperature data collected near the mouth of Salt Creek indicates a trend of increasing stream temperatures when the period of record since 1982 is compared to the reference period. Data collected near the mouth of Salt Creek since 1981 indicates that the lower mainstem of Salt Creek currently does not meet the state water quality standard for temperature during at least some portion of the critical summer season (June 1 through September 30) of some years (see page 24 of this chapter).

The temperature of the lower mainstem of Salt Creek is elevated above the relatively cool temperatures observed in the upper mainstem within Subwatershed 20 3. From the mouth to headwater reaches, the mainstem of Salt Creek gradually becomes cooler. Available data indicates that above river mile ten, it is likely that summertime water temperatures are maintained below the maximum state water quality standard.

Field data collected by the USFS indicates streams tributary to the mainstem of Salt Creek are within state water quality standards for temperature. Brief or localized exceptions to this are likely associated with stream reaches still recovering from past management impacts or wildfires. Given the current standards for riparian area protection, it is likely the trend in the mainstem of Salt Creek and its tributaries recovering from management activities will be in the direction of cooler summertime water temperatures.

STREAM TURBIDITY

Turbidity levels in streams have likely increased above natural levels in the mainstem and some tributaries of the Salt Creek watershed due to management activities including timber harvest, road construction and use, and removal of large woody material from stream channels. These activities have increased the frequency of landslides which deliver sediment to stream channels and in some cases have increased streambank and bed erosion. Chronic sediment source areas likely contributing to increases in stream turbidity are those areas where management has impacted areas of active or currently stable land flows composed of soils with a high clay content. Additional source areas of turbidity are roads located on slopes greater than 40 percent slope. The majority of these areas with roads within this category are in Subwatersheds 20 1 and 20 2.

QUESTION 5

What are the most important delivery mechanisms for sediment generated by vegetative manipulation in this watershed? What are relative amounts of sediment delivery to streams by these mechanisms? Where are the high risk areas?

Delivery Mechanisms

- Landflows primarily located in subwatershed 20 1 are primary locations for delivery of fine sediments. (i.e. streams cutting land flow toe slopes)
- Steep, shallow soils are locations for potential sources of course sediment (debris torrents).
- Maps of high risk areas are located in the Reference/Current Condition chapter, Figures 3.1-3 and 3.1-4.
- See narrative in Reference/Current Condition chapter for discussion of important sediment delivery mechanisms.
- Streambank erosion due to increases in magnitudes of peak flows

The rate of sediment yield for individual tributary areas has varied depending on the fire history, hillslope processes, landtype and channel type. During the pre-management time period, increases in sediment yield rates can likely be associated with large unstable land forms, fire activity, and floods. Large fires coupled with steep topography resulted in increased sediment delivery to stream channels.

During the post-management time period, sediment yield has increased due to management impacts combined with fire and flood events. Those tributary areas that have a relatively high natural instability combined with moderate to high roading density and harvest impacts are the greatest current sediment sources.

Shallow mass soil movement, usually referred to as "debris torrents" and "debris slides", are the typical delivery mechanism for large amounts of sediment to the stream network. These events often occur in unmanaged forests but are accelerated by reduction of rooting strength due to harvesting and, more typically, by road construction and road related disruption of drainage patterns and sub-surface water flow. Road drainage entering the stream network is a more chronic source of sedimentation.

The areas of highest risk of becoming sediment source areas are identified as soil category 1 (fine sediment) and soil category 3 (coarse grained sediment), and are displayed in Reference/Current Condition chapter, Figures 3.1-3 and 3.1-4 respectively. Other high risk sediment source areas are those mid-slope roads on slopes greater than 40 percent and existing mass wasting sites (see Reference/Current Condition chapter, Figures 3.1-5, 3.1-6 and 3.1-7).

QUESTION 6

Where and to what extent has removal of existing and future sources of large wood material in stream channels affected in-stream habitat condition? Where and to what extent has vegetation manipulation affected channel function and riparian habitat condition and its contiguity?

See the answer to question 4 under Issue #1.
Also see Figure 3.4-3 and Table 3.4-2 (Reference/Current Condition chapter) Riparian Reserve Acres Harvested by Decade and Subwatershed.

Large woody material is an important component of most streams within the Salt Creek watershed. Large wood provides cover for fish and amphibians; creates large pools; and stores and sorts sediment, increasing the availability and quality of spawning gravels. It contributes to stream bank stability and the retention of smaller sized organic materials used as a food base for macroinvertebrates. The rooting strength of vegetation along stream banks is an important component contributing to bank stability, especially where stream banks are composed of unconsolidated materials. Those riparian areas associated with streams that have experienced the greatest amount of harvest impacts are the areas of highest concern. Streamside vegetation also contributes to stream channel function and condition, by supplying fine organic material to the stream channel. The input of small to fine sized organic material is an important component of a healthy, functioning aquatic ecosystem. The riparian vegetation component that would require the longest time to recover from timber harvest related impacts is the supply of large woody material (LWM) to the stream channel. Large conifers are the most important source of large wood since they decompose slowly and can benefit the stream channels for a longer time than do hardwood species.

The majority of timber harvests within riparian reserves occurred between 1960 and 1989. The riparian reserves that experienced the largest amount of stand replacement harvest are those associated with Class IV streams. Table 4.1-2 displays the harvest by subwatershed and decade.

Table 4.1-2: Harvest by Subwatershed and Decade

Decade	SUBWATERSHED 20 1 % of Total Harvest Acres in Riparian Reserves		SUBWATERSHED 20 2 % of Total Harvest Acres in Riparian Reserves		SUBWATERSHED 20 3 % of Total Harvest Acres in Riparian Reserves	
	Acres	Percent	Acres	Percent	Acres	Percent
< 1929	195	4	0	0	0	0
1930-39	0	0	0	0	0	0
1940-49	152	3	0	0	0	0
1950-59	413	9	45	4	137	9
1960-69	1,388	31	337	29	527	33
1970-79	1,438	32	431	37	361	23
1980-89	831	19	303	26	511	32
1990-95	36	1	64	5	40	3

All surveyed streams in the Salt Creek watershed are deficient in large woody material. Subwatershed 20 1 had 5.3% of the surveyed streams meeting current Willamette National Forest (WNF) Plan/Pacfish objective amounts while Subwatershed 20 2 had only 1.5%. In Subwatershed 20 3, none of the surveyed streams met WNF Plan objectives for LWM (see Reference/Current Condition). All of the subwatersheds will take many decades to recover the number and sizes of woody material within stream channels as existed under pre-management conditions.

Past management activities such as logging without leaving a riparian buffer, salvage logging adjacent to the stream channel, and stream cleaning projects have reduced the amount of large wood in the stream channels of the Salt Creek watershed to levels below objective values and reference conditions (Table 4.1-3).

Table 4.1-3: Percent of Subwatershed Not Meeting PACFISH or WNF Objective Values for Large Woody Material

Subwatershed	Total Stream Miles Surveyed	% Of Streams Not Meeting WNF Plan LWM Objective Values
Lower Salt Creek (20 1)	16	94.7%
Middle Salt Creek (20 2)	*30.3	98.5%
Upper Salt Creek (20 3)	7.3	100%

**Mainstem Salt Creek reaches were apportioned into their respective subwatersheds.*

The removal of this large wood from the riparian areas and the stream channels has resulted in reduced channel complexity, reducing the number of areas with high quality habitat for fish and other aquatic species. Nearly every reach surveyed in the last seven years, in each sub-watershed, did not meet minimum objective values for large pools, which are an important habitat for adult fish. It should be noted, however, that the natural conditions of streams in the upper watershed may be below objective levels for LWM due to the high fire frequency, the generally smaller tree size in higher elevation areas, and the relatively faster wood deterioration rates of high elevation tree species. Other potentially limiting habitats affected by levels of large wood include spawning gravels, rearing areas, and overwintering habitat (see the Physical Habitat Requirements discussion in Reference/Current Condition chapter). The greatest area impacted by timber harvest within riparian reserves are located adjacent to Class II and Class IV stream channels.

Stream channels with the greatest amount of adjacent stand replacement timber harvest are associated with the greatest adverse impacts. Short term impacts include the loss of fine organic material input to stream channels. Long term impacts are primarily associated with the loss of existing and potential LWM.

Removal of mid and late-seral forests within and near riparian areas may have resulted in a decrease in lake/river aquatic/riparian and riparian guild species that use mid/late seral habitats, with a corresponding increase in such guilds that use early seral habitats.

QUESTION 7

How have our vegetation management practices affected water quality of summer residence and campground water supplies?

Currently there are five summer homes near the mouth of Salt Creek that withdraw water from Salt Creek for domestic use. In addition, there is one residence near the mouth of Warner Creek that uses this stream as a domestic water source. Treatment of this water would be necessary at all times of the year to insure this water would be suitable for domestic consumption. Due to the naturally high levels of turbidity and suspended sediment during high flows, filtration in addition to disinfection would be required regardless of the intensity of upstream management activities to insure drinking water standards are met. Upstream management activities including roads and harvest units may increase suspended sediment and turbidity during these high flow events. This additional suspended sediment may incrementally increase the cost of water treatment when these surface water sources are used as a domestic water source due to increased operation and maintenance of filtration and disinfection equipment.

Currently there are no campgrounds within the watershed that utilize surface water as a potable water source. A water diversion for campground use from Warner Creek is currently used only for the flush toilets in Blue Pool Campground. Long term plans for this campground include installation of a ground water treatment system to provide potable water.

ISSUE #2

The exclusion of natural fire from the ecosystem has altered the natural processes.

ISSUE #2 KEY QUESTIONS

QUESTION 1:

Fire pattern, fire behavior, and burn intensity are affected by fuel loading conditions. How do current conditions relate to risk of fire? What areas are at high risk?

There has been a change in fuel loading (tonnage or total fuel available) from reference conditions. The pattern of stands and their respective fuel loadings is very different now than was present during reference conditions.

The risk of stand replacement fire is a function of stand age: young stands have more flashy fuels and younger trees are more susceptible to damage by fire (protection of younger stands from stand replacing events promotes older seral stages). Subwatershed 20 1, 20 2, and 20 3 have a smaller number of acres in stands 0 to 80 years of age than typical reference conditions had. Under reference conditions, 20 1 had 47% in stand initiation and stem exclusion stages compared to 32% current. Similarly, 20 2 had 52% in reference condition compared to 24% currently. 20 3 had 34% compared to 4% currently.

Identified areas of high risk are south slopes with closed canopies and high fuel loads, especially upslope from potential ignition sources such as Highway 58 and the railroad. Older stands could also be at risk due to increased fire severity related to the gradual accumulation of large fuels, the continuity of those fuels, and past fire suppression in those stands.

QUESTION 2:

If we utilize prescribed fire within established forest stands (as opposed to post-harvest site preparation) in order to reduce high fuel loading and bring the landscape back to the reference condition, under what conditions could we control the fire? How many acres (per period of time and land allocation) and under what conditions could we prescribed burn and still remain within air quality limits, and where are the high priority areas?

PRESCRIBED FIRE CONTROL CONDITIONS:

- If the arrival of a weather front could be accurately predicted;
- If management can be flexible in terms of timing (season and year), budget expenditure, in terms of risk of exceeding prescription, as well as accepting potentially negative short term resource effects;
- If fire in riparian reserves is acceptable;
- Stands with lower fuel accumulations (100 to 200 years old) may be underburned with more control;
- Fuel loading is not a special concern, rather when and how the fuel burns. Any age stand can burn catastrophically under extreme conditions but stands that have been underburned may not burn catastrophically under extreme conditions;
- Air quality is not now a limiting factor as long as ignitions occur before July 1st or after September 30th, which is when conditions would be most favorable for control;
- Priority areas for prescribed underburning would be the LSR and adjacent areas to prevent future catastrophic fire in an area where late-successional habitat is currently at low levels.

During the Warner Fire Recovery Project, the District Fuels Management Specialist addressed the issue of allowing natural fire to burn within a prescription that would reduce fuel loadings and preserve habitat (Final Environmental Impact Statement, Warner Fire Recovery Project, Appendix B). Results are felt to be consistent with our ability to introduce prescribed fire into natural stands to meet the same requirements. Higher elevations will become available in early to mid summer even though conditions for burning will be similar to those found in the spring. However, the probability of exceeding prescription will be higher and the probability of a rain event will be somewhat lower in early to mid summer (Table 4.2-1).

Table 4.2-1: Fire Prescription Probabilities for Any Given Year

Time of Year	Probability Rx* 5 Day Window	Probability of Rain in Rx**	Probability of Exceeding Rx***	Probability of Ignition
Spring	Moderate / High	Moderate	Moderate	Low
Summer	Low / Moderate	Low	High	High
Winter	Unknown	High	Low	Low / Unknown

* Probability includes all windows, all years

** With 1 foot and greater flame length

*** If given a window, what is the likelihood it will exceed prescription

Smoke management and air quality are discussed in the Reference/Current Condition chapter.

QUESTION 3

Under a reference condition fire regime, what would the habitat diversity look like? Where could prescribed fire help us to re-establish or maintain the reference condition?

Reference era terrestrial wildlife habitat conditions were discussed in Chapter III. Reconstructing reference condition habitat diversity involves speculation to fill in the gaps where knowledge of fire history is weak, and limitations such as using a 200 year fire history timeframe. Predicting the timing, intensity, and extent of underburns between stand replacement fires is also speculative.

Throughout the watershed, but particularly in the eastern half of the analysis area, fire suppression may have contributed to changes in edge habitat abundance that may have naturally developed along the borders of fires which frequently and extensively affected vegetation in this area (creating the early seral portion of edge habitat). Fire exclusion may have allowed late-seral habitat conditions to develop in areas that might have otherwise been exposed to repeated burns. Late seral and old-growth habitat has increased 5% in Douglas-fir/western hemlock and increased 18% in true fir/mountain hemlock plant associations when compared to reference conditions (Compare Figures 3.4-1 and 3.4-2, Reference/Current Condition chapter). This trend toward later seral habitat is likely to continue as many fire regenerated stands are allowed to mature under a relatively low level of intensive timber harvest or repeated large scale and frequent fires. The result of having large tracts of timber maturing into late seral and old-growth forests is a shift in the biotic community from early and early-to-mid-seral habitat users to mid-to-late and late seral habitat users.

About half of the portion of LSR0220 in this watershed was intensively burned during the Warner Creek fire of 1991. The effect of the fire has decreased the capability of portions of this watershed in the LSR to contribute to meeting long-term management objectives for LSRs. Habitat capability has increased however, where portions of this LSR have matured into late seral and old-growth habitat.

Fire suppression and transition of large blocks of timber into late-seral conditions within the true fir/mountain hemlock plant associations has increased the capability for a host of higher elevation species (e.g. mountain chickadee, pine grosbeak, heather vole). This trend has also reduced the abundance of early seral habitats which may have reduced capability to support high elevation early seral or contrast species such as boreal owls, elk, Cassin's finch, calliope hummingbird, mountain bluebird, and green-tailed towhee.

It is difficult to assess whether fire exclusion has increased, decreased or had a neutral effect on the abundance of edge habitat above and beyond that created by timber harvest without accurately knowing the intensity and patchiness of historic fire events. Frequent reburns of an area may have a tendency to mask the natural complexity that may have been present within this fire affected area, and speculations on what the potential pattern and intensity of suppressed fires might have been is difficult.

In some areas of the watershed, where late-seral/old-growth stands remain, there may be a shift from a more open forest habitat (associated with frequent underburning of stands with fire tolerant overstory trees) to a trend toward densely-structured habitat. This shift in late seral/old-growth habitat structure would increase suitability for some species (e.g. spotted owl) and decrease suitability for others (e.g. northern goshawk).

An analysis of forested stands less than 80 years old, and 80 to 200 years old, on soil types that are commonly found associated with special habitats (SHABs) identified 1,639 acres and 5,585 acres respectively, that can be classified as potential SHABs, see Figure 3.4-4 (Reference/Current Condition Chapter). The age of these stands and their positions on the landscape (often located adjacent to or in the immediate vicinity of existing SHABs) suggests these areas were once SHABs that may have become forested due to fire suppression.

These areas, and portions along the western edge of the High Cascade Plateau where big game forage quality and quantity would benefit from the effects of fire, are candidates for prescribed fire. Prescribed fire could assist in maintenance of reference conditions elsewhere in the watershed such as areas where underburning historically provided open late seral/old-growth forest habitat.

In some areas of the watershed, particularly in Douglas fir/western hemlock plant associations, historic natural fire events favored early- to mid-seral plant species by recruiting seral species into canopy gaps. This created relatively stable percentages of species numbers. Over the long term, fire suppression and forest succession may pose the biggest threat to herbaceous fire dependent species. While harvest activities may encourage early-seral vegetation following harvest, subsequent shrub and sapling competition, roadside re-vegetation (often with invasive non-native species), and other non-native spread may result in replacement of species that would have persisted through periodic low to moderate intensity fire events.

QUESTION 4

How and where would prescribed fire affect TE&S and ROD species habitat, fire dependent plant species, big game habitat, and aquatic species habitat?

Late seral species, such as the spotted owl, could experience a short term loss of habitat for their prey species but a long term benefit to structural development of late seral stands. Great gray and flamulated owls could benefit short and long term due to the creation of contrast habitat. Falcons could benefit short and long term as fire effects improve prey species habitat and enhance hunting success over a more open canopy. Wolverines may also benefit short and long term as habitat for their most important prey (big game) improves.

Prescribed fire can enhance forage quality in the short term and cover quality in the long term.

Openings created by fire would be favorable for early-mid seral plant species habitat by opening canopy cover, scarifying seeds, and preparing seed beds with reduced competition and high nutrient availability.

Repeated low to moderate intensity fire events help maintain open habitat, and encourage sexual and vegetative reproduction. Historic natural fire events were beneficial to most plant species, assuming fires occurred during the time when plants had completed their reproductive cycles for the year.

Moderate intensity fall burns may assist in germination of fire dependent species such as woodland milkvetch and branching Montia. The Warner Creek and Shady Beach fires both burned in the fall and both fire areas experienced increased germination of these two species. It is unknown whether spring fires would stimulate these species to germinate.

Short term effects to aquatic habitat include increased water temperature, decreased shade, increase in water pH, increased sedimentation rates, increase in nutrient output, abrupt change in aquatic foods with associated change in insect populations, creation of additional large woody material input (existing large woody material usually not affected), and could cause a long term shortage of new large woody material input. Aquatic habitats will recover as vegetation recovers. Increased sunlight, nutrients, and insect populations can be a benefit to fish. Smaller order streams would be more likely to see these effects.

Prescribed fires may be detrimental to localized populations of sensitive and threatened amphibian species such as salamanders and frogs. The existence of supplemental Late-Successional Reserves and Riparian Reserves may help to minimize these effects if these areas are not subject to prescribed fire. Also cool or patchy burns may facilitate escapement of individuals within such populations.

ISSUE #3

The density, condition, use, and location of transportation systems has altered the landscape processes and influenced wildlife habitats.

ISSUE #3 KEY QUESTIONS

ROADS (system and non-system)

QUESTION 1:

Where has the density, condition, location, and use of roads influenced natural and management induced disturbance (i.e. landslides, surface erosion, slope movement)?

Road related slope failures have altered the spatial and temporal distribution of landslides within the Salt Creek watershed. Although landslides occurred during pre-management conditions, roads within the watershed have increased the frequency of these events when compared to the natural condition.

The majority of road related debris slides likely occurred before 1970 and are associated with sidecast construction techniques on steep terrain. Failure mechanisms associated with this construction technique come in two stages; immediate, and delayed with approximately a 20 year gap between the two.

The majority of management related road failures have occurred on steep hillsides in association with mid-slope roads or stand replacement harvest. Figures 3.1-5, 3.1-6, and 3.1-7 in the Reference/Current Condition chapter, displays the location of roads constructed during the 1960's and 1970's and the greatest risk of road failures generally occurs within the first two decades after construction. Therefore if roads are properly maintained, it is likely the rate of road related failures due to unstable fill material will be lower in future decades when compared to rates observed over the last two decades. Another potential source of sediment from roads is the potential for the capacity of culverts to be exceeded during high runoff events. In addition, lack of road maintenance could result in culverts being plugged or otherwise non-functional. Data from the Watershed Improvement Needs inventory indicates a high proportion of undersized stream crossing culverts and road relief culverts with partial to total blockages. Failure of these structures could result in catastrophic failure and erosion of the road fill and possibly initiation of a debris torrent. These events have the potential to deliver large quantities of sediment to stream channels with associated damage to aquatic and riparian habitat.

QUESTION 2:

Where and to what extent have the presence, patterns, and use of roads and trails affected native and non-native plant and animal habitat diversity, species composition, guild viability, amount of interior habitat, habitat connectivity, and riparian reserves?

TERRESTRIAL WILDLIFE EFFECTS

INTERIOR FOREST, HABITAT, CONNECTIVITY, DIVERSITY, AND FAUNAL SPECIES COMPOSITION

Terrestrial wildlife guilds whose habitat requirements might benefit from the road network established in this watershed could include patch species with small home ranges that select for early seral (e.g. bluebird spp., fence lizard), mosaic species with small home ranges that select for early seral (e.g. mountain quail, black-tailed rabbit), contrast species with small to medium home ranges that select early seral (e.g. dusky flycatcher, big brown bat, little brown myotis), and most generalist species especially those with smaller home ranges that select for early to mid seral habitat. Guild maps in Appendix A can be referenced to see how current guild habitat has changed and to see that changes can often be associated with areas having higher road density.

The effect of the influence of roads on wildlife populations such as deer and elk has been the focus of many studies and has been discussed in numerous publications. References on this subject can be found in Appendix H of this document.

Concerns about the effects of roads on big-game animals generally are not associated with the road itself. The negative influence of roads on big-game animals is associated with humans that use the roads. The potential effectiveness of otherwise appropriate habitat for big-game animals is thus diminished as open road density and traffic levels increase in areas where these animals are hunted. Open road densities greater than 2 miles per square mile of habitat have potential to significantly reduce elk use in an area. Six of the ten Big Game Emphasis Areas in this watershed currently exceed 2 miles per square mile of habitat. The habitat effectiveness variable for roads is currently below Willamette National Forest standards for four of the emphasis areas (Reference/Current Condition chapter, Table 3.5-3).

Frequent human disturbance associated with roads and trails is known to frighten big-game animals from distances ranging from .4 miles to .8 miles. The disturbance response by elk has been found to be greater towards slowly moving vehicles on lower level forest roads than towards faster moving vehicles on more improved forest roads. Table 3.4-3 (Reference/Current Condition chapter) shows that overall 75% of the watershed is within .5 mile of a road and 88% is within 1 mile, with a range between subwatersheds of 49%-95% and 72%-100% respectively.

Habitat connectivity for species associated with riparian habitats may have been affected at site specific locations throughout the watershed. The overall impact of roads on riparian habitat connectivity in this watershed is most significant along highway 58 and the railroad. Certain species such as bats may benefit from some road openings in riparian areas. These openings could have value as important feeding sites. Amounts of road openings and miles of trail within riparian reserves for this watershed are listed in Table 3.4-4 (Reference/Current Condition chapter).

Some features associated with roads and trails may provide structural habitat for selected species. These features include roost sites under bridges or in the roof of shelters that could be used by bats, or shelter under boardwalks across wet areas that could be used by amphibians. Some segments of trail are situated close to occupied or potential sites for threatened, endangered, or sensitive plant or animal species. Use of motorized vehicles on trails is restricted in some areas. Seasonal restriction of motorized trail maintenance work has been applied to some segments of trails close to known nest sites. Based on feedback from the USFWS, relocation or closure of some trail segments to protect T & E nest sites has been accomplished in some areas and may be appropriate in others.

Seasonal restriction of dispersed recreation sites close to occupied peregrine falcon nest sites may be warranted in some cases. The Forest Plan and regional species recovery plans require management plans to be prepared for occupied bald eagle and peregrine falcon management areas, in addition to consultation with the USFWS for any actions potentially affecting these species. Though spotted owls are present in some areas close to trails and dispersed sites, no activity centers have been identified that are likely to be adversely affected by recreational use of existing facilities.

HABITAT STRUCTURE

Snag and large woody debris habitat generally tend to be deficient near roads. Roads have traditionally facilitated the salvage of down wood contributed from adjacent stands. Many snags are removed from the vicinity of road prisms for safety concerns. As the anticipated level of maintenance decreases and segments of roads are closed or abandoned, certain areas of the watershed may eventually experience an increase in levels of snag and down wood habitat. This restored habitat characteristic may not be long term however, as future access needs into areas would most likely re-open old corridors and result in removal of these components.

NON-NATIVE SPECIES

The extent to which roads and trails may affect non-native species within this watershed is not well understood. Domestic animals such as cats, dogs and horses are known to have been abandoned or lost throughout the area. When these animals are intentionally abandoned it is usually along a road and often not far from the community of Oakridge. Occasionally pets are separated from their owners along trails or at dispersed campsites associated with roads. The introduction of these animals into the ecosystem is usually short term as they succumb to inefficient survival skills or fall victim to larger native predators. However some detrimental effects may occur, such as competition for habitat and prey resources, direct interactions including nest parasitism and predation on native species, potential introduction or spread of parasites and disease, and occasionally hybridization (particularly in canines). Whether or not roads have affected the dispersal establishment of opossum in this watershed is unknown. It is unlikely that roads have played much of a role in the establishment of barred owls, other than by providing access for timber management and through roadside seeding which may increase prey populations.

RIPARIAN AND AQUATIC DEPENDENT SPECIES

Figure 3.4-6 (Reference/Current chapter) displays the overlap between road clearings (including road surfaced area and altered roadsides) and riparian reserves. Table 3.4-4 (Reference/Current Condition chapter) displays the acres of riparian reserves and percentage of overall riparian reserves occupied by road openings. These road surfaces and open areas may pose barriers to movement by the least mobile species, but do not affect the dispersal of more mobile species. Table 3.1-4 (Reference/Current Condition chapter) displays the number of stream crossings along roads by stream class. Many of these stream crossings are associated with impassable culverts and/or steep fill slopes and cut banks. These features may also complicate travel for less mobile species. Railroad tracks are known to pose migration problems for northwestern pond turtles. Much of the 45 mile length of railway in this watershed is located where pond turtle migration could potentially occur.

There are many culverts in the Salt Creek watershed which create upstream migration barriers for fish. These barriers prevent fish from utilizing suitable habitat located above these barriers. In some situations, resident populations of trout exist above barriers however they are currently genetically isolated. In small tributary streams with high winter water velocities, trout commonly migrate downstream to overwinter in larger, deeper streams (Benhke 1992). When impassable culverts are present these fish migrate downstream, but are not able to migrate back upstream. Along the mainstem of Salt Creek all stream crossings, except the uppermost, are bridges and therefore do not affect migration. In fish bearing tributary streams however, stream crossings are generally associated with culverts. Nearly all of these culverts create upstream migration barriers.

PLANTS

The extent of effects of the presence, patterns, and use of roads and trails on special habitats or threatened, endangered, and sensitive species is not well documented at this time. Many sites have been altered, degraded or created by past management actions. Road cuts have potentially affected natural meadows by intercepting ground water or serving as a noxious weed vector. In other cases, special habitats may have been created or enhanced by impoundments, rip rap placed over tall fill slopes, or construction of bridges. Many instances of the creation of "linear" meadows and ditchline wetland habitats can be found in this watershed.

Some sections of trail cross areas that have been or may be altered by the type and level of use. In some areas trails pass across meadows and rocky areas (special habitat areas). In such areas extensive use by horses, motorcycles or mountain bikes may deepen trails which could effect the moisture regime of the meadow, or may loosen rocks that support the trail surface, causing raveling off at the trails edge. These occurrences are site specific as many miles of trails exist that have little or no effect on special habitats.

Several non-native plants are now well established in the vegetative communities in the watershed. Non-native vegetation will continue to be a formidable presence in the landscape. Continuing invasion and establishment will occur, whether from inadvertently traveling on vehicles/equipment, from stock packing use on trails, spread by road grading activities, perpetuated by timber harvest, or road right-of-way maintenance activities. These non-native plants out-compete natives in meadows formerly grazed and seeded with forage mixes, or by non-native erosion control and roadside seeding. Roadsides, temporary spur roads, and firelines often serve as seed beds for noxious weeds. The percentage of acreage in the watershed within a half mile and within one mile of roads indicates that the majority of the watershed is subject to the threat of changes in species composition by weed spread (see Table 3.4-3, Reference/Current Condition chapter). However, if roads are closed and allowed to overgrow, many noxious weed and non-native populations would eventually become shaded out by overtopping vegetation. The same trend holds true in maturing stands. Some will remain in the system as they are already naturalized species. Of concern are upper elevation areas where tree regeneration is slower and migrating weed populations could invade and establish and displace native plants, and floodplain areas where Himalayan blackberry and other invasive non-natives exist.

Some introduced species have contributed to social and economic well being by offering berry picking opportunities, by enhancing scenic quality, by controlling other undesirable exotic species, providing for erosion control, and providing flowers for sight-seeing. Others have less desirable social and economic effects such as toxicity to livestock, infestation of agricultural areas, contamination of food stuffs and buildings, depredation on crops and poultry, and reduction of bird watching opportunities in some areas. Loss of native species can have social and economic effects in terms of entity and medicinal values.

QUESTION 3:

Where has the density and location of roads affected hydrological function (i.e. wetlands, stream characterization, expansion of the drainage network, and streamflows)?

Roads contribute to increases in peak streamflows primarily due to the area of road surface that has a reduced infiltration capacity, more rapid routing of water to streams in roadside ditches, interception of subsurface flow and conversion to more rapid surface flow, and in some situations the formation of gullies where runoff is concentrated below culvert outlets.

Interception of subsurface flow by a midslope road can result in the area below the road becoming dryer due to a routing of water away from these areas. Roads can create areas of increased surface runoff by concentrating water in roadside ditches on the upslope of the road, or surface water may be increased in those areas where relief culverts concentrate runoff from roadside ditches below culvert outlets.

Adverse road related affects are most likely to occur where road construction has occurred on mid-slopes. Figure 3.1-5, 3.1-6, and 3.1-7 of the Reference/Current Condition chapter displays a map of roads within the watershed on slopes greater than 40 percent. The highest overall road density is found in subwatershed 20 1. Current Road densities by planning subdrainage can be found in the Reference/Current Condition chapter Table 3.2-6.

QUESTION 4:

What are the known transportation improvements and how do they affect habitat?

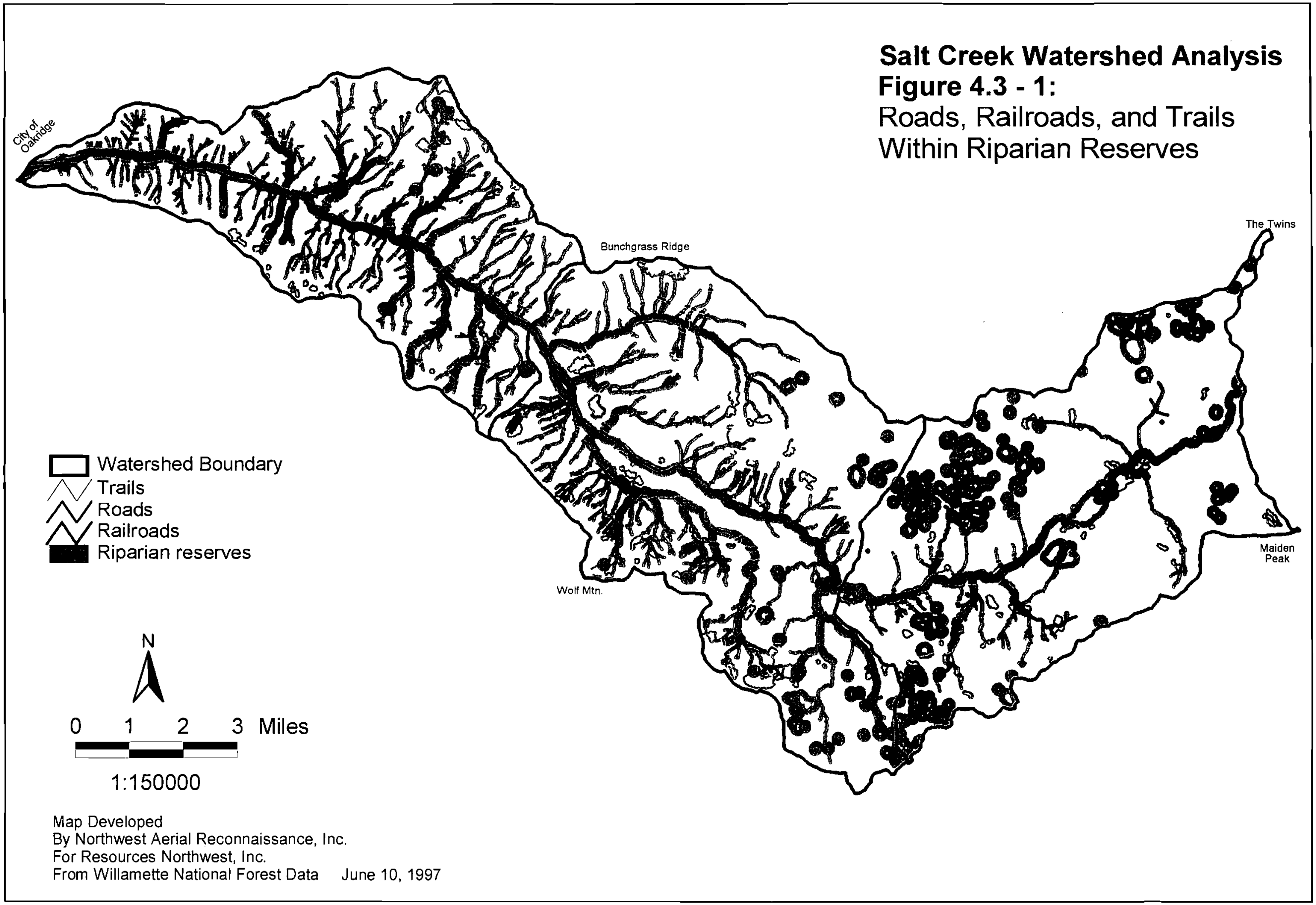
Two of the most significant transportation improvements within the watershed are State Highway 58 and the Union Pacific Railway (previously Southern Pacific). These central features extend from the western edge of the watershed through the eastern end of the watershed.

Highway 58 is within a riparian reserve for a class I stream the majority of its length within the watershed (Figure 4.3-1). Though the majority of crossings over the Class I streams are bridges, the uppermost crossing on Salt Creek is a concrete box culvert. This culvert is currently being fitted with a foot bridge to allow passage by small mammals and amphibians. Fish passage was not addressed in this culvert restoration project due to the presence of natural barriers above and below the culvert. Highway 58 also crosses numerous class II, III and IV streams within the watershed (Figure 3.4-1). Steps are being taken to provide access for small mammals and amphibians through culverts for these streams and ditch relief culverts. Fish passage is blocked by culverts at McCredie Creek.

Though the railway is also within a Class I riparian reserve in subwatershed 20 1, it ascends upslope on a gradual grade necessitating the crossing of many streams ranging from class 1 to IV in subwatersheds 20 2 and 20 3. With the exception of the trestle over Salt Creek, the railroad was constructed primarily with concrete box culverts at larger stream crossings. Where sediment has been deposited on the bottom of these culverts and outlets are not perched, aquatic connectivity may not be disrupted. However where significant flow and slick concrete floors or outlet drop-offs impede travel by small mammals, fish and amphibians, connectivity of riparian habitats may be obstructed by presence of the railway and associated disturbed areas. This is of concern especially where road fills are large and exposed, reducing potential success of animals attempting migration around and over riparian crossings.

As displayed in Table 3.1-3 (Reference/Current Condition chapter), 223.7 miles of system road occur in the watershed. Of this, approximately 198 miles are forest roads. The majority of these were constructed to access timber harvest area though some have been constructed to access points of interest and recreational areas. Though these forest roads are not as likely to interrupt connectivity of habitat for species capable of overland migration, many aquatic habitats are disconnected at road crossings - especially at crossings involving high gradient culverts, large fill slopes and drop-off outlets.

The railway and highway combined with the network of forest roads contribute to road density, road openings and sediment sources, as described elsewhere in this chapter.



Salt Creek Watershed Analysis
Figure 4.3 - 1:
Roads, Railroads, and Trails
Within Riparian Reserves

QUESTION 5:

What and where are the potential resource effects of not maintaining all the roads in this road system due to lack of funding?

Since the timber harvest program has declined with an associated decrease in road maintenance funding, road maintenance will not be done to the extent it was in the past. Road maintenance will be concentrated on the maintenance level 5 and 3 roads. Maintenance levels will have to be reconsidered and lowered on a portion of the road system so as to balance the budget with the maintenance program. This will result in some of the system roads that have been accessible by passenger cars now only being accessible by high clearance vehicles and in some cases not being accessible at all. Brush will encroach into the roadway on some of the system roads, making them impassable. Rock fall, tree fall, and slope ravel will close roads or make them accessible only to high clearance vehicles. Some loss of the roadway is possible from failed drainage systems and embankments. As a result we could see a loss in accessibility to some dispersed recreational sites and opportunities. Changes in access may also result in increased cost and reduced ability to meet administrative needs, including emergency access, fire control and implementation of a variety of resource projects. There may also be a reduced ability to accomplish monitoring programs, thus compromising the ability to adjust management practices to best meet resource objectives.

If roads are not maintained there is a higher probability of culvert and roadbed failures and formation or extensions of gullies below culvert outlets. These road related problems could introduce sediment into the stream system. Such introduction could silt in spawning gravels, reducing the spawning success of native trout and potential future populations of bull trout and spring chinook salmon. Introduction of sediment would also increase stream turbidity. Culvert failures could also block up-stream migration of fish. Refer to Figure 3.4-6 (Reference/Current Condition chapter): Roads and Trails Within Riparian Reserves.

Decreased maintenance will compromise drainage structures, resulting in diversion of water onto fill slopes, creating an increased likelihood of road related slope failures.

QUESTION 6:

Where are the high risk or high priority road/stream crossings which do not have drainage structures designed to withstand 100 year events?

An adequate amount of time was not available to do the extensive analysis needed to generate this information. Current management direction states that new culverts, bridges and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100- year flood, including associated bedload and debris (Northwest Forest Plan, Standards and Guidelines p.C-33).

ACCESS

QUESTION 7:

How does changed access influence the potential for human caused fire ignitions, suppression response time, and the amount of acres burned?

THE WILLAMETTE NATIONAL FOREST FIRE MANAGEMENT ANALYSIS SYSTEM (NFMAS)

This planning process was developed to provide fire managers with optimal organizations and funds for fire suppression. Included are three segments; Level I analysis, Level II analysis, and Initial Attack Assessment (IAA) model. Level I analysis introduces all of the elements used to build a database for IAA, except for fire behavior information (output from Level II). This includes weather data, fire occurrence, fire management analysis zones (FMAZ), and representative locations (RL). The IAA model uses Level I data and combines it with resource values, suppression costs, escaped fire sizes, and resource information loss/benefit (Net Value Change or NVC) information. IAA also utilizes fire behavior information that is called Level II. The output from the model provides information on the changes in the number of acres burned, resource loss and emergency suppression costs over an array of alternatives (9 alternatives were used). Alternative 4 was chosen because it represented the least Cost + NVC.

Table 4.3-1: Wildfire Response: South Zone (non-wilderness)

Location Code	District	Type Response
RL1	Rigdon	Roaded -- Engine
RL2	Lowell	Roaded -- Engine
RL3	Oakridge	Roaded -- Engine
RL4	Rigdon	Roaded -- Hand
RL5	Lowell	Roaded -- Hand
RL6	Oakridge	Roaded -- Hand
RL7	Rigdon	Roaded -- Hand or Air
RL8	Lowell	Roaded -- Hand or Air
RL9	Oakridge	Roaded -- Hand or Air

Table 4.3-2: Wildfire Response: South Zone (wilderness)

Location Code	District	Type Response
RL1	Rigdon	Hand
RL2	Oakridge	Hand
RL3	Rigdon	Air
RL4	Oakridge	Air

Representative locations for this analysis were chosen based on primary type of first attack and time of attack on fires that occurred from 1970-1989 by district. Oakridge is assigned RL3, RL6, RL9. The types of first attack for the non-wilderness FMAZ were grouped into 3 categories: roaded (primarily an engine first response), roaded dispersed (primarily a hand first attack), and remote non-wilderness (primarily attacked from the air or by ground forces). The types of first attack for the wilderness FMAZ were grouped into two categories: hand and air. This information is displayed in Table 4.3-1 and 4.3-2.

It is important to remember that this analysis was based on a period of time when most of the district road system was established and fire size was minimized due to accessibility of engines and hand crews. Time to first attack was assigned as one hour. However, with road closures or road removal, response times are estimated to increase by one half to one hour. This would also mean a decrease in RL3 and an increase in RL6 and probably little change in RL9 since it applies to areas similar to that which is found south and east of Fuji Mountain and Mount Ray to the crest of the Cascades that is non-wilderness. Net changes expected would be increase in response time, increase in fire size, increased number of initial attack forces, increased mop up time, increased use of retardant, and increased resource damage. Overall, an increased Cost + NVC. This situation is currently being addressed on a regional level because of its expected impacts on regional resources such as smoke jumpers, retardant planes, Type I fire crews, helicopters, and rappel crews. Currently there are no fire dollars available to keep roads accessible.

Roads in areas of relatively low road density are more important for fire suppression activities than any given road segment in areas with a high road density.

QUESTION 8:

How does changed access, including impacts from recent floods affect public and administrative use of the forest?

Closure of roads will restrict the amount of traditional road use by hunters, firewood cutters and recreationists. Many hunters do not venture far from roads and firewood collectors are closely tied to roads. Road closures would reduce the amount of land accessible for various activities such as pleasure driving, road hunting, special forest product collection, and firewood cutting. A decrease in maintenance on roads accessing trail heads could make it more difficult for some to access existing trails. Road closures could have the effect of extending the trail system by effectively creating a new trailhead at the point of road closure. Such a trail system expansion could add to or detract from the trail experience and would likely increase the amount of trail maintenance that would need to be done.

Just as some hunters and anglers prefer open roads, others are in favor of road closures which provide enhanced opportunities for more secluded hunting or fishing experiences. Transformation of roads to trails could increase horse, mountain bike, and ORV use. Business increases 20% at Oakridge's Sentry Market over the summer season (spring fishing through fall hunting). An increase in trail users could seasonally benefit local businesses, especially if increased recreational opportunities are marketed effectively.

A significant decrease in amount of open roads could reduce the number of human-caused fires but would also hinder ability to suppress natural and human-caused fires.

QUESTION 9:

With the current method of response to hazardous material spill, what would be the risk of a hazardous material spill from Highway 58 or the Union Pacific Railroad?

The Willamette National Forest has developed several documents detailing the policy and direction guiding the protection from contamination source areas of water on the forest. The following is a list of documents containing current policy and direction and a summary of the content of these documents.

- Willamette National Forest Pollution Prevention Plan:
  Prepared in response to Executive Order 12856 to serve as the guiding document covering facilities to reduce the acquisition and disposal of hazardous materials.

- Hazardous Substance Management Plan, Willamette National Forest:
  Policy and direction concerning hazardous substances, their purchase, use, and storage.

- Willamette National Forest Hazardous Material Spill/Discovery Emergency Action Plan:
  Guidance for the response to spills or discovery of hazardous materials within the boundaries of the Forest.

FACILITIES

Any chemical or petroleum spill occurring along Highway 58 or on the railroad right-of-way could potentially enter streams and aquifer. Old underground tanks and future industrial use are not a concern in this watershed.

ACTIVITIES

Fuel and chemical spills along Highway 58 and the railroad could potentially pose a threat to an aquifer. A number of other activities could also pose a threat. These include meth lab operations and disposal of waste products, vehicle accidents, residential facilities, and illicit dumping,

Currently, the greatest risk of contamination is from an accidental spill from the railroad or the highway.

ISSUE #4

Aquatic communities may have been changed from reference conditions due to the introduction of non-native species, migration barriers and other management activities.

ISSUE #4 KEY QUESTION

QUESTION 1:

What are the effects of introduction of non-native species on native aquatic communities?

Stocking of non-native species and strains of fish and the introduction of fish to naturally fishless lakes has occurred since the early 1900's. ODFW has been largely responsible for fish stocking. Anglers have stocked lakes and streams with their favorite fish species to a lesser extent. The introduction of non-native species of fish has negatively affected naturally occurring aquatic species. The introduction of brook trout to many of the lakes has most likely affected downstream native populations of cutthroat trout and rainbow trout, as well as anadromous species such as bull trout. Brook trout often migrate down-stream from the lakes where they were originally introduced and often out-compete rainbow trout and cutthroat trout and have been known to hybridize with bull trout.

The introduction of fish to previously fishless lakes may negatively affect other species naturally occurring in the lake. Introduced fish prey on frogs and salamanders (which were previously the top predator), as well as aquatic macroinvertebrates and the larger species of zooplankton, thus changing the community structure of the lake. Bullfrogs have similar effects on native species.

The presence of brook trout in upper Salt Creek (above the falls), Fall Creek, Diamond Creek, and Deer Creek would prohibit the future re-introduction of bull trout into these areas. The presence of brook trout in these areas is due to the stocking of high elevation lakes in the vicinity of these streams. Brook trout have not been observed in the mainstem of Salt Creek below the falls or any of the other tributaries.

The relative importance of these native non-fish communities varies, depending upon social values. Social values determine whether fishing for native (rainbow and cutthroat trout) or non-native species (brook trout) is more important, or whether amphibians native to lakes are more desirable than fish.

ISSUE #5

There is a concern for how existing and proposed developed and dispersed recreation may have affected landscape processes and wildlife habitat.

ISSUE #5 KEY QUESTION

QUESTION 1:

Where has recreation use affected native and non-native plant and animal habitat diversity, species composition, and habitat use?

Use of developed and dispersed recreation sites, as well as roads and trails, have contributed to the introduction of non- native plants. Seeds and sometimes roots and stems are carried on tires, on off-road vehicles and in livestock feeds and bedding. Introduction of some non-native animals such as upland gamebirds (pheasants, turkey) and fish into naturally fishless lakes has been promoted by recreational values. Introduction of brook trout into Gold Lake (and other high elevation lakes) has resulted in overpopulation of the introduced species and competition or predation on naturally occurring species. The exotic species are also sometimes taken as prey by native species.

In some cases recreational facilities may be used by wildlife; shelters may be used by bats or rodents, scenic vistas may be grazed by big game and small mammals, campgrounds may offer food sources for gray jays, mallards, ground squirrels and Chipmunks. However, often human activity is perceived by wildlife as a danger, resulting in avoidance of heavily used recreation areas by most species. It is anticipated that wildlife use of areas around campgrounds, observation decks, hot springs and developed winter sports areas have significantly changed form reference conditions. For example, the development of Gold Lake Campground has likely affected the use of the adjacent lakeside and bog habitats, especially during periods of high sensitivity (such as calving and fawning periods for big game, and nesting season for birds). Development and promotion of winter sports facilities from Waldo Lake Road to Willamette Pass may result in avoidance of areas that would otherwise be utilized by reclusive species such as wolverine. Low density recreational use in expansive remote areas such as the Island Lakes, Maiden Peak and Diamond Peak probably do not result in significant displacement of wildlife use at this time (except during hunting seasons). As demand for secluded recreation opportunities increase and facilities for access are improved, displacement or disturbance of wildlife populations may increase.

QUESTION 2:

Do recreational use and facilities affect water quality?

Although recreational use and facilities can lead to adverse impacts to water quality, no available information indicates adverse impacts to water quality from these uses within the watershed.

QUESTION 3:

What and where are potential impacts from proposed recreation (development of winter sports recreation, Willamete Pass Ski Area expansion, McCredie Springs and Waldo Sno-park)?

Increased winter recreational use could lead to some adverse impacts of resources within the areas of the proposed recreation development.

Development of winter sports facilities may result in avoidance of areas that would otherwise be utilized by reclusive species such as wolverine.

Increased use of winter sports facilities such as summer use of trails and lifts at Willamette Pass Ski Area could displace big game from the area depending of the extent of human activity.

Due to the closeness of streams in the area, development of the Waldo Sno-Park and McCredie Springs area could have adverse affects on riparian reserves as per Northwest Forest Plan, standards and guides.

Waldo Sno-Park activities may have adverse impacts on wildlife and water quality of the adjacent Waldo basin.

There is the potential to impact water quality and soil productivity from soil erosion resulting in sediment transport to streams especially associated with the McCredie Springs and Waldo Sno-Park areas. Willamette Pass Ski Area development has the potential for reducing soil productivity by disturbing natural soil conditions and placing low nutrient pumice soils on the surface and creating localized areas of soil erosion which contribute to the difficulties in revegetating pumice soils.

RECOMMENDATIONS

CHAPTER V

RECOMMENDATIONS

INTRODUCTION

The following recommendations are made "to bring the results of the previous steps to conclusion, focusing on management recommendations that are responsive to watershed processes identified in the analysis." (USDA, USDI, 1995). The recommendations are based upon the analysis synthesis presented in the preceding Interpretation Chapter. While a summarization of the rationale is presented with each specific recommendation, a review of the discussions interpreting the analyses for each issue statement (Chapter IV) will assist in a full understanding of the rational behind these recommendations.

In many cases not enough site specific data or relevant studies exist to absolutely quantify the full ramification of the current conditions. In the face of this incomplete information, the watershed analysis team, in an interdisciplinary process, has relied upon known resource problems and professional judgment to generate these recommendations which in many cases are conceptual in nature.

ISSUE #1

Intensity and pattern of vegetation manipulation related activities.

Riparian Reserve Widths

One of the primary reasons for this watershed analysis was to determine whether prescribed interim riparian reserve widths can or should be changed (USDA, USDI, 1994a, page B-13). Riparian reserves provide dispersal and connective habitat for terrestrial animals and plants as well as protection of aquatic environments. These corridors and connections will in many cases be wider than prescribed due to overlap with special wildlife habitat allocations, supplemental Late-Successional Reserves, green tree retention clumps, and areas unsuitable for timber management. It is recommended that interim widths as stated in the Northwest Forest Plan be maintained unless site specific analysis supports modification. Consider site class and plant association in determining site potential tree height, Appendix D . This analysis has found no information indicating the interim widths are excessively wide or too narrow to accomplish the objectives of the Aquatic Conservation Strategy and providing for terrestrial habitat connectivity. Due to the scope of this analysis, it is recognized that site specific project analysis could reveal circumstances that require consideration for modifications to the interim riparian reserve widths. Unless further analysis supports deviating from the interim riparian reserve widths, the rationale for these differences must be documented and demonstrate that Aquatic Conservation Strategy objectives and terrestrial habitat connectivity would not be adversely affected. (Refer to Riparian Reserve Evaluation Techniques and Synthesis, Supplement to Section II of Ecosystem Analysis at the Watershed scale: Federal Guide for Watershed Analysis. Version 2.2)

It is recommended that definitions and buffer prescriptions in the Willamette National Forest Special Habitat Management Guide be utilized for management activities around wetlands less than 1 acre in size.

Riparian Reserve Restoration

It is recommended that riparian reserves in this watershed can best be served, from an aquatic and terrestrial connecting habitat perspective, by an aggressive program of riparian restoration in areas where past clearcut harvest has created large areas of early-successional forests. This restoration should consist of any activities that would speed up the development of late-successional conditions. Such restoration activities could include density control to develop larger stem size and a shade tolerant understory, reintroduction of large woody material and/or other structural elements into channels, reforestation and underplanting, and possibly fertilization. Riparian reserves draining into or directly adjacent to wetlands should be treated with caution to avoid detrimental affects to amphibian populations.

Activities in Riparian Reserves

Watershed analysis is also conducted to determine what management activities are appropriate within this watershed (USDA, USDI, 1994a, page C-7) and specifically within riparian reserves (USDA, USDI, 1994a, pages C-31 and 32).

Considering past experience in this and adjacent watersheds, it is recommended that the following activities are generally acceptable within riparian reserves, assuming appropriate, site specific environmental analysis determines they are consistent with Aquatic Conservation Strategy objectives, Forest Plan Standards and Guidelines, and terrestrial habitat needs. In many cases the following activities are beneficial to the attainment of Aquatic Conservation Strategy Objectives. Those that do not directly benefit are neutral to those objectives.

- Commercial Thinning of Young Stands

Commercial thinning (usually cutting and/or removal of trees greater than 6 inches in diameter) is beneficial to riparian reserve objectives if it is shown that thinning will increase the average diameter of the stand, and/or accelerate the development of a shade tolerant understory. Accelerating the diameter growth and increasing horizontal and vertical diversity of riparian stands will assist in creation of late-successional conditions sooner and provide for a faster development of large woody material sources for in-stream and terrestrial habitat. See Appendix D for a more in-depth discussion of the detriments and benefits of thinning.

- Young Stand Density Management

Thinning such as cutting trees less than 6 inches in diameter and leaving them on site, has the same future advantages for stand development. Density management may also include cutting or girdling of trees greater than 6 inches. Young stand density management prescriptions should consider options that avoid a later commercial thinning entry, especially where additional entries may result in excessive soil compaction, logging feasibility problems or poor cost effectiveness. Tighter spacing may be appropriate where these concerns are not prevalent and where ground level shade and moisture levels or closed sapling habitats are of concern.

- Planting and Underplanting

The establishment of forest cover and the re-establishment of shade tolerant understories in otherwise undiverse young stands have advantages to future riparian habitat. Planting of cedar into previously cedar dominated sites should be considered.

- Collection of Regenerative Materials (seed, scions, cuttings, etc.)

Seed material and cuttings are collected and used for general reforestation and riparian area revegetation. Removal of this kind of material in a well vegetated riparian zone will have little influence on the amount of vegetation within riparian zones. Seed without the proper, early-successional environment may not germinate or seedlings will not survive and cut shrubs will vigorously resprout. Collection of such material can have high off-site benefits to riparian zones and upland areas needing revegetation. Such collections should have a neutral effect on the riparian zone experiencing the collection, given that this material is annually renewed and that collection would be done prudently leaving a substantial percentage of the vegetation in place.

- Collection of Special Forest Products

Commercial harvesting of berries and conifer boughs is considered neutral to riparian resources since these collections do not remove the associated plants, and involve the harvest of material that is annually renewable and, since collection would be done prudently, leaving a substantial percentage of the vegetation in place.

- Road Maintenance

The cutting of road side brush and trees, including blowdown trees that fall across roads, to provide for better visibility and a passage wide enough for vehicles, occurs only within the roadway prism. It would occur in areas where decisions have been made to keep the roads open for a variety of resource, administrative, and recreational reasons. Road side brush and tree cutting would have a neutral effect on riparian systems since it would generally affect a small percentage of any stream reach. (see the ROD Standards and Guidelines, C-32 & C-33) Roadside brushing will provide access for drainage monitoring and culvert maintenance. This potentially reduces the risk of road related impacts to riparian areas and slope stability.

- Wildlife Tree Creation or Enhancement

The killing, topping or modification of green trees to create dead and defective tree habitat in areas that are currently deficient in this habitat component has a beneficial effect on riparian objectives. It creates a more diverse forest structure and could generate large woody material faster than natural processes for in-stream and terrestrial habitat. Treatments are generally distributed within a stand such that canopy closure is negligibly affected.

- Improving Aquatic Habitat (i.e., large woody material or other structural placement in stream channels)

While there could be some short term negative effects due to sediment production and damaging of small amounts of riparian vegetation, introduction of various channel structural elements in stream reaches currently deficient in large woody material (due to floods or past management) would improve the complexity and productivity of in-channel habitat for fish and other wildlife species, as well as improving bank stability. Habitat improvement projects should be based upon a limiting factor analysis. Habitat improvements may be prioritized by protecting and improving habitat in areas where high quality habitat and healthy fish populations exist and where threats to habitat and structures from high flows are low. Habitat that is badly degraded may be found to be a lower priority. A more project specific analysis is needed to determine which areas have highest priority.

- Browse Enhancement or Release of Trees

Cutting of brush for forage generation or to release sapling trees occurs in young, managed stands that have yet to close their tree canopy. This activity could have negative effects if it occurs on channel edges close enough to stream channels to affect channel shade. With this precaution taken this activity has a neutral effect on riparian objectives, and tree release can have long term benefits if that activity accelerates the development of a diverse coniferous forest.

- Fertilization

Fertilization benefits riparian area function to the extent that it accelerates the growth and development of vegetation (as long as there is no direct application to water surfaces). It also may increase the productivity of the stream system by generating increases in energy and nutrients that enter the stream through litter fall. Fertilization is not recommended within stream channels, near domestic water sources, wetlands or within 200' from wetlands and streams during amphibian breeding season.

- Provision of Recreational Opportunities (trails, campgrounds, river and lake access, viewpoints, dispersed sites, ski area development and McCredie Springs.)

Current recreational sites and facilities often contain areas of bare soil and comparatively low vegetation density. Many campground and dispersed sites are on flat or stable ground that is relatively resistant to erosion. Since the bare areas are relatively few and far between, the current number and use level of these sites and facilities have a low effect on the function of riparian systems. It is recommended that all recreational development and associated seasonal activities be monitored and appropriate mitigating actions taken to minimize surface erosion and effects on riparian reserves.

- Creation and Maintenance of Water Sources

Creation of sites for pumping water to supply fire suppression and road maintenance water needs can be detrimental to riparian connectivity and fish passage if improperly designed and placed. If properly designed, placed, used, and maintained they can increase the diversity in riparian habitat by creating deep pools where none existed before. These facilities can be beneficial or neutral where their creation is designed with appropriate analysis. These facilities should be monitored for the presence of T, E, and S species and fish before any maintenance or enhancement work is begun.

- Creation of Skyline Corridors if Needed to Avoid Construction of Excessive Amounts of Road

Road construction is often the largest source of sediment. It may sometimes be preferable to yard logs through riparian zones to avoid the need to construct road to access landing sites providing for yarding away from streams. Though skyline corridor clearing may increase the amount of solar radiation entering a riparian zone, the effect is short lived as narrow canopy gaps can close fairly quickly. Skyline corridors are most compatible with riparian area objectives if properly designed and trade-offs between corridor effects and road construction are evaluated. They may be the least impact alternative if their creation is to avoid the construction of potentially more damaging roads. Reserve trees felled for corridors shall be left in riparian reserves.

- Use of Individual Trees for Cable Yarding System Tail Holds

Cable yarding tail and guy line anchor points often involve the cutting of a tree to provide a secure anchor. If in riparian areas, these trees are usually left in place when felled. Since these tail holds usually involve one tree and there are relatively few landings near riparian zones, their effect on riparian functions is negligible and their creation is in most circumstances neutral to riparian values. Since there is value to down trees as well as standing trees, there may be some benefit to riparian resources if down trees are needed to enhance riparian or terrestrial habitat. Additionally, if tail holds in the riparian zone can accomplish full log suspension on adjacent upland areas, there would be a benefit to riparian areas by avoiding adjacent soil disturbance. Where anchor trees are not felled during harvest operations, they should be left standing.

- Fuels Treatments (generally hand pile and burn or light underburning)

Reduction of fuels may be prescribed to protect a riparian zone from future fire risk, especially in areas where fuel is generated by thinning. Treatment of such fuel accumulations has the additional advantage of providing for easier travel for large animals. See also the discussion of prescribed underburning of LSR's discussion in Issue #2 of this chapter. Piles of woody debris also provide habitat for a variety of birds, small mammals, reptiles, and amphibians. Thus, where consistent with fire risk concerns, some piles should be left unburned as wildlife habitat.

- Noxious Weed Treatment

Killing or reduction of noxious weeds, if properly and sensitively done, can have large benefits to riparian systems. Such treatment can avoid exclusion of native species. Certain noxious plants can affect the use of riparian zones by out competing favorite forage plants or by restricting travel (as Himalayan blackberry can).

- Crossing of Streams by New Road Construction

Road crossings should be properly designed, constructed, and maintained to have minimal effect to riparian management objectives. Avoid road crossing in riparian reserves where possible. Road construction may be preferable to yarding across streams if acceptable log suspension cannot be achieved from existing roads. Alternative yarding methods should be considered (e.g., helicopter). All new culverts will be evaluated for 100 year flood criteria for installation based on restoration needs.

- Culvert and Bridge Maintenance

Cutting of selected trees within 100 feet upstream of large culverts and all bridges is sometimes proposed to protect these structures from debris that could, if large amounts accumulate against trees growing within or between channels, i.e. sand bars in the stream channels, cause a failure of the stream crossing structure. Such cutting can have small negative effects, but prevention of structure failure may have larger, long term benefits to riparian resources. Where practical, place woody material downstream of the structure, especially when a stream is low or deficient of large woody material.

- Aquatic Habitat Management

It is recommended that reintroduction of bull trout and spring chinook salmon be considered for this watershed. There is a need to maintain and restore habitat for future reintroduction of spring chinook salmon and bull trout as well as for existing aquatic species in the watershed (specifically in reaches where habitat is currently deficient). Stream habitat improvement projects in Salt Creek and its fish bearing tributaries should continue in anticipation of the eventual reintroduction of spring chinook salmon and bull trout into this watershed as well as for the existing resident fish populations.

Habitat components such as large woody material, spawning and rearing areas, and overwintering habitat, are available throughout portions of the Salt Creek watershed (see the Reference/Current Conditions chapter: specifically Resident Salmonid section, pages 70). In addition, brook trout are only present in reaches above Salt Creek Falls, as well as in Fall Creek, Diamond Creek and Deer Creek. They have not been located elsewhere in the mainstem of Salt Creek or its tributaries.

In areas used by boaters, large woody material or other channel structures that span the width of the creek should not be used in the mainstem of Salt Creek to avoid creating boating hazards.

District should work with local ODOT maintenance section to assure sediment and sanding material or other de-icing components do not adversely affect Salt Creek water quality or instream habitat.

If any recreational suction dredging begins to occur it should be closely monitored to determine its effects on salmonid eggs and young in order to determine how or if potential impacts could be decreased should this activity become more common.

Activities in Upland Areas

In addition to activity recommendations listed for riparian reserves, the following activities (again with appropriate, site specific environmental analysis) are also considered acceptable in upland areas.

- Wildlife Habitat Management

Prohibit habitat altering and disturbance activities within bald eagle or peregrine falcon primary management zones. Management plans should be used to guide activities proposed within primary, secondary, and tertiary zones. The focus should be on reproductive security and prey species habitat enhancement for these areas.

Apply silvicultural practices in matrix, such as post thinning underplanting, which promote progression of hiding cover to thermal cover for big game, especially on winter range. Implement treatments (such as seeding, fertilization and browse cutback) to improve forage quality in BGEAs currently below standards.

Identify riparian and upland areas during project planning with high potential to provide late-successional habitat connectivity between adjacent watersheds and between large LSRs. Propose management activities that maintain or restore habitat features for long-term connectivity potential in such areas.

- Sensitive Plant Habitat

Continue to identify and classify special habitats during project level planning. Ground truth during field visits to confirm or reclassify SHABs identified during watershed analysis. Analyze SHABs to determine buffer prescriptions to maintain the integrity of the site. Refer to Special Habitat Management Guide.

Rare forested stands identified in the Willamette National Forest Special Habitat Guide should be evaluated for significance when encountered during harvest project analysis to determine if they need to be included in a Research Natural Area, or otherwise protected from disturbance.

Conduct surveys, consistent with the Northwest Forest Plan Record of Decision, for C-3 Survey and Manage Species known in the watershed during planning efforts. Consider opportunities to designate special interest areas or areas of critical concern for "hot spots" of biological diversity on a planning area basis.

- LSR Activities

Young stand density management (or early thinning), commercial thinning, and stand fertilization activities should be prescribed in Late-Successional Reserves, consistent with the findings of the interim LSR Assessment, to accelerate the development of late-successional habitat.

- Noxious Weeds

Continue noxious weed surveys to identify new invaders and "sleepers" (those that may have the potential for dramatic future spread). Inventory other invasive non-natives at the same time. Continue introduction of biological control agents.

Recognize that the main travel routes for weeds are roads, and consider opportunities during the Access and Travel Management Plan analysis to close and decommission roads to allow native species to shade out non-native plants.

Look for opportunities such as using Jobs-in-the-woods crews, YCC crews, FS road maintenance, etc., to control scotch broom and blackberries in sites that are not well established and on edges of distribution range.

Collect and propagate native species for use on decommissioned roads and other ground disturbing project sites that promote non-native spread. Prioritize higher elevation roads and sites that are not likely to revegetate quickly or shade out weedy species after closing for re-seeding with native herbaceous species. Consider the use of native leguminous species. Consider the use of native species with a potential for Special Forest Products collection opportunities.

Use prescribed fire plots to eradicate any weeds.

Monitor fire areas for noxious weeds and use small prescribed fire test plots to evaluate noxious weeds control. Consider selective use of herbicides on new invader species.

- Thinning

For the reasons mentioned in Appendix D, in addition to the objective of maximizing timber volume production in matrix lands, thinning of young stands is recommended. As with all other activities, thinning should only occur when site specific exams and stand growth modeling show that thinning would better or more quickly accomplish various stand management objectives such as producing larger stems, more diverse stand structure, or capturing suppression mortality.

- Fuels Management

It is recommended that prescribed burning be considered in strategic areas, including within the LSRs, to more closely mimic natural processes and to better protect reserves from catastrophic fire. Wildfire is a wide spread ecosystem process in this area, and extensive portions of the area have periodically underburned during times when stand replacement wildfire occurred. As mentioned in the Chapter II discussion of fire history, not enough is known of the extent of underburning in this area to provide specific prescriptions in terms of area per unit of time. It is recommended that natural fire patterns be evaluated to develop a better idea of how frequently and where prescribed fire may be appropriate. Prescribed fire can be detrimental to late-successional habitat in terms of removing large wood, soft snags, and shade tolerant trees but may be beneficial on a landscape level in terms of protection from catastrophic fire and creation of new snags. It is felt that the percentage of this watershed treated with prescribed fire in a given decade should not be large. See the prescribed fire discussion under Issue #2 of this chapter for a more thorough discussion of underburn fire prescriptions.

- Erosion

Erosion potential and slope stability should also be considered in determining where green trees, snags, and large woody material are to be retained in harvest areas, in addition to other objectives, such as those for habitat structure and logging feasibility.

- Compaction

Least impact methods such as cut-to-length yarding, harvester forwarder, and grapple piling or other method should be considered to minimize soil compaction effects. An associated monitoring program should be implemented to evaluate whether these methods are successfully meeting the Forest Plan Standards and Guidelines (not greater than 20% of activity area in a detrimental soil condition). Amelioration of compaction through sub-soiling should be considered in compacted areas if such activities will not affect the health and function of live trees already on the sites.

ISSUE #2

The exclusion of natural fire from the ecosystem has altered the natural processes.

Prohibit habitat altering and disturbance activities within bald eagle or peregrine falcon primary management zones. Management plans should be used to guide activities proposed within primary, secondary, and tertiary zones, and should focus on reproductive security and prey species habitat enhancement for these areas.

The various reserve areas in this watershed are important in maintaining diversity and meeting management direction. Fire suppression efforts are critical to maintaining the values of these reserves. Provision of access, establishment of fuel breaks, and providing for quick response to fires may be preferred since fuels reduction could be appropriate in late-successional habitat. Underburning may be acceptable in some areas. Protection of younger stands from fire promotes development of older seral stages. It is recommended that priority road access be maintained in the Late-Successional Reserve. Consider the development of fuel breaks to assure the needed protection, in addition to treatment of fuels. Creation of fuel breaks should involve treatment of fuels along strategic locations such as roads or ridges.

Prescriptions for underburning in Late-Successional Reserves should be considered. Treated areas may include the riparian reserve areas and may be dominated by Douglas-fir and other coniferous species. The area to be treated should be determined by an LSR assessment and LSR fire management plan. Benefits to prescribed burning in LSRs include: the more fire susceptible early seral stands would be buffered and the risk of stand replacement fires may be reduced. Effort should be made to protect classic old-growth from fire until younger stands acquire characteristics of late-successional habitat. Underburning in LSR's could have some short term detriment to late-successional habitat and short term benefit for big game. It may have long term benefit for late-successional habitat in terms of protection from future catastrophic fire.

Prescribed natural fire could help to restore big game forage quality and quantity in areas where current forage values are below reference conditions (the eastern portion of subwatersheds 20 2 and all of 20 3). Opportunities exist to allow fires to play their natural role. Prescribed fire should be considered in BGEAs currently below standard in forage quality (refer to Table 3.5-3). The majority of the areas likely to be considered for prescribed fire treatments are in wilderness, semi-primitive dispersed recreation areas, special interest areas, and riparian areas.

Consider use of prescribed fire, girdling, and selective harvest methods to maintain and/or restore non-forested meadow complexes that are presently being encroached upon by trees. Prescribed fire could be used as a tool to encourage germination of fire dependent species such as woodland milkvetch and branching montia. Monitor burns to determine whether they were successful in releasing these species from the seed bank.

Issue #3

The density, condition, use, and location of roads and trails has altered the landscape processes and influenced wildlife habitats.

Implement road closures to be in compliance with Willamette National Forest Plan Big Game Habitat Quality standards in BGEAs:

Basin =9.7 miles	Hatchery = 1 miles
Eagle Head = 12 mile	Wicoppe Fields = 5 miles

As opportunities arise, the above road closures could be implemented to assist in accomplishing road restoration goals as identified in the Watershed Improvement Needs (WIN) surveys, and as determined by the ATM planning process.

Consider closures or relocation of roads and trails in bald eagle or peregrine falcon primary management zones. Management plans should be used to guide activities proposed within the primary, secondary, and tertiary zones and should focus on reproductive security and prey species habitat enhancement for these areas.

An inventory of roads, railroad access roads, and railway beds located on steep ground needs to be done with an emphasis on the road system constructed prior to 1980 and railroad drainage and sidecast material.

The Access and Travel Management Plan team should initiate the following:

- Review non-system roads to determine if any should be converted to system roads or placed on the trail system. If not placed in the system, either road or trail, the recommended method of decommissioning to reduce the potential resource impacts should be identified.
- Review system roads that have chronic maintenance problems. Determine what actions to take to protect resources.
- Determine which road systems produce high sediment delivery into the streams and recommend what actions to take.
- Determine if the road user should pay for maintenance of system roads when access to that road is primarily for that user, or users, if road maintenance funds are not available.
- Determine what actions to take if funds are not available to maintain system roads.
- Identify priorities for road stream crossing restoration.

Since less than 1% of the culverts within the analysis area have been assessed for hydraulic capacity relative to a 100 year flood, this work needs to continue. The District WIN database indicates a number of culverts have diminished hydraulic capacity due to plugging, damage, or deterioration. The WIN information should be used to prioritize culvert restoration work. Culverts with a high likelihood to fail and lead to degraded stream channel conditions should be repaired first. Continued analysis along timber sale haul routes should identify deficient culverts and utilize funding opportunities. Additional emphasis should be placed on analysis of culverts in streams identified as having high aquatic habitat value.

Road maintenance scheduling should factor in the results of culvert inventories. Culverts with identified deficiencies that are easily corrected, plugged inlets for example, should be treated as soon as possible.

Replace or modify culverts that are currently blocking fish passage to suitable habitat or compromising habitat connectivity. Tributary stream culverts that would increase access to the greatest amount of habitat should receive the highest priority for such modification. Consider providing habitat connectivity for small mammals and amphibians. Review the results of culvert condition surveys to determine the feasibility of developing small contracts for fish passage improvements. Continue to conduct surveys of railway culverts to assess effects to aquatic/riparian habitat connectivity. Develop plans to mitigate these affects cooperatively with UPRR (Union Pacific Rail Road).

Bridges and culverts that are passable to fish that cross tributary streams should continue to be installed as new roads and trails are built in the watershed.

Review railroad special use permits, and document local protocol for dealing with hazardous spills, including coordination with Forest Service district personnel.

Revisit these recommendations during ODOT Highway 58 corridor planning document preparation. Coordinate with ODOT to insure hazardous spill incidences are addressed in the Highway 58 corridor plan.

ISSUE #4

Aquatic communities may have been changed from reference conditions due to the introduction of non-native species, migration barriers and other management activities.

Study the effects of the introduction of fish into naturally fishless lakes in coordination with ODFW.

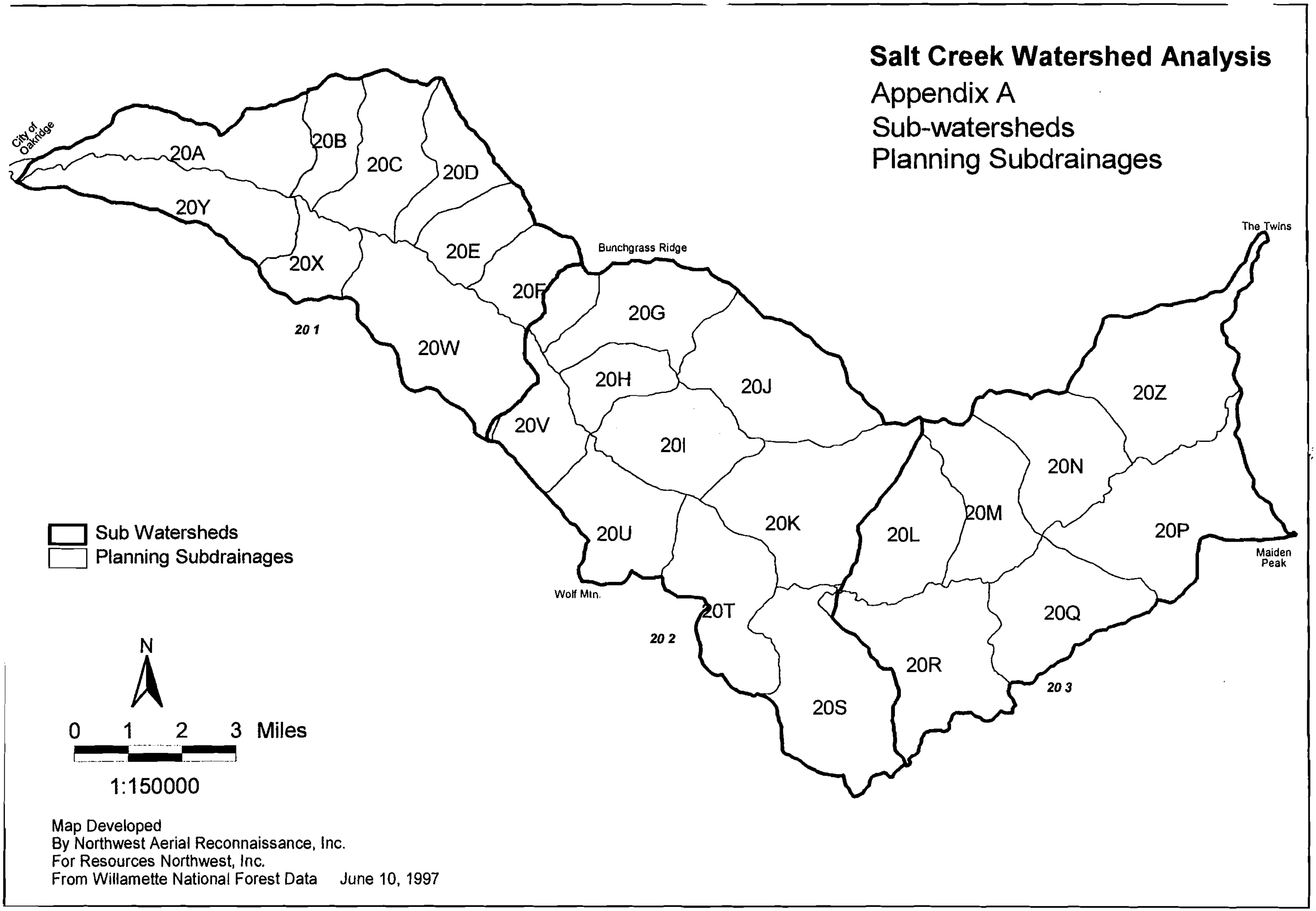
Brook trout should not be stocked in lakes which have outlets that are tributaries to Salt Creek. Where naturally reproducing populations of brook trout in lakes occur, measures should be considered to prohibit brook trout from establishing populations in streams where spring chinook salmon and bull trout could be potentially reintroduced.

ISSUE #5

There is a concern for how existing and proposed developed and dispersed recreation may have effected landscape processes and wildlife habitat.

- Assess new winter sports development affects on water quality and impacts to great gray owls and forest carnivores within the basin and adjacent basins.
- Update Winds of Destruction roadsite interpretive signs to reflect ecological benefits and recognize Warner Creek fire and floods of 1996. Emphasize interpretive information on natural disturbances.
- When evaluating current and proposed developed recreation sites, consider alternatives that minimize site impacts to resources and enhance or restore riparian areas while meeting long-term recreation objectives.
- Current concerns for wildlife habitat (such as disturbance and pollution) provides additional support for the overland/oversnow motorized travel restriction of the Waldo road in this portion of the Salt Creek watershed.

APPENDICES



Salt Creek Watershed Analysis
Appendix A
Sub-watersheds
Planning Subdrainages
City of Oakridge
20A
20B
20C
20D
20Y
20X
20E
20F
20 1
20W
Bunchgrass Ridge
20G
20H
20J
20V
20I
20Z
The Twins
20N
20M
20K
20L
20P
20U
Maiden Peak
Wolf Mtn.
20T
20Q
20 2
20R
20 3
20S
Sub Watersheds
Planning Subdrainages
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

APPENDIX B: Valley Segment Type and Rosgen Channel Definitions

Valley Segment Type	Valley Bottom Gradient	Side Slope Gradient	Valley Bottom Width	Channel Pattern	Stream Order	Landform & Geographic Features
F3 - Wide Mainstem Valley	<=2%	>5%	>5X	Unconstrained: moderate to high sinuosity; braids common	Any	Wide Valley floors bounded by mountain slopes; generally associated with mainstem rivers and the tributary streams flowing through the valley floor: sloughs and abandoned channels common.
F5- Gently Sloping Plateaus and Terraces	<=2%	<10%	1X-2X	Moderately constrained; low to moderate sinuosity	1-3	Drainage ways shallowly incised into flat to gently sloping landscape; narrow active floodplains; typically associated with small streams in lowlands, cryic uplands or volcanic flanks
F6-Palustrine Spring fed Meandering Flats	<2%	<5%	75X	Unconstrained; high sinuosity	>=2	Associated w/lakes, wetland outlets; often high elevation; fine sediment storage; grass/forb riparian communities
H1-Moderate Gradient Valley Wall / Headwater	3-6%	>30%	<2x, may be >2X in headwater cirques	Constrained	1-2	Small Drainage w/channels slightly to moderately entrenched into mountain toeslopes or headwater basins
M1-Moderate Slope Bound	2-5%	10-30%	<2X	Constrained; infrequent meanders	1-4	Constrained, narrow floodplain bounded by mod. gradient sideslope; typically found in lowlands/foothills, may occur on broken mountain slopes and volcano flanks
U1 - U-shaped Trough	<3%	<5%; gradually increases to >30%	>4X	Unconstrained; moderate to high sinuosity; side channels and braids common	1-4	Drainage ways in mid to upper watersheds with history of glaciation, resulting in U-shaped profile; valley bottom typically composed of glacial drift deposits overlain with more recent alluvial material adjacent to channel
U2-Incised U-Shaped Valley, Moderate Gradient Bottom	2-5%	Steep channel adjacent slopes, decreases <30% then increases to >30%	2X	Moderately constrained by unconsolidated material; infrequent short flats w/braids and meanders	2-5	Downcuts through deep valley bottom glacial till, colluvium glaciofluvial deposits; cross sectional profile variable, but generally weakly U-shaped w/active channel vertically incised into valley fill deposits; immediate sideslopes composed of unconsolidated & often unsorted coarse grained deposits
V1-V-Shaped Moderate Gradient Bottom	2-6%	30-70%	<2X	Constrained	>=2	Incised drainage w/steep competent sideslopes; very common in uplifted mountainous topography; also glacial outwash terraces in lowlands
V2-V-Shaped High Gradient Bottom	6-11%	30-70%	<2X	Constrained	>=2	Same as V1, but valley bottom longitudinal profile steep with pronounced stairstep characteristics
V3-Bedrock Canyon	3-11%	>=70%	<2X	Highly constrained	>=2	Canyon-like stream corridors with frequent bedrock outcrops, stairstepped profile; associated with faulted or volcanic landforms

Valley ˬ ˬ.ɪent Types CONTINUED

Valley Segment Type	Stream Order	Sideslope	Channel Pattern	Land Form Features	Channel Type	Channel Gradient	Large Woody Material
Lower Alluvial Valley (1)	Any	0-10%	unconstrained, highly sinuous	on lower large river floodplain/ lacustrine terrace, elevated glacial valleys	alluvial	0-5%	abundant large jams on channel margins
Alluvial Fan (2)	2-4	flat-moderate	sinuous, generally unconstrained	occurs where tributaries enter low gradient streams	alluvial	1-6%	frequent large jams and individual pieces
Steeply Incised Valley Moderate Channel Gradient (3)	2-4	steep	constrained, slightly sinuous	downcutting steep hillsides, often vertical canyon walls	bedrock, alluvial in short reaches	3-6%	infrequent large jams
Steeply Incised Valley /Steep Channel Gradient (4)	2-4	ssteep, often vertical	constrained, slightly sinuous	downcutting steep hillsides, often vertical canyon walls	bedrock, big boulder	>6%	infrequent large jams
Incised Glacial Till/Incised Colluvium Deposits (5)	2-4	steep w/flat to steep upper slopes	straight-slightly sinuous	downcutting through glacial deposits or colluvium substrate-high potential bank failure	boulder/ rubble	2-5%	abundant single pieces and occasional jams
Moderate-Slope Bound Valley (6)	1-3	flat-moderate	straight-slightly sinuous	lower foothill sand minor fault block areas as well as upper drainage areas	alluvial, short sections of bedrock	1-5%	small debris jams & single stems common
U-Shaped Glacial Trough (7)	1-3	flat	moderate-high meanders	located in bottoms and lower side slopes of U-shaped glacial valleys	alluvial	0-3%	abundant small jams and single pieces
Valleywall/Headwall Tributary (8)	1-2	moderate-steep	straight; stairstep profile	small tributaries flowing over moderate/steep hillsides	bedrock or boulder	1-5%	variable, creates stairsteps
Lava Flow/Spring Fed Meadow (9)	1-2	0-10%	slight meander	low gradient slopes and slight downcutting	alluvial or boulders	0-3%	infrequent large jams, beaver important
Alluviated Mountain Valley (10)	2-4	flat w/steep upper slopes	high meanders and braiding	wide annual floodplain, continual alluvial deposits	alluvial	0-3%	frequent jams & single pieces create pools
Moderately Incised Valley (11)	2-3	steep w/flat upper slopes	straight-slightly sinuous	steep bedrock banks with broad flat upslope areas	bedrock, boulder and rubble	3-5%	infrequent channel width jams, few single pieces

Rosgen Channel Types (After Rosgen 1994)

Stream Type	General Description	Entrenchment Ratio	Width/Depth Ration	Sinuosity	Slope	Landform/Soils/Features
Aa+	Very steep, deeply entrenched, debris transport streams	<1.4	<12	1.0 to 1.1	>.10	Very high relief. Erosional, bedrock or depositional features; debris flow potential. Deeply entrenched streams. Vertical steps with/deep scour pools; waterfalls.
A	Steep, entrenched, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel	<1.4	<12	1.0 to 1.2	.04 to .10	High relief. Erosional or depositional and bedrock forms. Entrenched and confined streams with cascading reaches. Frequently spaced, deep pools in associated step-pool bed morphology.
B	Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.	1.4 to 2.2	>12	>1.2	.02 to .039	Moderate relief, colluvial deposition and/or residual soils. Moderate entrenchment and W/D ratio. Narrow, greatly sloping valleys. Rapids predominate w/occasional pools.
C	Low gradient, meandering, point-bar, riffle/pool alluvial channels with broad, well defined floodplains	>2.2	>12	<1.4	<.02	Broad valleys w/terraces, in association with floodplains, alluvial soils. Slightly entrenched with well-defined meandering channel. Riffle-pool bed morphology.
DA	Anastomosing (multiple channels) narrow and deep with expansive well vegetated floodplain and associated wetlands. Very gentle relief with highly variable sinuosities, stable streambanks.	>4.0	<40	variable	<.005	Broad, low-gradient valleys with fine alluvium and/or lacustrine soils. Anastomosed (multiple channel) geologic control creating fine deposition w/well vegetated bars that are laterally stable with broad wetland floodplains.
E	Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio	>2.2	<12	>1.5	<.02	Broad valley/meadow. Alluvial materials with floodplain. Highly sinuous with stable, well vegetated banks. Riffle-pool morphology with very low width/depth ratio
F	Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.	<1.4	<12	>1.4	<.02	Entrenched in highly weathered material. Gentle gradients, with a high W/D ratio. Meandering, laterally unstable with high bank-erosion rates. Riffle-pool morphology
G	Entrenched "gulley" step/pool and low width/depth ratio on moderate gradients	<1.4	<12	>1.2	.02 to .039	Gulley, step-pool morphology w/moderate slopes and low W/D ratio. narrow valleys, or deeply incised in alluvial or colluvial materials; i.e. fans or deltas. Unstable, with grade control problems and high bank erosion rates.

APPENDIX C: Water Temperatures

Reference Water Temperatures of Streams in the Salt Creek Watershed: Year 1964 (Stream Survey Data)

Stream	Date	Min. (F)	Max. (F)	n =	Location of Measurement
Basin Creek	September 1964	47	47	1	Mouth
Coyote Creek	September 1964	52	52	1	Mouth
Eagle Creek	June-Oct 1964	42	54	9	Mouth, 1 temp. taken 3 mi upstream
Gobel Creek	September 1964	49	49	1	Mouth
McCredie Creek	September 1964	49	49	1	Mouth
Pepper Creek	September 1964	49	49	1	Mouth
Sage Creek	September 1964	49	49	1	Mouth
South Fork Salt Creek	June 1964	40	43	3	First bridge (Beamer) from mouth
" "	July 1964	50	57	2	Second bridge from mouth
" "	August 1964	54	56	2	1 mile upstream of mouth
" "	September 1964	46	57	2	First bridge (Beamer) from mouth
Sugar Creek	September 1964	49	49	1	Mouth
Tumble Creek	1964	N/A	N/A	--	Dry at mouth
Warner Creek	September 1964	48	48	1	Mouth
Average Temperature		**48.0**	**50.6**		

Current Salt Creek Water Temperatures: Year 1980, 1987, 1990, 1996 (Stream Survey Data)

Date	Min. (F)	Max. (F)	n =	Location of Measurement
August-Sept 1980	46.0	63.0	6	bridge near Salt Ck C.G. to Gold Lake
August 1987	62.0	62.0	2	Wicopee site
July 1990	49.0	62.0	25	Reach 1-4
August 1996	47.0	56.0	16	Reach 1-9
September 1996	40.0	54.0	17	Reach 9-10
Average Temp.	**48.8**	**59.4**		

Current Water Temperatures of Tributaries to Salt Creek (1992 and 1996 Stream Survey Data)

Stream	Date	Min. (F)	Max. (F)	n =	Location of Measurement
Diamond Creek	July 1996	54.0	51.0	31	Reach 1 and half of Reach 2
	August 1996	44.0	55.0	18	Half of Reach 2 and all of Reach 3
Deer Creek	August 1996	40.0	47.0	18	Reach 1
	September 1996	39.0	46.0	23	Reach 2
Fall Creek	July 1996	39.0	55.0	45	Reach 1-6
McCredie Creek	April 1992	43.5	49.0	6	Reach 1, 4, 5, 7, 8
South Fork Salt Creek	July 1996	52.5	55.5	2	FS road 5884 crossing of stream
	August 1996	50.0	68.0	27	Reach 1-3
	September 1996	45.0	50.0	33	Reach 5-9
Warner Creek	July 1996	45.0	56.0	33	Reach 1-3
Trib 20e 36.7	May 1992	50.0	50.0	1	Reach 1
Trib 20f 41.3	May 1992	49.0	49.0	1	Reach 1
Trib 20f 46.3	May 1992	44.0	44.0	1	Reach 1
Trib 20w 11.8	August 1992	47.0	49.0	2	Reach 1
Average Temperature		**45.8**	**52.5**		

APPENDIX D: Botanical Resources

Potential Sensitive Plant Habitats

The Regional Forester designates a list of species for which they and their habitat is managed by the Region's Sensitive Species Program in order to prevent future federal listings. Sensitive species are those that are vulnerable due to low population levels or have significant threats to their habitat (USFS, R-6 FSM). Known population locations are on the Oakridge Geographical Information System (GIS) and population information is contained in an associated advanced revelation (ADREV) database. Sensitive plant surveys conducted in the watershed are generally associated with proposed management activities (timber sales and other projects).

Many plant species are closely associated with fires, however, little is known about the maintenance and evolutional relationships of plants, animal, and fire. A current sensitive plant species, the Woodland milkvetch (*Astragalus umbraticus),* and a former sensitive species, branching montia (*Montia diffusa*), are closely associated with fire as well as being responsive to other disturbances which create openings, such as logging. The woodland milkvetch has recently been documented in the Warner Creek Fire area in the Salt Creek Drainage (Dimling/McMahan, 1993), and is the northernmost documented range for this species. It prefers open canopies, and was noted to follow moderate intensity burn patches for the Warner populations (Dimling/McMahan, 1993). Branching montia was discovered growing very profusely after the Shady Beach fire on the Rigdon District in 1988 in plant succession ecology plots. Branching montia was also found in the Baby Rock fire area on the Oakridge District (McCabe, 1993). This pattern of occurrence influenced the downlisting of the species from sensitive to a "Forest Watch List Species". It is likely the woodland milkvetch could also eventually be dropped off the forest sensitive list in view of recently documented occurrences. The central range of this species is in the Umpqua NF, just to the south of the Willamette National Forest. An assumption can be made that the North Fork of the Middle Fork of the Willamette River, the Middle Fork of the Willamette River, Salmon Creek, and the Umpqua River watersheds may have contained connected populations. Tall bugbane (*Cimicifuga elata*) has recently been documented within the Salt Creek watershed. A good-sized population was found growing within a second growth stand. This population will be included as part of a group of "selected populations" for management to maintain species viability across the species range in of the *Cimicifuga* Conservation Strategy (1996).

The following table lists habitat where sensitive plants may potentially be found in the watershed.

Habitat	Species	Habitat	Species
Mesic meadows	*Agoseris elata*	Moist woods	*Botrychium minganense*
	Calamagrostis breweri		*Botrychium monatum*
	Delphinium oreganum		*Cimicifuga elata*
	Frasera umpquaensis		*Huperzia occidentalis*
	Gentiana newberryi		*Poa laxiflora*
	Sisyrinchium sarmentosum		
	Asarum wagneri	Dry meadows/	*Agoseris elata*
		open woods	*Allium campanulatum*
Wet meadows/Bogs	*Carex livida*		*Astragalus umbraticusa*
	Lycopodiella inudata		*Frasera umpquaensis*
	Ophioglossum pusillum		*Hiercacium bolanderi*
	Oxypolis occidentalis		
	Scheuchzeria palustrisa	Rocky outcrops/	*Asplenium septentrionale*
		Cliff crevices	*Pellaea andromedaefolia*
Ponds	*Utricularia minora*		*Polystichum californicum*
	Wolffia columbiana		
	Montia howellii	Rocky slopes/Scree	*Arnica viscosa*
			Aster gormanii

Riparian	*Botrychium minganense* *Botrychium monatum* *Calamagrostis breweri* *Huperzia occidentalis* *Cimicifuga elata* *Poa laxiflora* *Sisyrichium sarmentosum*	*Campanula scabrella* *Lewisia columbiana var. clumbiana* *Romanzoffia thompsoniia*

[a] species documented in the Salt Creek Watershed

RARE AND UNIQUE PLANTS

Sensitive and rare plants, including survey and manage species, whether they occur at the edge of their range, disjunct, regional endemics and/or those found only in unique habitats are important contributors to the overall diversity of landscapes. Some may be genetically diverse (adapted to marginal conditions), and therefore necessary genotypes to maintain the species in the advent of environmental change. It is crucial to prevent the need to list these species by considering them in appropriate management actions.

Rare and plant species of concern occur are found within forested and non-forested special habitats. Six species that are listed on the WNF Watch and Concern Lists are located within the watershed. These species are located and tracked along with sensitive plant inventories and other botanical inventories conducted in Wilderness, Special Interest Areas, and other non-timber allocation areas.

Rare and Unique Plants in the Salt Creek Watershed.

Watch List Species:	Occurrence
Dulichium arundinaceum	Heather meadow
Erigeron cascadensis	Bunchgrass
Montia diffusa	Baby Rock
Sidalcea cusickii	Heckletooth Mtn.
Carex buxbaumii	Gold Lake Bog
Species Of Special Concern:	**Occurrence**
Parassia fimbriata var. hoodiana	Hells half acre

The Cascade daisy (*Erigeron cascadensis*) inhabits rock outcrops in high subalpine mountain peaks and is confined to bedrock and Scree microsites. *Parassia fimbriata var. hoodiana* is found in wet meadows, bogs, fens, along streams, and in open and forested seeps, generally in mid to high elevations. Dulichium (*Dulichium arundinaceum*) is a member of the sedge family, and is found in marshes and wet meadows in the lower mountain elevations. The branching montia (*Montia diffusa*), formerly on the sensitive list, is found in moist places. This species was delisted due to the discovery of it's being found growing profusely following major fire events. *Sidacea cusickii* occurs in open fields in valley ares; the Salt Creek watershed is in the northern part of its range. *Carex buxbaumii* is found in bogs, fens, marshes, wet meadows, streambanks; low to high elevations.

SURVEY AND MANAGE SPECIES: FUNGI, BRYOPHYTES, LICHENS, & VASCULAR PLANTS

The ROD for the Management of Habitat for Late-Successional and Old-growth Forest Related Species within the Range of the Northern Spotted Owl (USDA and USDI, 1994a) contains management direction and standards and guideline provisions for survey and manage plant and animal species generally associated with late-successional and/or riparian forests (Table C-3 list in the ROD). Ecological goals of these S&G's are to maintain late-successional and old-growth habitat and ecosystems on federal lands and to maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations. Late-successional species habitat in the watershed has declined due to extensive harvest of old-growth stands and associated road building. The current old-growth in the watershed, compared to reference conditions, has been highly fragmented. Many survey and manage species have limited dispersal capabilities, thus in fragmented habitat areas geneflow between populations may be restricted. Single species planting of desired species after harvest in riparian forests along with adjacent upland stands has contributed to a simplification of species richness in plant communities.

Survey and manage species have not yet been systematically inventoried in this watershed. The Regional Ecosystem Office (REO) is currently in the process of developing C-3 species survey protocols. Existing biological and ecological information is minimal for most of these species. However, if systematic surveys were conducted for old-growth dependent species a much larger number of sites would be found in the watershed.

Survey and Manage measures from the ROD (USDA, USDI, 1994a) which apply forestwide, regardless of allocation, are as follows:

Survey strategy 1: manage known sites

- Provisions must be made for these sites for activities implemented in 1995 and later. Survey strategies 1 and 2 are the responsibility of the National Forests.

Survey strategy 2: survey prior to activities and manage sites.

- For these species, activities implemented in 1999 or later must have completed surveys.

Survey strategy 3: conduct extensive surveys to find high priority sites for species management.

Survey strategy 4: conduct general regional surveys.

- Survey strategies 3 and 4 are more general and must be underway by 1996. These strategies are to be conducted at the regional level. Each species was rated during the analysis for the EIS and is designated certain survey strategy(ies) to follow, depending on the rarity of the species, potential threats, and numerous other factors.

Survey and Manage Species Documented Occurence in the Watershed.

Species	Survey Strategy	Habitat
Vascular plants:		
Allotropa virgata	1, 2	pole/mature/old-growth
Nitrogen fixing lichens:		
Lobaria oregana	4	mature/old-growth
Lobaria pulmonaria	4	mature/old-growth
Rare false truffle:		
Alvopa alexsmithii	1, 3	mature/old-growth
Rare Boletes:		
Gastroboletus ruber	1, 3	Old-growth
Mushrooms:		
Cantharellus cibarius	3, 4	Second growth stands
C.subalbidus	3, 4	Upper elevation areas

Fungi-

Fungi have critical roles in forested systems, contributing to nutrient cycling and changes in structural and species diversity, which in turn provides habitat for other plant and animal organisms. Mycorrhizal fungi play an important role in transferring nutrients to vascular plants. Fungal fruiting bodies, mushrooms, conks and truffles, are an important food source to small mammals; some are important for their food or medicinal value in the special forest products industry. The rare false truffle, *Alvopa alexsmithii*, is found in mature and old-growth mid to upper elevation TSME, Abies and possibly other Pinaceae forests ranging from Mt. Rainier to Willamette Pass. Rare boletes such as *Gastroboletus ruber* are found in old-growth TSME, mid to high elevations from the North Cascades to Willamette Pass. Chanterelles (*C. cibarius* and *C. subalbidus*) are both sought after as choice edibles. Golden chanterelles are not uncommon in second growth Douglas-fir stands.

Bryophytes, Hornworts, Liverworts & Mosses-

Bryophytes, the hornworts, liverworts, and mosses are small, non-green, non-vascular spore-bearing plants of highly diverse habitats from deserts to coastal shores. Like many late-successional dependent species, most bryophytes do not become established until at least 100 years, becoming well developed in much older stands (400 years) and in riparian areas on hardwoods. Like lichens, they are important to nutrient cycling, accumulate air pollutants, contribute to soil structure and stability, and are food and habitat for vertebrates and invertebrates. The traditional harvest of mosses and liverworts for floral arrangement material is a serious concern for long-term sustainability of bryophyte species and their connection to ecological processes.

Lichens-

Lichens occur on many kinds of specific substrates and habitats, either growing on trees as draping or matting epiphytes, imbedded into rocks, on exposed soil in a leaf-like form, in stream splash zones, or on decaying wood. Many lichens are critical for nitrogen-fixation, some are used for air-quality biomonitors. Many lichens are important forage, nesting material and camouflage for birds and mammals, and habitat and food for invertebrates. Forest development causes a succession of lichen species, which can grow slowly over time compared to other organisms. Late-successional lichens become established with increasing successional stabilization, which may take over 200 years, some old-growth dependent species do not become established until 500 years or so, when the ecological continuity of mature tress enable them to persist. As most lichens use vegetative propagules rather than spores as a means of dispersal, their dispersal range is relatively short. They have long been harvested as Special Forest Products for medicinal, floral, and dye-making uses.

Lobaria pulmonaria and *L. oregana* are found forest-wide in old-growth stands, and are not uncommon in the watershed.

Vascular Plants

Candystick (*Allotropa virgata*) occurs in the Salt Creek watershed. It is not considered uncommon on the Oakridge Ranger District. This species grows in deep humus, in association with coarse woody debris, in dry, well-drained soils, primarily in old-growth Douglas-fir, though this species is also found in pole and mature stands. It is a non-green mycotrophic plant that may not flower or emerge from the soil every year, instead lying dormant underground. Fire suppression, fragmentation of habitat, and reduction of large decaying logs are contributing factors to declining occurrences of this species. Candystick is slow to establish and its minute seeds have a short survival span. It does not tolerate competition well and is never abundant. Repeated thinning and shorter rotations are considered detrimental, resulting in increased competition, reduced coarse woody debris, and mechanical disturbance to the ground.

NOXIOUS WEEDS AND OTHER NON-NATIVE INVASIVE PLANT SPECIES

Non-native plant species have been introduced into Oregon since European settlers began arriving into the state for uses such as ornamentals and herbal medicines. Many noxious weeds species spread from gardens or contaminants brought in inadvertently from shipping goods from other areas. Scotch broom was introduced as an ornamental shrub and erosion control agent in the 1920s. The advent of logging forest land and building roads produced an abundant increase in noxious weeds and invasive non-natives since the 1930s, when many noxious weeds would have been considered newly invading species. Livestock grazing on forest land utilized on-site forage and initially did not contribute as much towards non-native invasion as did logging practices, but sheep grazing in non-forested openings likely brought in St. John's-wort and other non-native grass and forb species.

Non-native plant species play a significant role in influencing changes to native plant communities. Many noxious weed species and other non-native invasive plants are found in the watershed. Many of these species are firmly established and have been for some time now, and some are currently increasing in their rate of spread largely due to logging and road building practices over the long term assisting in the establishment of dispersal pathways and mechanisms.

Those non-native plant species legally designated as noxious, mean "any weed designated by the Oregon State Weed Board that is injurious to public health, agriculture, recreation, wildlife, or any public or private property" (ODA Noxious Weed Policy and Classification System, 1995). Several detrimental effects are included as the basis for criteria for rating and classifying weeds as noxious, one being "a plant species that is or has the potential of endangering native flora and fauna by its encroachment in forest and conservation areas" (ODA, 1995). Most northwest weeds are originally native to Europe or Asia and were introduced intentionally or by accident. Noxious weeds and other invasive non-natives have the potential to alter native plant communities as they are able to displace and outcompete native species. They are opportunists with broad ecological tolerances, can grow under a wide range of climatic and soil conditions, and have excellent reproductive capabilities (Taylor, 1990).

The Willamette NF initiated the Integrated Weed Management Plan (WNF IWMP) in 1993 (USDA, 1993a). The standards and guidelines in the forest plan directs us to identify and analyze noxious weed sites for the most effective control methods based on site-specific analysis of populations. The highest priority species for treatment are new invader species that are in the early stages of invasion and have not naturalized to the point that resource damage is occurring. New invaders are of biological concern in the watershed because of their potential to move from road systems in established sites into natural non-forested openings where they could outcompete natives. Control of new invaders may include hand-pulling, mechanical mowing or chemical application depending upon the characteristics of the site, closeness of water and/or human uses. Established infestations are weed species populations that have spread to the point that eradication is impossible and resource damage is unacceptable. Due to the sheer degree of infestations, control methods are generally limited to biocontrol agents, which involve the use of insects that naturally feed upon that plant and its seeds, affecting the vigor and reproduction abilities of the targeted weed. Noxious weeds are classified on the Willamette NF as potential invader, new invader, or established species in the WNF IWMP. The following table lists the documented noxious weeds, potential noxious invaders, and several noted invasive non-natives:

Common Name	Scientific Name	ODA Noxious Weed Classification
rough pigweed	*Amaranthus retroflexus*	none
dog fennel	*Antlemis cotuls*	none
cheatgrass	*Bromus tectorum*	none
butterfly bush	*Buddljea*	none
diffuse knapweed	*Centaurea diffusa*	potential
spotted knapweed	*Centaurea maculosa*	new, established
meadow knapweed	*Centaurea pratense*	new, established
yellow starthistle	*Centaurea solstitialis*	potential
ox-eye daisy	*Chrysanthemum leucanthemum*	none
Canada thistle	*Cirsium arvense*	established
bull thistle	*Cirsium vulgare*	established
field bindweed	*Colvulvulus arvensis*	new
houndstounge	*Cynoglossum officinale*	potential
hedgehog dogtail	*Cynosurus echinatus*	none
scotch broom	*Cytisus scoparius*	established
wild carrot	*Daucus carota*	none
teasal	*Dipsacus sylvestris*	none
leafy spurge	*Euphorbia esula*	potential
English ivy	*Hedera helix*	none
St. John's-wort	*Hypericum perforatum*	established
spotted cat's-ear	*Hypochaeris radicata*	none
wall lettuce	*Lactuca muralis*	none
nipplewort	*Lapsana communis*	none
everlasting peavine	*Lathyrus latifolius*	none
dalmation toadflax	*Linaria dalmatica*	new
yellow toadflax	*Linaria vulgaris*	new
bird's foot trefoil	*Lotus corniculatus*	none
rose campion	*Lychnis coronaria*	none
purple loosestrife	*Lythrum salicaria*	potential
coast tarweed	*Madia sativa*	none
sweet clover	*Melilotus sp.*	none
canary reedgrass	*Phalaris arundinacea*	none
plantian	*Plantango lanceolata*	none
bulbous bluegrass	*Poa bulbosa*	none
Giant knotweed	*Polygonum sachalinense*	new, established

heal-all	*Prunella vulgaris*	none
red sorrel	*Rumex acetosella*	none
curly dock	*Rumex crispus*	none
Himalaya blackberry	*Rubus discolor*	none
evergreen blackberry	*Rubus lacinatus*	none
tansy ragwort	*Scenecio jacobaea*	established
tansey	*Senecio vulgaris*	established
climbing nightshade	*Solanum dulcamara*	new, invader
spiny sowthistle	*Sonchus asper*	none
dandelion	*Taraxacum officianle*	none
gorse	*Ulex europaeus*	new
mullein	*Verbascum*	none
periwinkle	*Vinca major*	none

Invasion and Establishment of non-native plants in the watershed are a serious threat to native plant diversity. The WNF Integrated Weed and Management Environmental Analysis lists seven site types where potential occurs to harbor noxious weeds already established on the forest and potential invader weeds. All of these site types are found within the watershed. Site types range from bare, rocky, gravely ground such as road beds, quarries, etc., to floristically diverse areas such as meadows, sensitive plant sites, wetlands, etc.

Roadside inventories on the Oakridge Ranger District of noxious weeds were conducted by the ODA in 1988 and again in 1993. The results of these inventories have shown that some noxious weed species have increased in an alarming rate of spread. For instance, scotch broom (*Cytisus scoparius*) was calculated to have infested an additional 35% of sections and increased the number of roads infested to 51% (Glen Miller, pers. comm.).

Major forest roads and other corridors, such as right-of-way clearances, serve as noxious weed dispersal pathways and establishment sites. Timber sale units, associated roads and landing sites, trails, and other disturbed openings have seral conditions which typically support weed populations. Other spread mechanisms in the watershed include bird and mammal seed dispersal and weed seed contamination of forage and erosion control seeding mixes.

Scotch broom is abundant in the lower elevation reaches of the watershed, particularly on river banks, gravel bars, roadsides, and other areas where past ground disturbance has resulted in openings. It competes with young conifers in plantations. This species is eventually outcompeted, due to lack of sunlight. A biocontrol agent, the seed feeding weevil (*Apion fuscirostre*), has been used on scotch broom since the 1980's and releases will be continued. Isolated targets will be emphasized in future releases. Scotch broom is a designated target or "T" weed, a selected weed that is included in an annual list of species the ODA develops to prioritize those species considered to be an economic threat to the State of Oregon and receive more intensive control treatments.

Spotted knapweed (*C. maculosa*) has numerous documented sites within the watershed, mostly scattered along Highway 58. These are small roadside populations that were sprayed with herbicide in 1996 by the Oregon Department of Agriculture as part of their noxious weed control program. This species has also been given priority status as a target weed for established population control work and slowing population spread on the forest. It has been moving eastwards over the Cascade Crest through major travel routes and is considered a major threat to native biodiversity (USDA, 1993a). Several types of biocontrol agents are being considered for use in the spotted knapweed control program.

Bull and Canada thistle (*C. vulgare* and *C. arvense*) are commonly found in timber sale clear cuts, landings, roadside sites and other areas with prior ground disturbance and open canopies in the watershed. These weeds are also found in meadow communities. These are early seral species and eventually become shaded out with canopy closure, therefore are of low risk to forested interiors. Galls formed by the fly larvae of *Urophora stylata* are presently being used on bull thistle to reduce flower head formation to prevent seed dispersal.

Tansy ragwort (*Senecio jacobea*) is widely established west of the Cascades in Oregon and is moving east over the crest of the Cascades (USDA, 1993a). Tansy ragwort is well established in the watershed. Biocontrol agents have been in use on the district since late 1970s to control tansy densities and are still currently being released. The root-eating flea beetle (*Longitarsus jacobaea*), was last released on rosettes on several tansy populations within the watershed in winter 1995. The Cinnabar moth (*Tyria jacobaeae*) was first released in Western Oregon in the 1960's to combat tansy ragwort. The moth was not tested thoroughly enough to determine plant host specificity (this testing and release of bio-control agents is accomplished by the APHIS, a section of the Federal Dept. of Agriculture) (MF WA, 1995). The Cinnabar moth was released on tansy ragwort populations to cause defoliation. Cinnabar moth defoliation damage to related native sencecio species such as arrow-leaf groundsel (*S. Triangularis*) has recently been of concern on the Rigdon District, where moderate impacts on the plant has been identified (MF WA, 1995). However, the cinnabar moth does not fare well during cold, wet spells, and eventually will disappear from the system (Glen Miller, pers. comm.). Informal tracking of such damage is now emphasized during SHAB surveys. Tansy ragwort has been included on the latest "T" list for future priority control work.

St. John's-wort (*Hypericum perforatum*) is an aggressive pioneer species which poses a threat to plant communities in dry and mesic meadow openings by displacing native forb and grass species via underground spread and seed set (USDA, 1993a). These areas often contain natural soil disturbers such as groundhogs and mountain beavers, who provide conditions where this pioneer weed thrives. It has become a common roadside noxious weed in the watershed. It is now found in most natural meadows on the district.

Giant knotweed (*Polygonum sachalinense*) is another invader of concern. Populations have been established on private lands in the Westfir area along the North Fork Willamette River and in the Oakridge City limits. Populations have recently been noted on the Rigdon District (E. Everett, pers. comm. and G. Craig, pers. comm.) and is found elsewhere in the Cascades. Several undocumented sites occur in the Westfir and Oakridge city limits as landscape plants and as established escaped populations. This species was introduced into the Coast Range to stabilize stream banks and is now widespread there in riparian areas (MF WA, 1995).

Weed competition is openly occurring with desirable native plant species in reforestation project areas, wildlife use areas (including small wetlands and river floodplains) and it has also been noted that some weeds are extending into natural dry/moist meadow openings and rock garden communities. In many areas, non-desirable weed species are excluding other desirable plants to the point of forming dense weed patches and thickets. The following are some of the weed species that have been documented or have the potential of occurring within the watershed:

The non-native invasive Himalayan and evergreen blackberries (*Rubus discolor* and *R. lacinatus*) flourish in floodplain sites and form monocultures which often extend underneath the forest canopy. Historically, blackberries are locally abundant in lower elevations, especially along river floodplains on the district and their potential rate of spread in the watershed is of concern. They are of particular concern because there are currently no biological controls available to use on blackberries and they have the potential to directly compete with the sensitive plant, tall bugbane, by occupying the same habitat (S. Santiam WA, 1995). They have not been systematically surveyed on the forest, but are now a priority for informal tracking of new infestations and rate of spread. Blackberries have also been found at higher elevations (up to 4,000 feet) at several locations in the watershed, in moist ground along roadsides and in openings. Their vigor is noticeably less higher up due to harsher site conditions.

Ox-eye daisy (*C. leucanthemum*), another weed of concern, has become common along roads, in disturbed forest openings and in meadows. This species forms dense colonies and populations could move up into higher elevation reaches, invading meadows and reducing native plant diversity. This could be of special concern in wilderness and other special areas of botanical and wildlife interest.

Sweet pea (*Lathyrus latifolius*), another potential species of concern, has been documented along lower elevation roadsides on the Lowell Ranger District and the Oakridge District. This species could potentially spread farther into the watershed.

Purple loosestrife (*Lythrum salicaria*) is a noxious weed currently on the Forest's potential invader list of concern to watershed plants and wildlife. Purple loosestrife is found in extremely wet habitats, and is currently invading the state of Oregon and is becoming established in the Willamette Valley. Biodiversity in wetland habitats within the watershed could potentially be seriously disrupted and wildlife habitat decreased by this very aggressive species. Prolific spread of purple loosestrife is accomplished by seed set (up to 3 million per plant annually) lasting several years, waterborne seed transport, and sprouting by fragmentation of plant parts and roots (ODA, 1995). No occurrence of this weed has yet been documented in the Willamette, however, it is expected to eventually make its way into the forest (Glen Miller, pers. comm.).

Canary reedgrass (*Phalaris arundinacea*) is present in the watershed. This grass is a very effective and widespread invader and has the potential to spread into upper elevations and wilderness areas. It is currently in use; propagated and dispersed for revegetation purposes (E. Everett, pers. comm.).

RIPARIAN THINNING ANALYSIS

On August 12, 1996 Al Johnson (hydrologist), Eric Ornberg (planner/silviculturist), Dede Steele (wildlife biologist), Tim Bailey (planner/silviculturist), and Mike Jenson (forester) met to determine whether thinning young managed stands within riparian reserves is needed to achieve Aquatic Conservation Strategy Objectives (ROD, page B-11) and if so, to develop prescriptions for these stands that are typically 35 to 45 years old and created by past harvest.

We were especially interested in these questions as most young managed stands contain riparian reserves as prescribed by the Northwest Forest Plan. We wanted to come to a common understanding as to whether it was appropriate and desirable to thin within riparian reserves (especially in regards to Willamette National Forest Land and Resource Management Plan MA 15-07 and FW-103) and if so, how thinning prescriptions should differ between riparian zones and Matrix and other adjacent lands.

Based upon typical age, densities, and general condition of these young stands, we feel it is appropriate to implement some thinning in riparian reserves. In consideration of our desire to minimize the number of harvest entries, therefore minimizing the amount of soil and residual tree disturbance, and the objective to increase within-stand structural diversity, we determined that some amount of thinning within young, managed riparian reserve stands is desirable and in many cases essential to achieve Aquatic Conservation Strategy objectives. We also determined that there should be no thinning within 50 feet of perennial channel edges or within 10 to 25 feet of intermittent streams or their inner gorge. This should maintain or improve current water temperatures, provide for a constant high level of fine organic material input, maintain existing rooting strength, and avoid the possibility of channel edge disturbance. We also recognized that often times the conifers immediately adjacent to the stream channels are not particularly dense due to the greater diversity of tree and shrub species in riparian environments, so there is often a lesser need to thin to promote diversity or to generate larger conifer stems near channel edges.

Recognizing that we want to assure (for both aquatic and terrestrial habitat long-term objectives) these stands will contain large-diameter dominant trees in the future, we believe thinning at some level is necessary within dense young stands in the riparian reserve. To reduce changes in microclimate however, we initially suggested that riparian reserve thinning be less intensive than what would be prescribed for Matrix and other adjacent lands.

Perennial Streams: The critical factor for these streams is shading and stream temperature since the Willamette National Forest Land and Resource Management Plan (MA 15-07) mandates trout stream temperatures be reduced in this watershed. Our discussion centered upon whether and how much the canopy within the zone of temperature influence could be reduced without significantly affecting stream temperatures.

Intermittent Streams: Stream stability is the critical factor. Shading is not as important since these streams are often dry during critical high heat period.

<u>Recommendations-</u>
With these qualifications, our recommendations for thinning in riparian reserves for the Salt Creek watershed are as follows:

- No thinning should occur within 50 feet of any perennial stream channel (Class I, II, or III).
- No thinning should occur within 10 to 25 feet of the edge of the inner gorge, or if there is no inner gorge, then within 10 to 25 feet of the channel, on any intermittent stream (class IV).
- The portion of the riparian reserve from the edge of the unthinned area to the edge of the riparian reserve should be thinned to a lesser degree than Matrix and other adjacent lands. Riparian reserves should be thinned to a canopy closure of no less than 25 percent on average, or to an average spacing between dominant conifers of 20 feet (110 TPA). In some areas it may be appropriate to leave additional trees (beyond desired stocking level) to provide for

snag and/or down wood habitat. For example in stands that are in areas deficient in snag habitat or where Class I and II LWD levels are low.

- The no harvest areas immediately adjacent to perennial channels could be narrower than 50 feet if site specific conditions indicate a need (i.e. very dense, stagnated stands), but will be no narrower than 20 feet. This situation is not expected to occur very often.

- Precommercial thinning could occur even closer to stream channels than above if the stand is dense. Serious consideration should be given to a fairly wide precommercial spacing in riparian zones to establish fast diameter growth early on in the hope of avoiding the need to commercially thin later when a change in microclimate and damage to understory vegetation could be of concern.

- Wetlands and special habitats less than one acre should be protected with a no-harvest buffer at least 50 foot wide and thinned the same as prescribed for Matrix and other adjacent lands in the remainder of the riparian reserve. In special situations where there is a need identified, this no-harvest buffer could be greater or a two-level thinning prescription could be implemented. In any case, such areas should be treated in accordance with the Forest Plan.

Advantages-
We identified the following advantages to thinning at a reduced spacing (compared to thinning prescriptions for Matrix and other adjacent lands) in the riparian reserves, while leaving a no-cut area adjacent to the channel:

- It would better buffer microclimate changes (temperature of air, soil, water; humidity; solar radiation; etc.) in the unthinned area immediately adjacent to the channels.

- The amount of crown damage and resultant microclimate changes and periods of crown closure recovery would be less than expected from a heavy thinning.

- There would be less potential for damage to understory layers near stream channels.

- It might provide better currently available dispersal habitat and more immediately effective dispersal corridors.

- It would provide for greater overall within-stand structural and species diversity.

- The reduced spacing prescription would leave more options for wildlife tree/large woody debris management, i.e. more trees would be available for falling or girdling without additional microclimate impacts or without causing the stands to become understocked.

- It would provide stand conditions with less potential for losses from windthrow.

Disadvantages-
We identified the following disadvantages of thinning the riparian reserves to a potentially lesser spacing than adjacent lands:

- There would be a reduced rate of diameter growth in the riparian reserve as compared to Matrix and other adjacent lands. This could result in a stand within the riparian reserve which has noticeably smaller dominant tree diameters as compared to Matrix and other adjacent areas in the future (50 to 100 years). There would also be a slower development of typical late-successional characteristics, such as deep crowns and establishment of a shade tolerant conifer understory.

The above stated advantages of thinning riparian reserves to a lesser spacing are more numerous than the disadvantages but it should be noted that the disadvantage of creating riparian stands with diameters smaller than the stands as a whole as the result of a different thinning prescriptions is of some concern. It should also be noted that many of the advantages are only short-term advantages and the disadvantage of slower relative diameter growth and longer establishment time for a shade tolerant understory is a long-term disadvantage. Potential micro-climate changes resulting from a heavier thinning might not last much longer than a decade, possibly less. That not withstanding, we have still opted to take a conservative approach in the short-term effects and have recommended that riparian reserves be thinned to leave a somewhat greater leave tree density to avoid potential excessive changes in micro-climate and general stand disturbance.

It should be kept in mind that growth rates for stands thinned as we suggest should be monitored and modeled, including a projection of diameter growth for the thinning prescriptions proposed. If we begin to see a trend indicating that riparian stands in decades hence may be of considerably smaller diameter than adjacent upland stands such that we may not be able to produce stems of sufficient size to fully meet aquatic conservation strategy objectives within a reasonable period of time, we should then reconsider this conservative approach to thinning within riparian reserves.

How Thinning In Riparian Reserves Relates To The Northwest Forest Plan Aquatic Conservation Strategy Objectives

This discussion focuses on proposed thinning of young managed stands (from 25 to 50 years of age) created by past clearcut harvest. This past harvest did not treat riparian zones differently than upslope areas and the stands are more or less homogenous across the slope. As of this writing most of the stands in this age range contain moderate to large amounts of large woody debris in and near stream channels as well as in upland areas but they contain essentially no large residual trees or snags. Most of these young stands were planted almost exclusively with Douglas-fir, though other species have naturally established to a greater or lesser extent. These stands were densely planted and those proposed for thinning are quite dense, often to the extent that tree mortality is currently occurring, or soon will, and understory ground vegetation is sparse to non-existent. Thinning is proposed in the riparian portion of these managed stands generally to create a stand more diverse structurally and biologically, and to assure that riparian stands have comparable stem size distribution and understory composition as adjacent thinned upland stands. How thinning specifically affects the nine Aquatic Conservation Strategy Objectives presented on page B-11 of the Northwest Forest Plan follows below:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to assure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Thinning will help to better achieve this objective. Thinning is proposed in these young stands to provide for a more diverse riparian and terrestrial stand by opening up the canopy somewhat such that shade tolerant conifers and ground vegetation can become established or to provide for the more vigorous growth of that which already exists. Thinning will also provide for greater long-term structural diversity by generating larger stem diameters, overall greater variation in stem sizes, a structurally more complex dominant tree crown (deeper, with thicker branches) and future sources of appropriately large snags and down woody material. If these dense, young stands are not thinned there will be, to a large extent, a detrimental impact on aquatic and terrestrial populations and communities in the long-run as these stands may take a very long time to generate large stem calipers and late-successional habitat conditions in general if they remain at their current densities.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.

Thinning will not affect the connectivity these recovering riparian stands now provide. While there may be some short-term negative effects in terms of micro-climate changes by reducing the current crown coverage, or in terms of branches and trees tops creating barriers to animal movement, there is an overall benefit in creating more structurally complex habitat for animals to travel through in the future.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.

Yarding systems and harvest prescriptions would be designed to protect and maintain channel stability in all cases including intermittent stream channels. Riparian areas within 10 to 50 feet of stream channels would generally not be thinned. Trees to be removed will not be transported across stream channels unless an analysis shows that additional road construction needed to avoid yarding across streams would be more harmful than a narrow skyline corridor through the riparian area. Skyline yarding corridors across stream channels would be minimized, however where analysis determined that yarding across a stream channel could be accomplished while protecting streambanks and channels, stream crossing corridors would be allowed. Logs would be fully suspended above intermittent and perennial stream channels unless analysis determined yarding could be accomplished while maintaining objectives for protection streambanks and channels.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.
Thinning would have a neutral effect on water quality in the short run. In the long run it may have a slightly beneficial effect as thinning will speed up the creation of large stems, some of which will eventually fall into the streams to provide for more stable channels. Retention of all trees within 50 feet of perennial stream channels will provide for shade to maintain cool stream temperatures during critical summer months.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.
See the above discussion; thinning will have neutral effect on sediment regimes as long as road construction effects are balanced with the desire to minimize yarding across stream channels. Thinning would enhance development of course woody material which when incorporated into stream channels has beneficial effects on storage and routing of sediment. No harvest areas adjacent to stream channels will reduce the potential for stream bank erosion.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.
Thinning will have a neutral effect on in-stream flows. Though thinning would reduce the amount of evapotranspiration in riparian zones and adjacent uplands, this effect would be very temporary; there would not be long-term change in the amount of leaf area supported by these sites. To a large extent thinning can be thought of as an activity that re-structures, rather than reduces, the vegetation occurring on a site. Thinning would also have a long-term positive effect on sediment, nutrient, and wood routing as discussed in objectives 4. and 5. above.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.
Thinning will have a neutral effect on the timing and variability of floodplain inundation and wetland water table levels, similar to the effects on in-stream flows as discussed above.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration to supply amount and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
Thinning is proposed in riparian stands primarily to better accomplish this strategic objective. Thinning will modify the species composition of these stands to more closely approximate the composition of stands occurring in these riparian areas prior to the regeneration harvest. Reducing the density of these stands will provide for growth of large tree boles which will ultimately have a number of positive effects on channel stability and complexity, as well as general stand structural diversity. Thinning will provide for the establishment and growth of understory vegetation which will provide for greater structural a diversity and for better thermal regulation and nutrient filtering. Thinning will have a neutral effect on surface and bank erosion. Thinning, through the eventual generation of larger in-channel woody debris, could influence future channel migration but the introduction of larger woody debris could also enhance channel stability.

9. Maintain and restore habitat to support well-distributed populations of native plant invertebrate, and vertebrate riparian species.

The young, previously managed stands proposed for thinning do not currently comprise late-successional habitat. One of the primary objectives of this proposed thinning is to make these dense, young stands more diverse from a structural and species composition perspective. Thinning will ultimately produce a more structurally diverse stand which will provide for development of more diverse plant and animal communities.

RIPARIAN RESERVE WIDTHS AND SITE POTENTIAL TREES

The following is a summary of the site potential tree data and riparian reserve widths recommended by the forest for our four major vegetation series. This data will be forwarded (5/96) to REO for final approval. These site potential tree heights may be used to determine the interim riparian reserve widths pending REO approval (according to Neal Forrester). Note that in some cases (*) the ROD default of 150' prevails for stream classes I, II, and III. Riparian reserve widths are slope distance. These riparian reserve widths are based on the assumption that no other "whichever is greatest" condition exists.

Vegetation Series	Douglas-fir	Western Hemlock			Silver fir	Mountain Hemlock
Site Class	All	2	3+4	5	All	All
Site Tree	155	222	172	115	147	127

Riparian Reserve Width (each side)

Stream Class:	Douglas-fir	Western Hemlock			Silver fir	Mountain Hemlock
I and II	310	444	344	300*	300*	300*
III	155	222	172	150*	150*	150*
IV	155	222	172	115	147	127

* - Based on ROD default of 150 feet

** - Includes lakes and natural ponds

*** - Includes constructed ponds and reservoirs, and wetlands greater than one

APPENDIX E: Terrestrial Wildlife

The following terrestrial wildlife species shown in the table below are listed by the US Fish and Wildlife Service as threatened, endangered, or candidates for listing are included on the R6 Regional Foresters Sensitive Species List, and are documented or suspected on the Willamette National Forest.

Common Name	Scientific Name	Documneted on WNF[a]	Documented in Watershed[a]	Federal Status[b]
Amphibians/Reptiles				
Northern red-legged frog	*Rana aurora aurora*	D	D	C2
Northwestern pond turtle	*Clemmys marmorata marmorata*	D	S	C2
Birds				
Northern spotted owl	*Strix occidentalis caurina*	D	D	T
Northern bald eagle	*Haliaeetus leucocephalus*	D	D (not nesting)	T
American peregrine falcon	*Falco peregrinus anatum*	D	D	E
Ferruginous hawk	*Buteo regalis*	S	U	C2
Harlequin duck	*Histrionicus histrionicus*	D	D	C2
Greater sandhill crane	*Grus canadensis tabida*	D	S	
Mammals				
California wolverine	*Gulo gulo luteus*	D	D	C2
Pacific western big-eared bat	*Plecotus townsendii townsendii*	D	S	C2
White-footed vole	*Phenacomys albipes*	D	S	C2

[a]= D=Documented, S=Suspected, U=Unknown - habitat may exist, USDA Forest Service
[b]= USDI FWS
C2= Candidate for listing by the USFWS (listing is possibly appropriate but conclusive information is lacking)
E= Listed as Endangered by the USFWS
T= Listed as Threatened by the USFWS

Terrestrial Wildlife CONTINUED

Wildlife Species that use Special or Unique Habitat for Breeding/Reproduction

Habitat Feature: Snags

Birds	Habitat Type
American kestrel	1
Barrow's goldeneye	1
European starling	1
Vaux's swift	1
black-backed woodpecker	1
black-capped chickadee	1
brown creeper	1
bufflehead	1
chestnut-backed chickadee	1
common barn-owl	1
common merganser	1
downey woodpecker	1
hairy woodpecker	1
hooded merganser	1
house wren	1
mountain bluebird	1
mountain chickadee	1
northern flicker	1
northern pygmy-owl	1
northern saw-whet owl	1
osprey	1
pileated woodpecker	1
red-breasted nuthatch	1
red-breasted sapsucker	1
song sparrow	1
spotted owl	1
three-toed woodpecker	1
tee swallow	1
violet-green swallow	1
western bluebird	1
western screech-owl	1
white-breasted nuthatch	1
white-headed woodpecker	1
wood duck	1
Bewick's wren	2
great horned owl	2
house finch	2

Herptiles	Habitat Type
Oregon slender salamander	2
clouded salamander	2

Mammals	Habitat Type
California myotis	1
Douglas squirrel	1
Virginia opossum	1
Yuma myotis	1
big brown bat	1
fisher	1
long-eared myotis	1
long-legged myotis	1
marten	1
northern flying squirrel	1
raccoon	1
silver-haired bat	1
western gray squirrel	1
black bear	2
bobcat	2
bushy-tailed woodrat	2
deer mouse	2
gray fox	2
hoary bat	2
little brown myotis	2
porcupine	2
spotted skunk	2
yellow-pine chipmunk	2

Note: 1 = Primary Habitat 2 = Secondary Habitat

Habitat Feature: Logs and Down Material

Birds	Habitat Type
Bewick's wren	1
Townsend's solitaire	1
house wren	1
ruffled grouse	1
rufous-sided towhee	1
turkey vulture	1
winter wren	1
Barrow's goldeneye	2
California quail	2
common merganser	2
dark-eyed junco	2
mountain chickadee	2
red-breasted sapsucker	2
song sparrow	2
white-breasted nuthatch	2
wood duck	2

Herptiles	Habitat Type
Oregon slender salamander	1
clouded salamander	1
common garter snake	1
ensatian	1
northern alligator lizard	1
ringneck snake	1
rubber boa	1
sharptail snake	1
western red-backed salamander	1
western skink	1
northwestern garter snake	2
western rattlesnake	2

Mammals	Habitat Type
Townsend's chipmunk	1
Trowbridge's shrew	1
Virginia opossum	1
black bear	1
bobcat	1
bushy-tailed woodrat	1
coyote	1
creeping vole	1
deer mouse	1
dusky shrew	1
ermine	1
fisher	1
golden-mantled ground squirrel	1
gray fox	1
heather vole	1
long-tailed vole	1
long-tailed weasel	1
marten	1
mink	1
mountain beaver	1
porcupine	1
red fox	1
shrew-mole	1
spotted skunk	1
water shrew	1
western red-backed vole	1
wolverine	1
Townsend's vole	2
coast mole	2
dusky-footed woodrat	2
mountain lion	2
snowshoe hare	2
striped skunk	2
vagrant shrew	2
yellow-pine chipmunk	2

Note: 1 = Primary Habitat 2 = Secondary Habitat

Terrestrial Wildlife CONTINUED

WILDLIFE GUILDS OF THE WILLAMETTE NATIONAL FOREST

Early and Mid Seral Stage Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
red fox	TLME	northwestern garter snake	TSME
rough-legged hawk	TLME	racer	TSME
swainson's hawk	TLME	scrub jay	TSME
badger	TMME	western fence lizard	TSME
merlin	TMME	western kingbird	TSME
rosy finch	TMPE	western pocket gopher	TSME
Brewer's sparrow	TSGE	Lincoln's sparrow	TSPE
Tennessee warbler	TSGE	MacGillivray's warbler	TSPE
western terrestrial garter snake	TSGE	Townsend's vole	TSPE
Bewick's wren	TSGEM	golden-crowned sparrow	TSPE
house wren	TSGEM	horned lark	TSPE
western skink	TSGEM	lark sparrow	TSPE
willow flycatcher	TSGEM	lazuli bunting	TSPE
American goldfinch	TSME	mountain bluebird	TSPE
Brewer's blackbird	TSME	night snake	TSPE
California ground squirrel	TSME	orange-crowed warbler	TSPE
California quail	TSME	ring-necked pheasant	TSPE
black-tailed rabbit	TSME	savannah sparrow	TSPE
bushtit	TSME	vesper sparrow	TSPE
calliope hummingbird	TSME	water pipit	TSPE
fox sparrow	TSME	western bluebird	TSPE
gopher snake	TSME	western meadowlark	TSPE
green-tailed towhee	TSME	white-crowned sparrow	TSPE
lesser goldfinch	TSME	white-throated sparrow	TSPE
mountain quail	TSME	wrentit	TSPE
northern shrike	TSME		

Mid and Late Seral Stage Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
barred owl	TLML	northern flying squirrel	TSGML
fisher	TLML	red-breasted nuthatch	TSGML
marten	TLML	varied thrush	TSGML
northern goshawk	TLML	western red-backed vole	TSGML
northern spotted owl	TLML	white-breasted nuthatch	TSGML
pileated woodpecker	TLML	white-winged corssbill	TSGML
black-backed woodpecker	TMML	Cordilleran flycatcher	TSPL
northern three-toed woodpecker	TMML	Pacific slopeflycatcher	TSPL
Oregon slender salamander	TSGML	Trowbridge's shrew	TSPL
Townsend's warbler	TSGML	brown creeper	TSPL
Williamson's sapsucker	TSGML	red tree vole	TSPL
hermit warbler	TSGML	shrew-mole	TSPL

Terrestrial Wildlife CONTINUED

WILDLIFE GUILDS OF THE WILLAMETTE NATIONAL FOREST (CONTINUED)

Riparian and Special Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
American coot	LKRVA	Cascade torrent salamander	LKRVARML
American widgeon	LKRVA	Pacific giant salamander	LKRVARML
California gull	LKRVA	*Pacific water shrew*	LKRVARML
Caspian tern	LKRVA	belted kingfisher	LKRVARML
Glaucous-winged gull	LKRVA	bufflehead	LKRVARML
Greater scaup	LKRVA	common goldeneye	LKRVARML
Greater white-fronted goose	LKRVA	common merganser	LKRVARML
Pacific loon (Arctic)	LKRVA	harlequin duck	LKRVARML
blue-winged teal	LKRVA	hooded merganser	LKRVARML
bonaparte's gull	LKRVA	tailed frog	LKRVARML
canvasback	LKRVA	water shrew	LKRVARML
cinnamon teal	LKRVA	wood duck	LKRVARML
common loon	LKRVA	Anna's hummingbird	LKRVRE
dunlin	LKRVA	common yellowthroat	LKRVRE
eared grebe	LKRVA	marsh wren	LKRVRE
Eurasian widgeon	LKRVA	purple martin	LKRVRE
gadwall	LKRVA	yellow-breasted chat	LKRVRE
green-winged teal	LKRVA	American redstart	LKRVRG
horned grebe	LKRVA	bank swallow	LKRVRG
leach's storm petrel	LKRVA	northern rough-winged swallow	LKRVRG
lesser scaup	LKRVA	warbling vireo	LKRVRG
northern pintail	LKRVA	downy woodpecker	LKRVRML
northern shoveler	LKRVA	red-eyed vireo	LKRVRML
oldsqaw	LKRVA	white-footed vole	LKRVRML
red phalarope	LKRVA	American bittern	SPCL
red-throated loon	LKRVA	Long-billed dowitcher	SPCL
redhead	LKRVA	Solitary sandpiper	SPCL
ring-billed gull	LKRVA	*Sora*	SPCL
ruddy duck	LKRVA	Townsend's big-eared bat	SPCL
snow goose	LKRVA	Virginia rail	SPCL
surf scoter	LKRVA	acorn woodpecker	SPCL
trumpeter swan	LKRVA	barn owl	SPCL
tundra (whistling) swan	LKRVA	barn swallow	SPCL
western grebe	LKRVA	black swift	SPCL
white-winged scoter	LKRVA	bushy-tailed woodrat	SPCL
Canada goose	LKRVARE	cliff swallow	SPCL
killdeer	LKRVARE	common snipe	SPCL
mallard	LKRVARE	greater yellowlegs	SPCL
water vole	LKRVARE	house mouse	SPCL
western pond turtle	LKRVARE	least sandpiper	SPCL
Dunn's Salamander	LKRVARG	lesser yellowlegs	SPCL
bald eagle	LKRVARG	northern harrier	SPCL
beaver	LKRVARG	northern waterthrush	SPCL
bullfrog	LKRVARG	pectoral sandpiper	SPCL
common egret	LKRVARG	peregrine falcon	SPCL
double-crested cormorant	LKRVARG	pika	SPCL
great blue heron	LKRVARG	prairie falcon	SPCL
green-backed heron	LKRVARG	red-winged blackbird	SPCL
mink	LKRVARG	rock dove	SPCL
muskrat	LKRVARG	rock wren	SPCL
nutria	LKRVARG	sandhill crane	SPCL
osprey	LKRVARG	semipalmated plover	SPCL
pied-billed grebe	LKRVARG	*short-horned lizard*	SPCL
ring-necked duck	LKRVARG	spotted frog	SPCL
river otter	LKRVARG	spotted sandpiper	SPCL
white-faced ibis	LKRVARG	white-headed woodpecker	SPCL
American dipper	LKRVARML	yellow-bellied marmot	SPCL
Barrow 's goldeneye	LKRVARML		

Terrestrial Wildlife CONTINUED

WILDLIFE GUILDS OF THE WILLAMETTE NATIONAL FOREST (CONTINUED)

Generalist Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
American crow	TLGG	clouded salamander	TLGG
black bear	TLGG	coast mole	TLGG
bobcat	TLGG	common garter snake	TLGG
common raven	TLGG	dark-eyed junco	TLGG
coyote	TLGG	deer mouse	TLGG
gray fox	TLGG	dusky shrew	TLGG
gray wolf	TLGG	ermine	TLGG
lynx	TLGG	evening grosbeak	TLGG
mountain lion	TLGG	golden-crowned kinglet	TLGG
wolverine	TLGG	golden-mantled ground squirrel	TLGG
Bohemian waxwing	TLGG	hairy woodpecker	TLGG
Cooper's hawk	TLGG	hermit thrush	TLGG
Virginia opossum	TLGG	house finch	TLGG
Yuma myotis	TLGG	house sparrow	TLGG
common nighthawk	TLGG	long-toed salamander	TLGG
gray flycatcher	TLGG	mountain beaver	TLGG
gray jay	TLGG	mountain chickadee	TLGG
hoary bat	TLGG	mourning dove	TLGG
long eared owl	TLGG	northern alligator lizard	TLGG
long-eared myotis	TLGG	northern oriole	TLGG
long-legged myotis	TLGG	northern pygmy-owl	TLGG
long-tailed weasel	TLGG	northwestern salamander	TLGG
mule deer and black-tailed deer	TLGG	Oregon meadow vole	TLGG
northern flicker	TLGG	pacific jumping mouse	TLGG
northern saw-whet owl	TLGG	pine grosbeak	TLGG
porcupine	TLGG	pine siskin	TLGG
sharp-shinned hawk	TLGG	purple finch	TLGG
silver-haired bat	TLGG	raccoon	TLGG
spotted skunk	TLGG	red crossbill	TLGG
striped skunk	TLGG	red-breasted sapsucker	TLGG
western rattlesnake	TLGG	red-legged frog	TLGG
western small-footed myotis	TLGG	red-napped sapsucker	TLGG
wild turkey	TLGG	ring-tailed cat	TLGG
American robin	TLGG	ringneck snake	TLGG
Cascade frog	TLGG	roughskin newt	TLGG
Douglas' squirrel	TLGG	rubber boa	TLGG
Ensatina	TLGG	ruby-crowned kinglet	TLGG
Hammond's flycatcher	TLGG	ruffed grouse	TLGG
Hutton's vireo	TLGG	rufous hummingbird	TLGG
Norway rat	TLGG	rufous-sided towhee	TLGG
Pacific tree frog	TLGG	sharptail snake	TLGG
Steller's jay	TLGG	snowshoe hare	TLGG
Swainson's thrush	TLGG	solitary vireo	TLGG
Townsend's chipmunk	TLGG	song sparrow	TLGG
Townsend's solitaire	TLGG	southern alligator lizard	TLGG
Vaux's swift	TLGG	tree swallow	TLGG
Wilson's warbler	TLGG	vagrant shrew	TLGG
band-tailed pigeon	TLGG	violet-green swallow	TLGG
black-capped chickadee	TLGG	western gray squirrel	TLGG
black-chinned hummingbird	TLGG	western redback salamander western	TLGG
black-headed grosbeak	TLGG	screech-owl	TLGG
black-throated gray warbler	TLGG	western tanager	TLGG
blue grouse	TLGG	western toad	TLGG
brush rabbit	TLGG	western wood-pewee	TLGG
cedar waxwing	TLGG	winter wren	TLGG
chestnut-backed chickadee	TLGG	yellow warbler	TLGG
chipping sparrow	TLGG	yellow-pine chipmunk	TLGG
Clark's nutcracker	TLGG	yellow-rumped warbler	TLGG

Terrestrial Wildlife CONTINUED

WILDLIFE GUILDS OF THE WILLAMETTE NATIONAL FOREST (CONTINUED)

Contrast Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
boreal owl	TLC	little brown myotis	TMC
elk	TLC	Cassin's finch	TSC
golden eagle	TLC	Lewis' woodpecker	TSC
great gray owl	TLC	Nashville warbler	TSC
great horned owl	TLC	ash-throated flycatcher	TSC
red-tailed hawk	TLC	brown-headed cowbird	TSC
turkey vulture	TLC	dusky flycatcher	TSC
American kestrel	TMC	flammulated owl	TSC
California myotis	TMC	heather vole	TSC
European starling	TMC	olive-sided flycatcher	TSC
big brown bat	TMC		

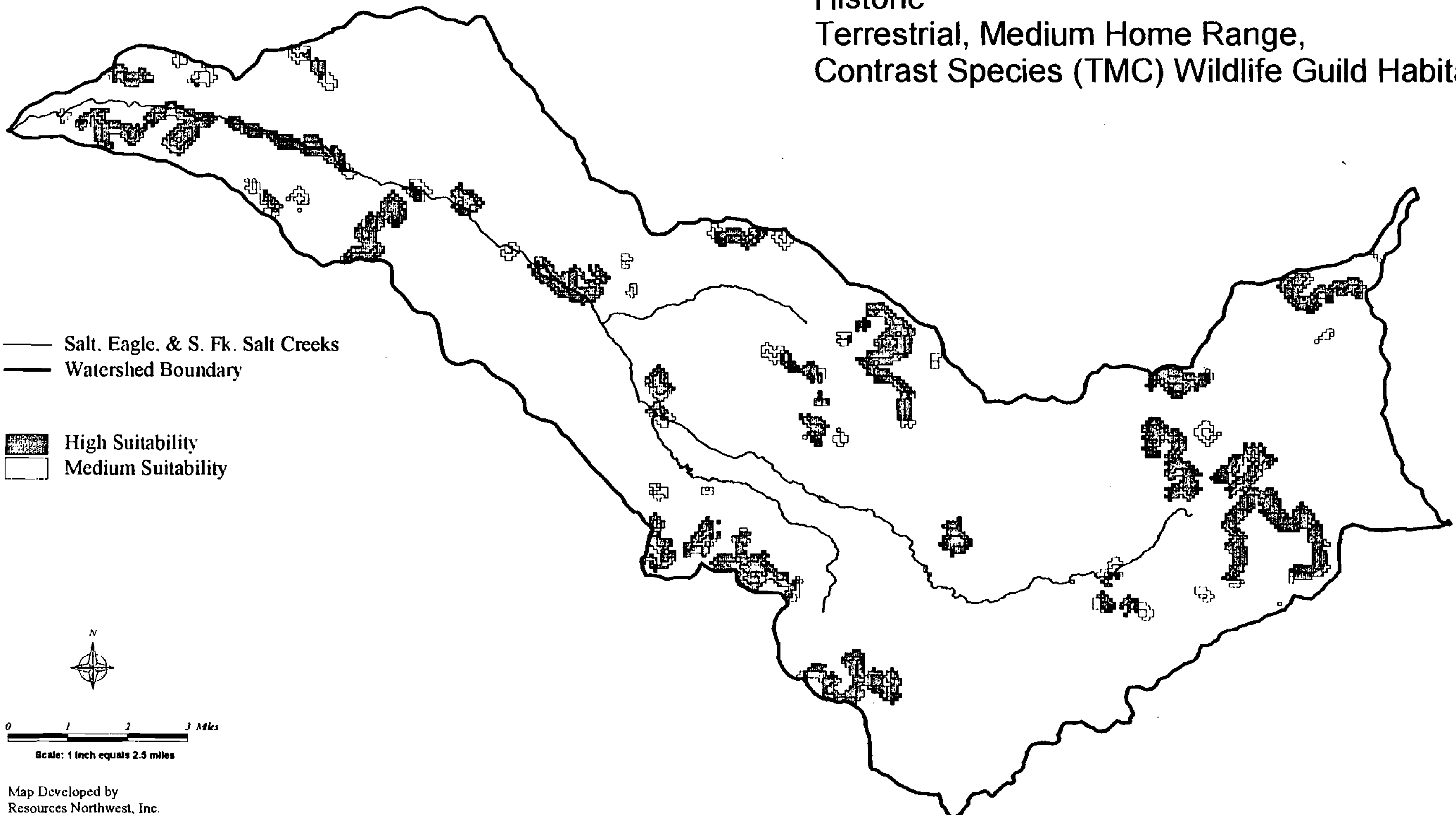
= =

KEY TO WILDLIFE GUILDS OF THE WILLAMETTE NATIONAL FOREST

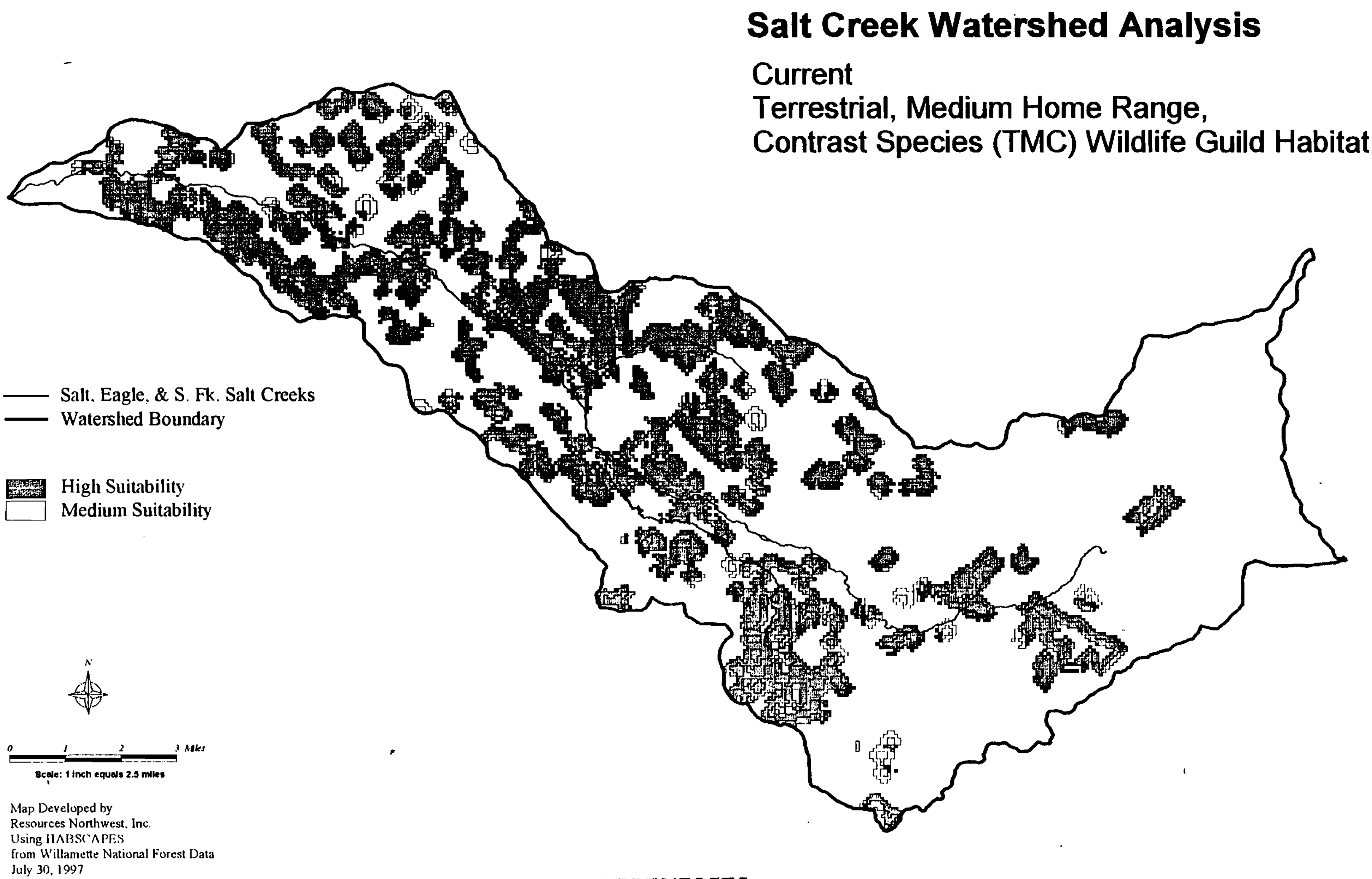
LKRVA = Lake or river, using the aquatic portion only.
LKRVARE = Lake or river, using the aquatic portion and terrestrial riparian vegetation in the early seral stage.
LKRVARG = Lake or river, using the aquatic portion and terrestrial riparian vegetation regardless of seral stage (generalist).
LKRVARML = Lake or river, using the aquatic portion and terrestrial riparian vegetation in the mid and late seral stages.
KRVRE = Lake or river, using the terrestrial vegetation only in an early seral condition.
LKRVRG = Lake or river, using the terrestrial vegetation only regardless of seral stage (generalists).
LKRVRML = Lake or river, using the terrestrial vegetation only in mid and late seral stages.
SPCL = Associated with a special habitat, as listed.
TLC = Terrestrial, large home range, contrast species.
TLGG = Terrestrial, large home range, generalist species.
TLME = Terrestrial, large home range, mosaic, early seral stage users.
TLML = Terrestrial, large home range, mosaic, late seral stage users.
TMC = Terrestrial, medium home range, contrast species.
TMGG = Terrestrial, medium home range, generalist species.
TMME = Terrestrial, medium home range, mosaic early seral stage users.
TMML = Terrestrial, medium home range, mosaic late seral stage users.
TMPE = Terrestrial, medium home range, patch species, early seral.
TSC = Terrestrial, small home range, contrast species.
TSGE = Terrestrial, small home range, generalist early seral.
TSGEM = Terrestrial, small home range, generalist early/mid seral.
TSGG = Terrestrial, small home range, generalist.
TSGML = Terrestrial, small home range, generalist mid/late seral.
TSME = Terrestrial, small home range, mosaic early.
TSPE = Terrestrial, small home range, patch species, early seral.
TSPL = Terrestrial, small home range, patch species, late seral.

Salt Creek Watershed Analysis

Historic
Terrestrial, Medium Home Range,
Contrast Species (TMC) Wildlife Guild Habitat



Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997



Salt Creek Watershed Analysis
Current
Terrestrial, Medium Home Range,
Contrast Species (TMC) Wildlife Guild Habitat
Salt, Eagle, & S. Fk. Salt Creeks
Watershed Boundary
High Suitability
Medium Suitability
N
0 1 2 3 Miles
Scale: 1 inch equals 2.5 miles
Map Developed by
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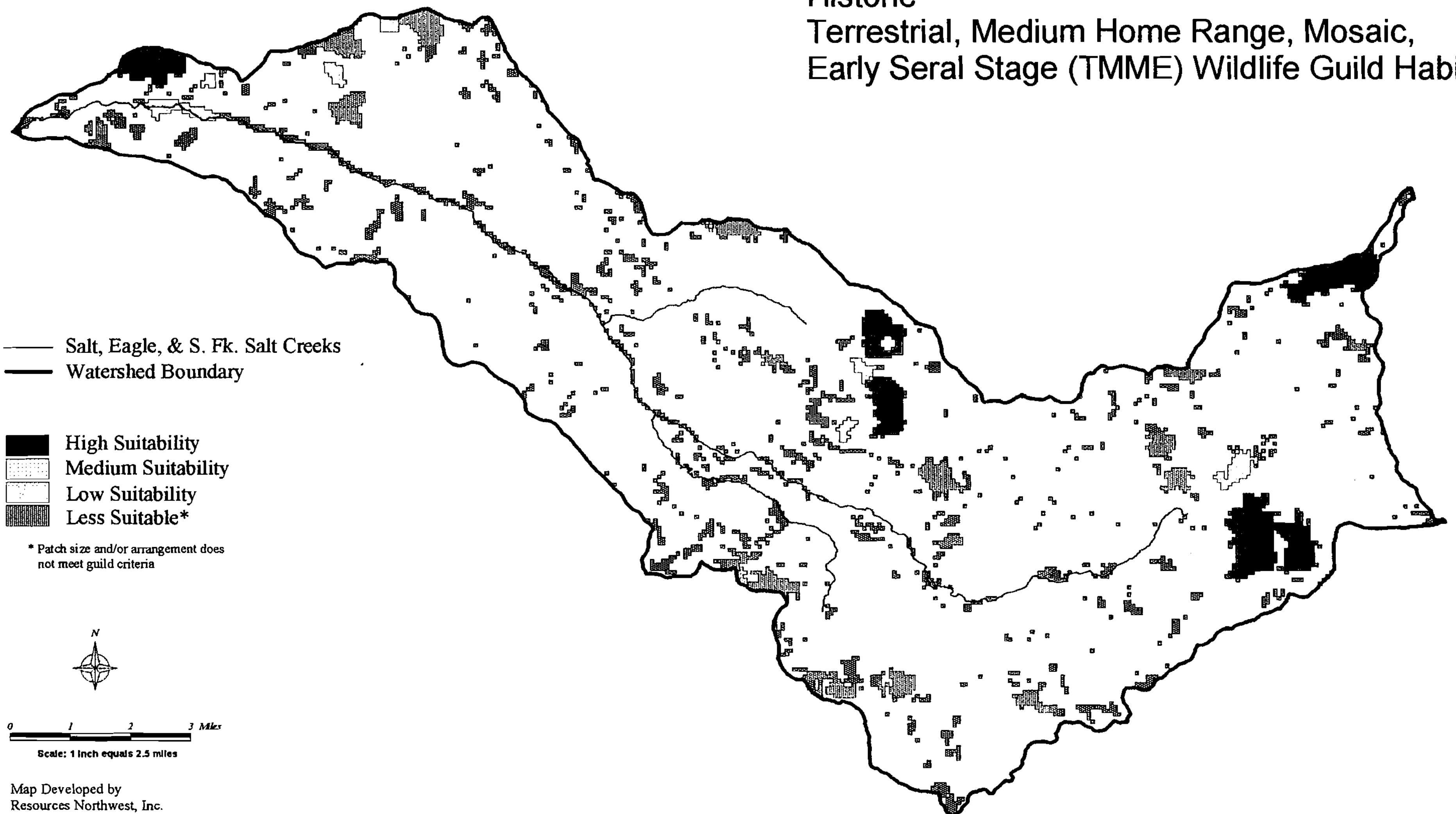
from Willamette National Forest Data
July 30, 1997

Salt Creek Watershed Analysis

Historic
Terrestrial, Medium Home Range, Mosaic,
Early Seral Stage (TMME) Wildlife Guild Habitat



Map Developed by
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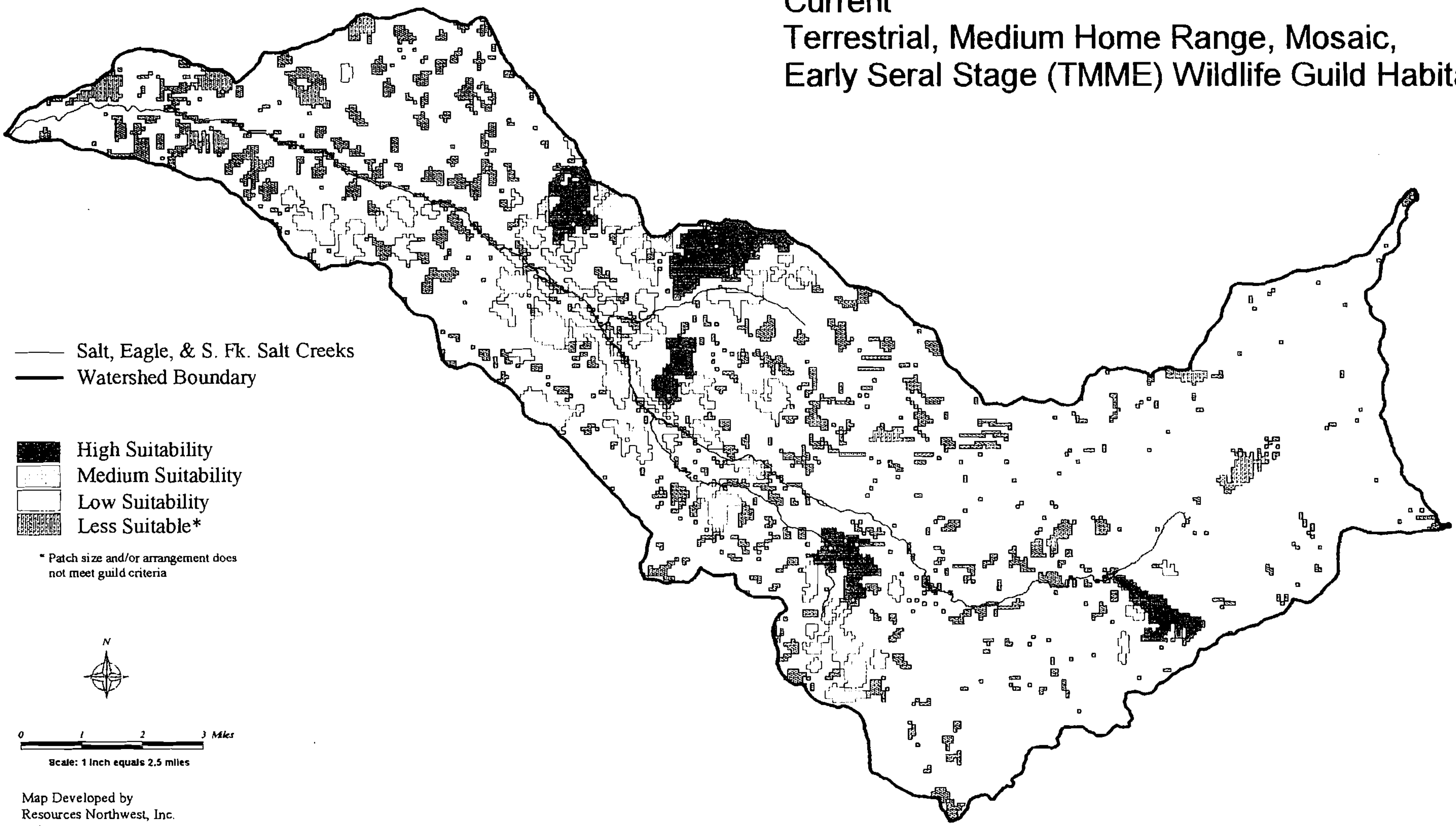
July 30, 1997

Salt Creek Watershed Analysis

Current
Terrestrial, Medium Home Range, Mosaic,
Early Seral Stage (TMME) Wildlife Guild Habitat



Map Developed by
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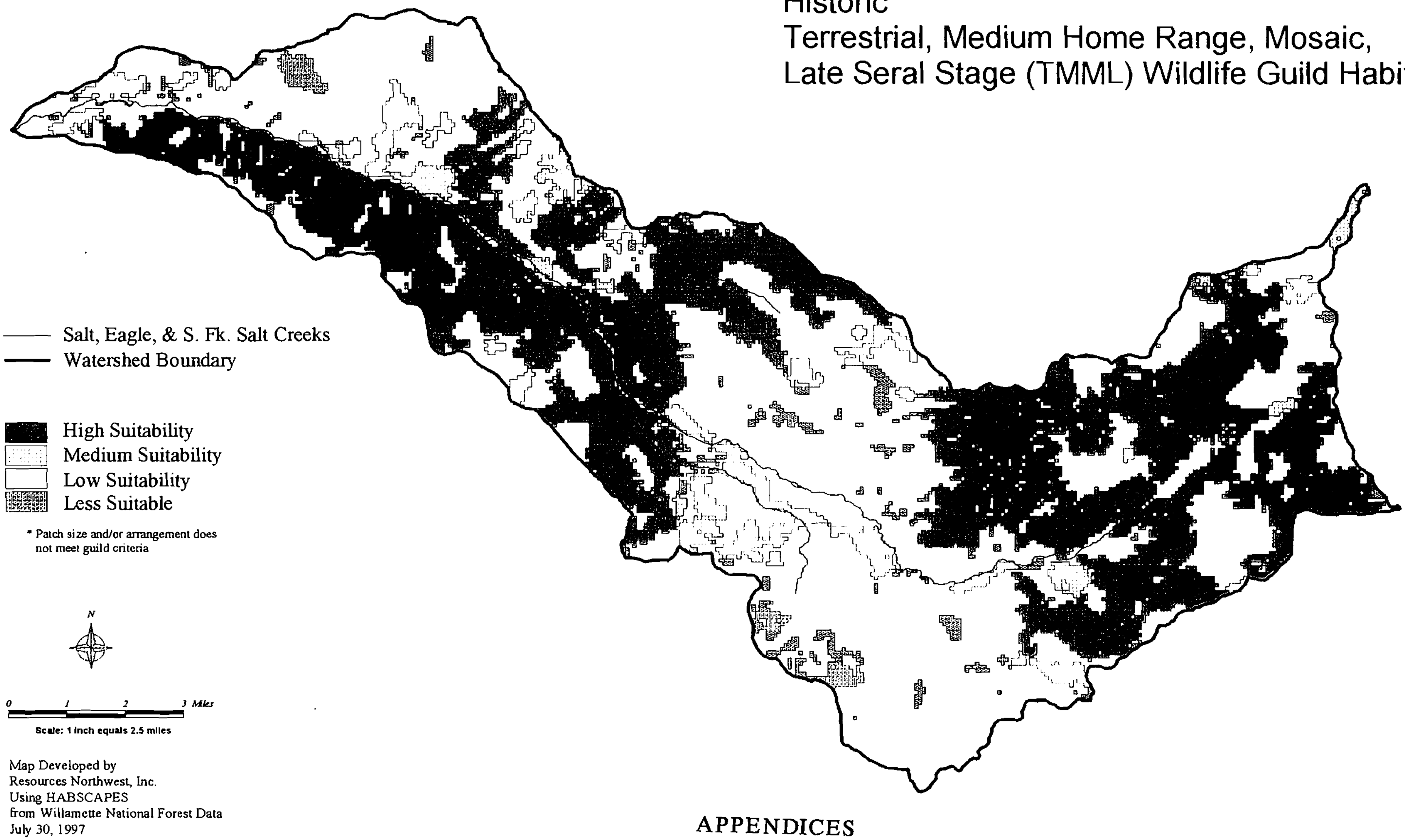
July 30, 1997

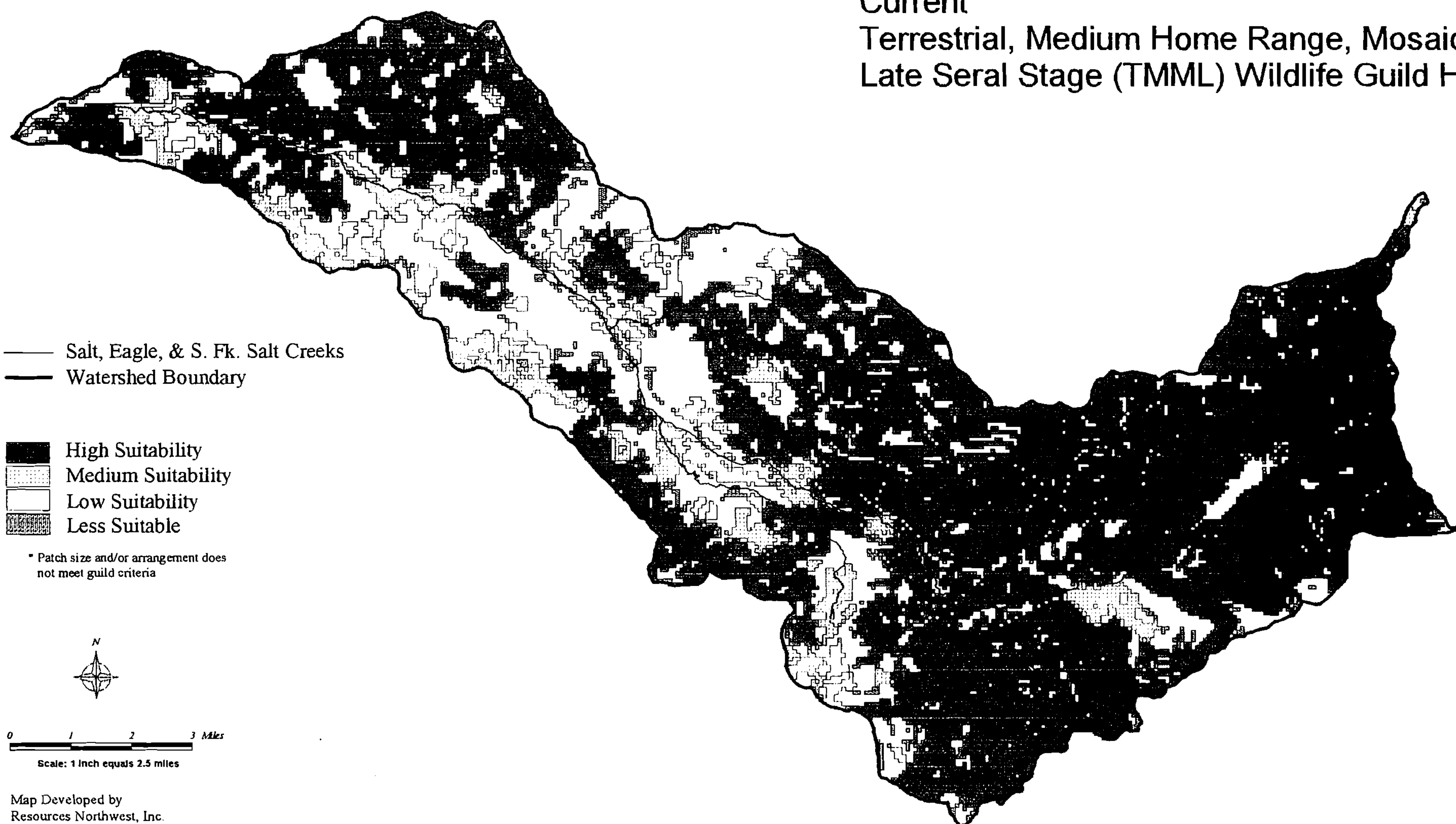
Salt Creek Watershed Analysis

Historic
Terrestrial, Medium Home Range, Mosaic,
Late Seral Stage (TMML) Wildlife Guild Habitat



Salt Creek Watershed Analysis

Current
Terrestrial, Medium Home Range, Mosaic,
Late Seral Stage (TMML) Wildlife Guild Habitat



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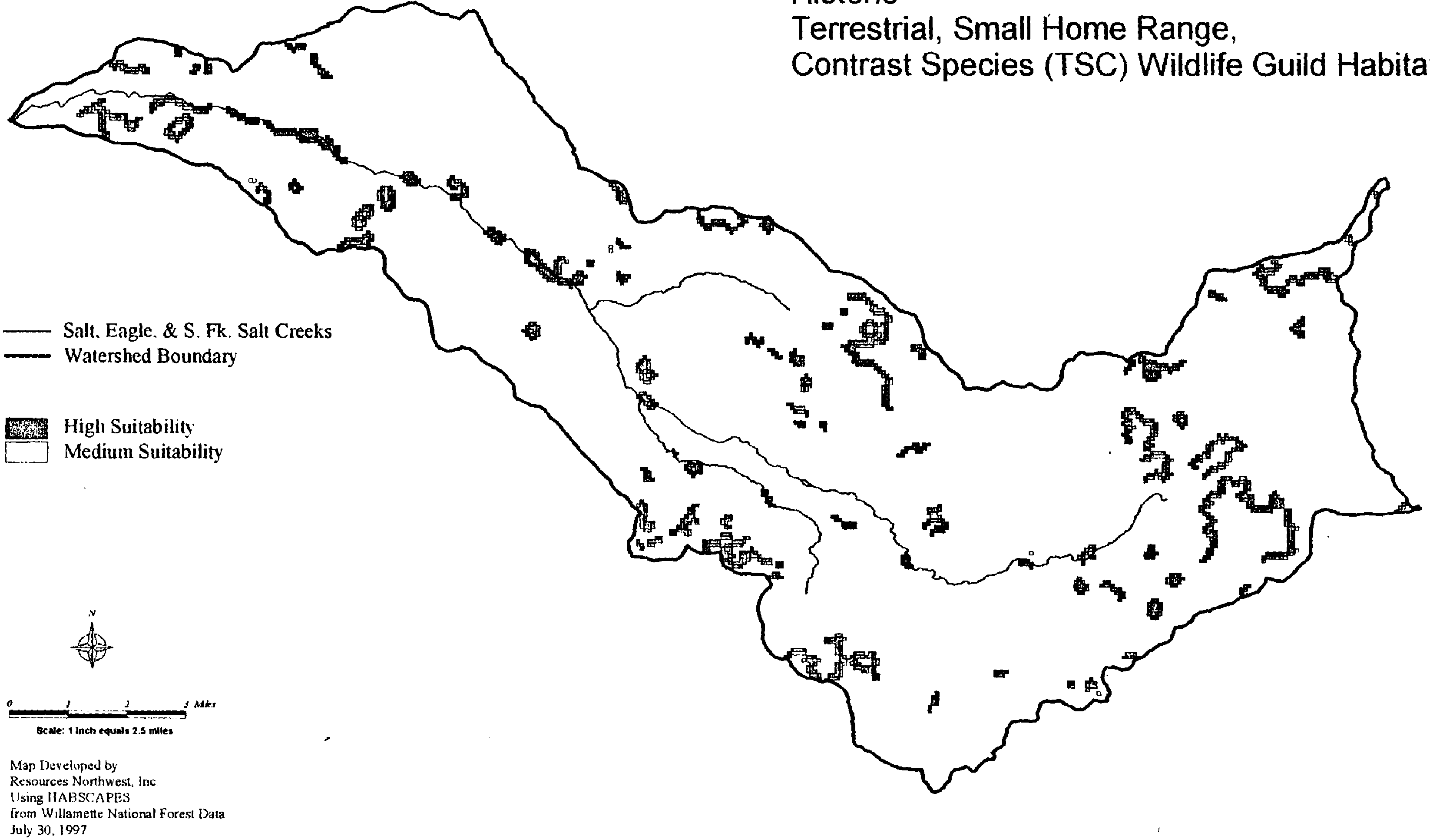
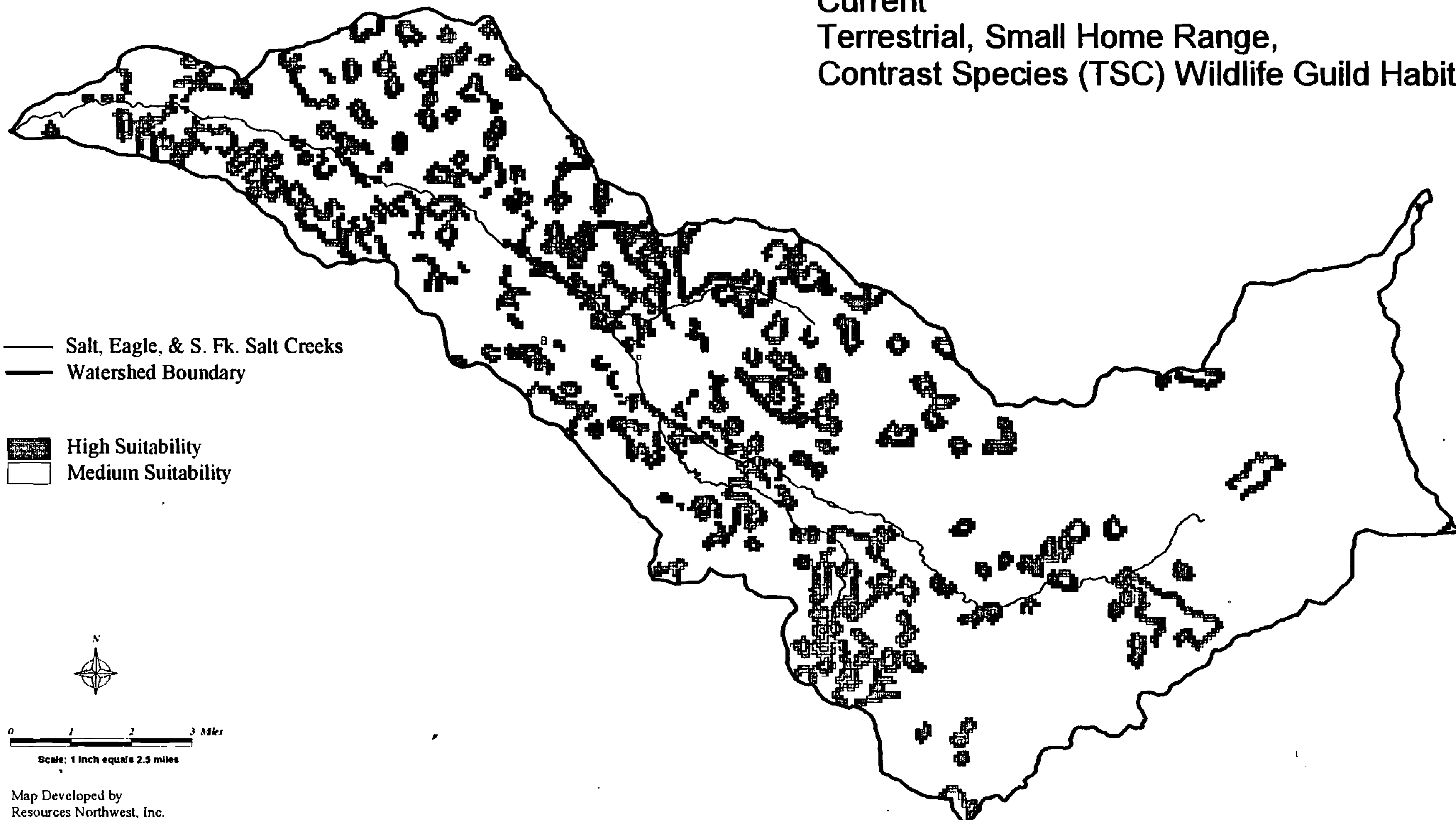
Salt Creek Watershed Analysis

Historic
Terrestrial, Small Home Range,
Contrast Species (TSC) Wildlife Guild Habitat



Salt Creek Watershed Analysis

Current
Terrestrial, Small Home Range,
Contrast Species (TSC) Wildlife Guild Habitat



Map Developed by
Resources Northwest, Inc.
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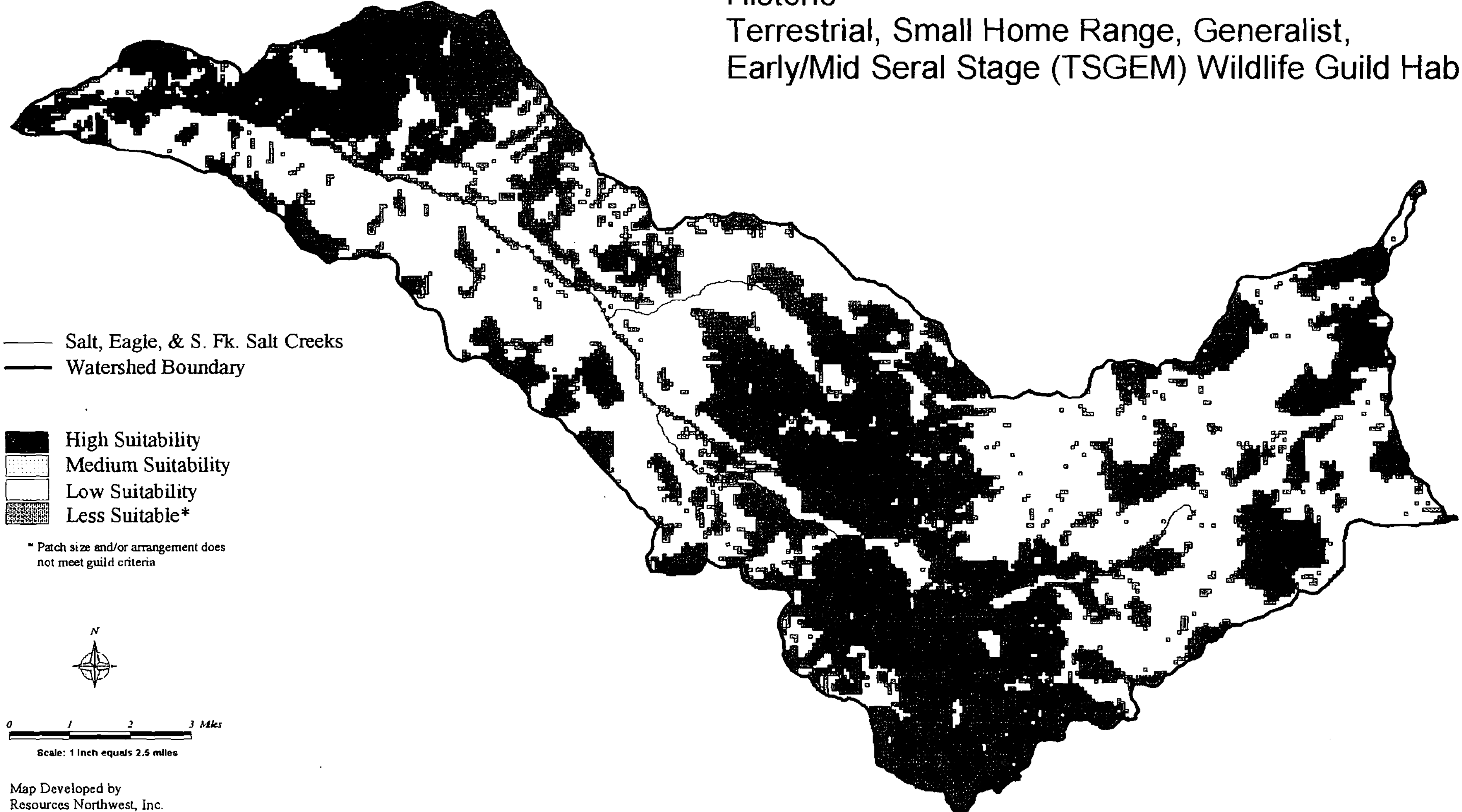
July 30, 1997

Salt Creek Watershed Analysis

Historic
Terrestrial, Small Home Range, Generalist,
Early/Mid Seral Stage (TSGEM) Wildlife Guild Habitat



Map Developed by
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Using HABSCAPES
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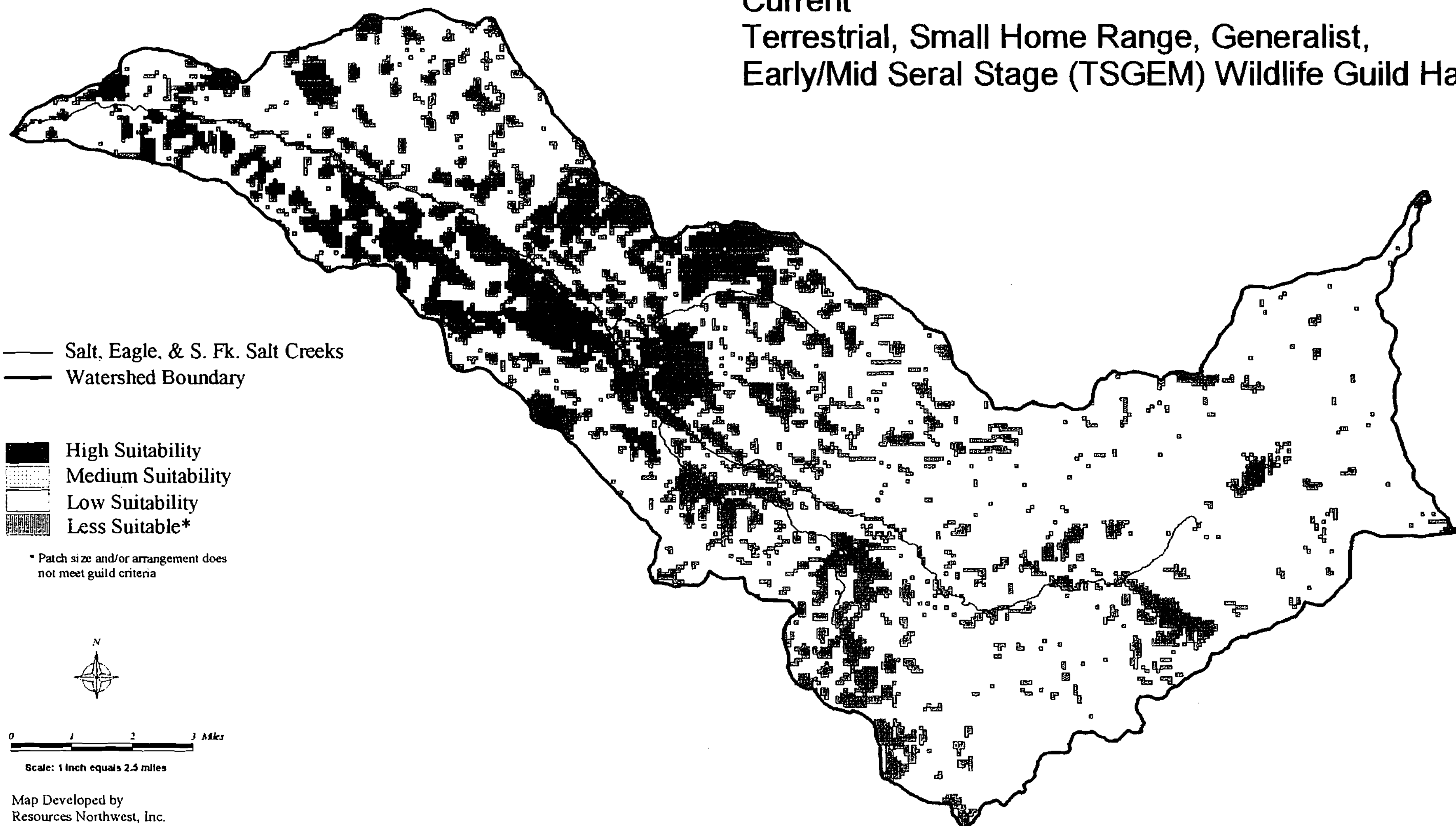
July 30, 1997

Salt Creek Watershed Analysis

Current
Terrestrial, Small Home Range, Generalist,
Early/Mid Seral Stage (TSGEM) Wildlife Guild Habitat



Salt, Eagle, & S. Fk. Salt Creeks
Watershed Boundary

High Suitability
Medium Suitability
Low Suitability
Less Suitable*

* Patch size and/or arrangement does not meet guild criteria

N

0 1 2 3 Miles

Scale: 1 inch equals 2.5 miles

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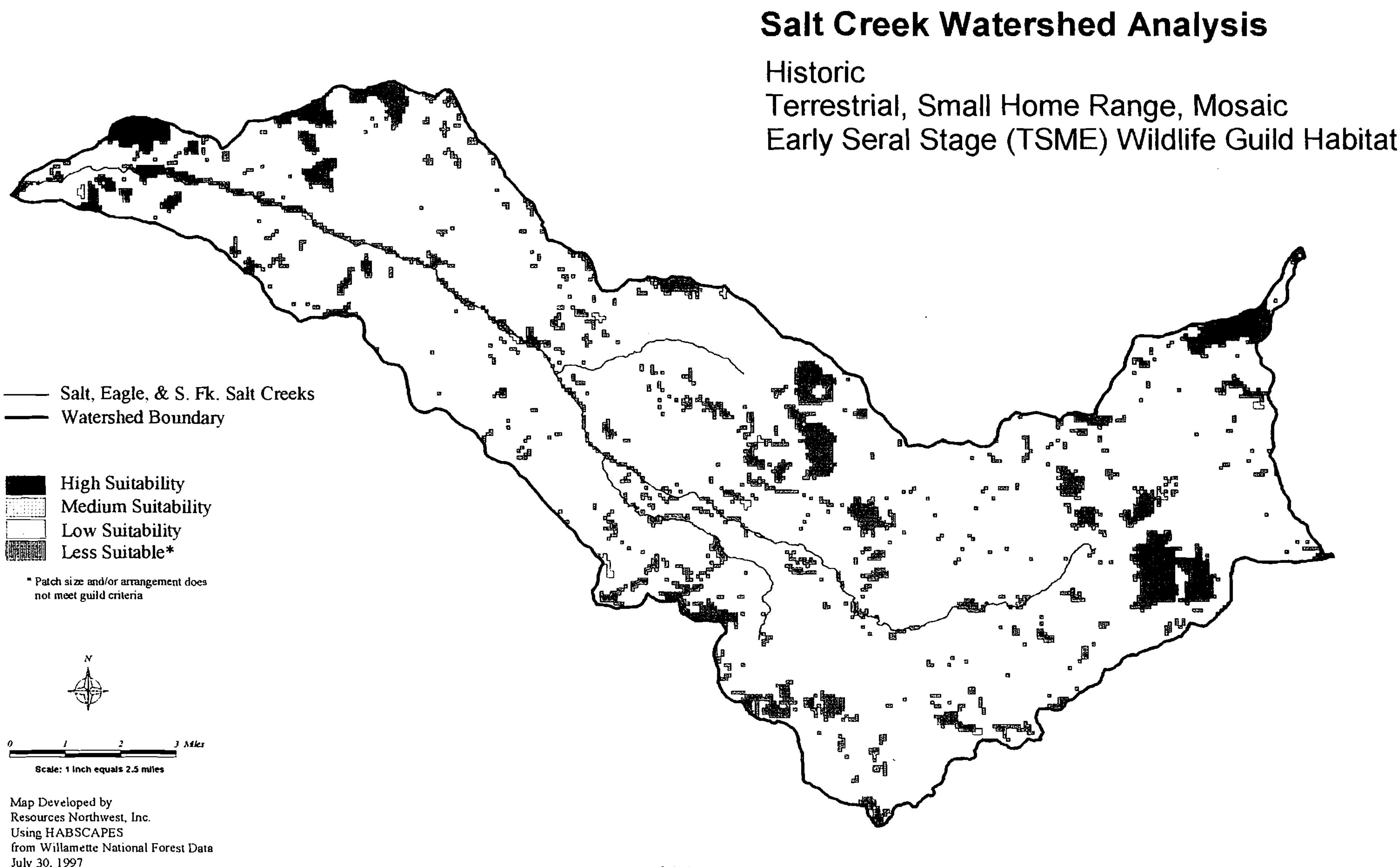
July 30, 1997



Salt Creek Watershed Analysis
Historic
Terrestrial, Small Home Range, Mosaic
Early Seral Stage (TSME) Wildlife Guild Habitat
Salt, Eagle, & S. Fk. Salt Creeks
Watershed Boundary
High Suitability
Medium Suitability
Low Suitability
Less Suitable*
* Patch size and/or arrangement does not meet guild criteria
N
0 1 2 3 Miles
Scale: 1 inch equals 2.5 miles
Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
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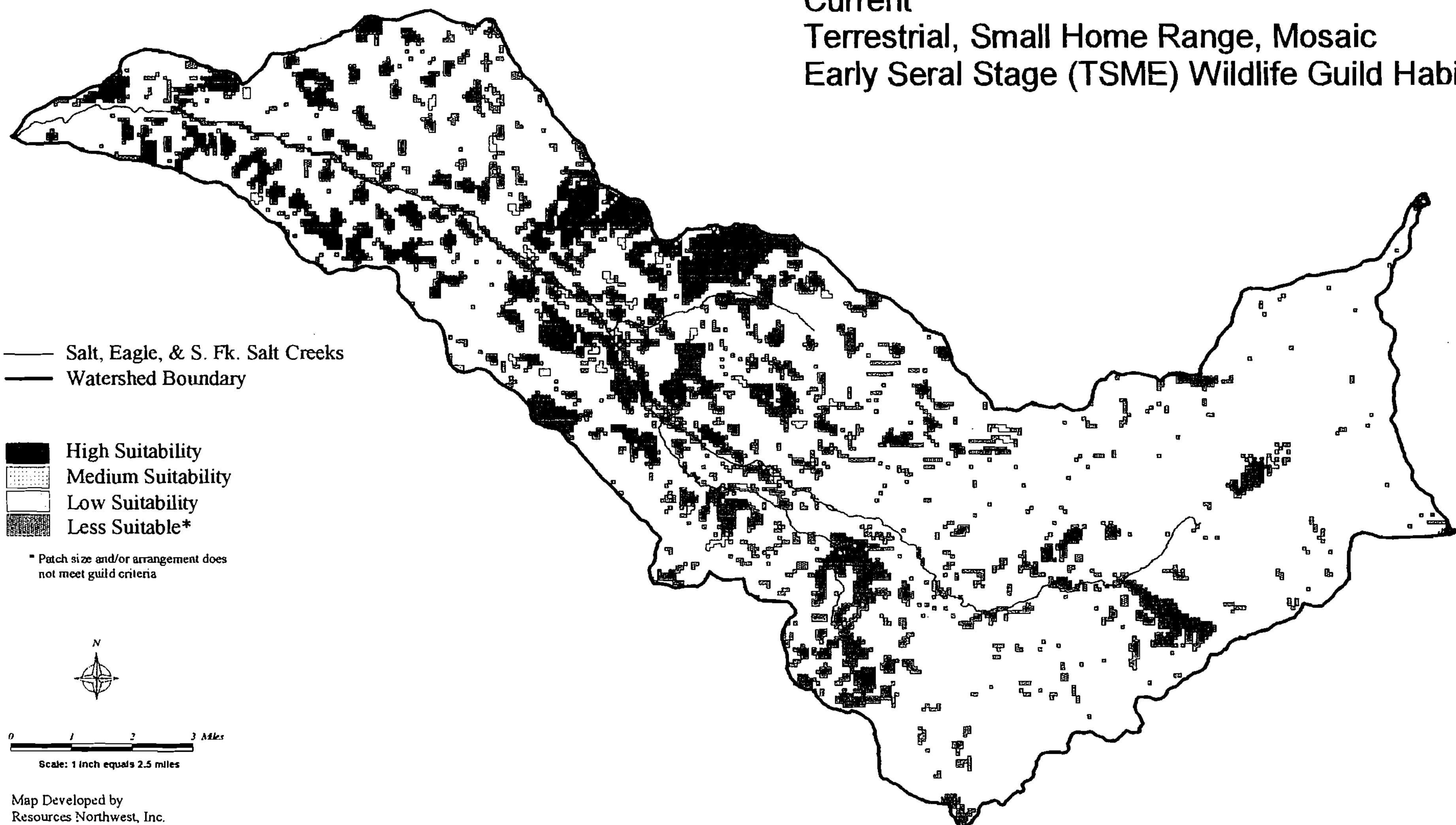
July 30, 1997

Salt Creek Watershed Analysis

Current
Terrestrial, Small Home Range, Mosaic
Early Seral Stage (TSME) Wildlife Guild Habitat



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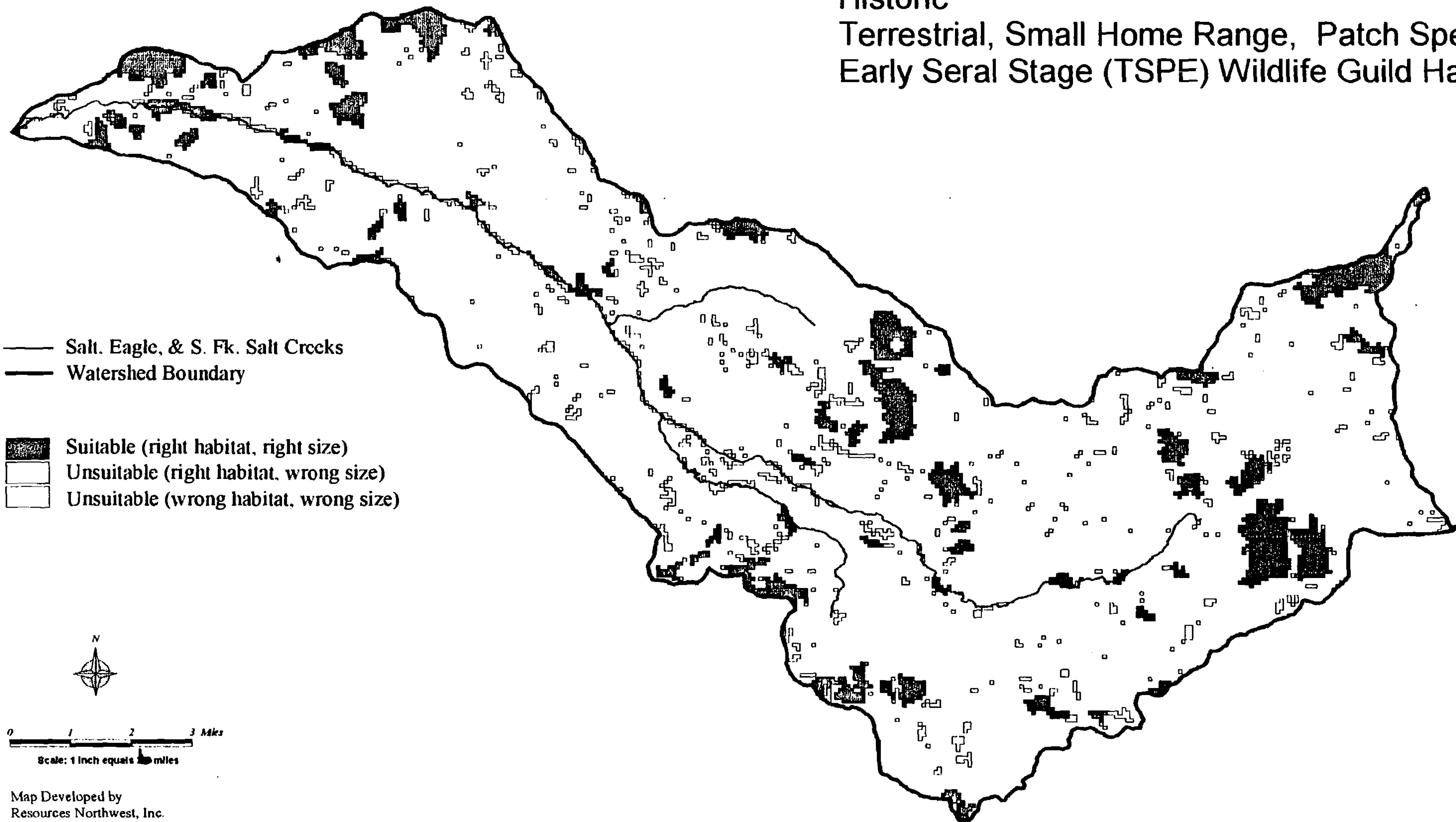
APPENDICES

Salt Creek Watershed Analysis

Historic
Terrestrial, Small Home Range, Patch Species, Early Seral Stage (TSPE) Wildlife Guild Habitat



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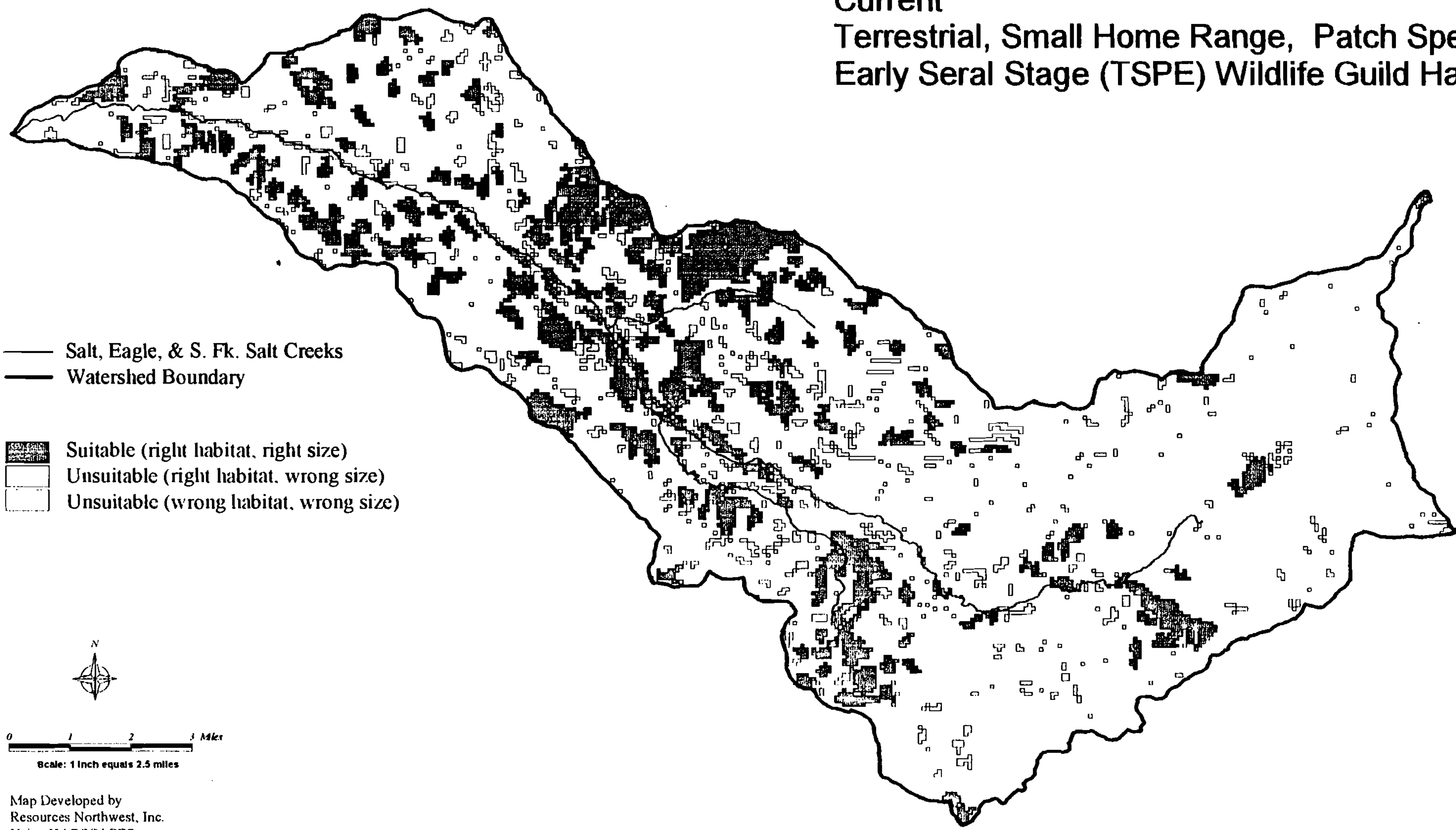
August 19, 1997

Salt Creek Watershed Analysis

Current
Terrestrial, Small Home Range, Patch Species, Early Seral Stage (TSPE) Wildlife Guild Habitat



Map Developed by
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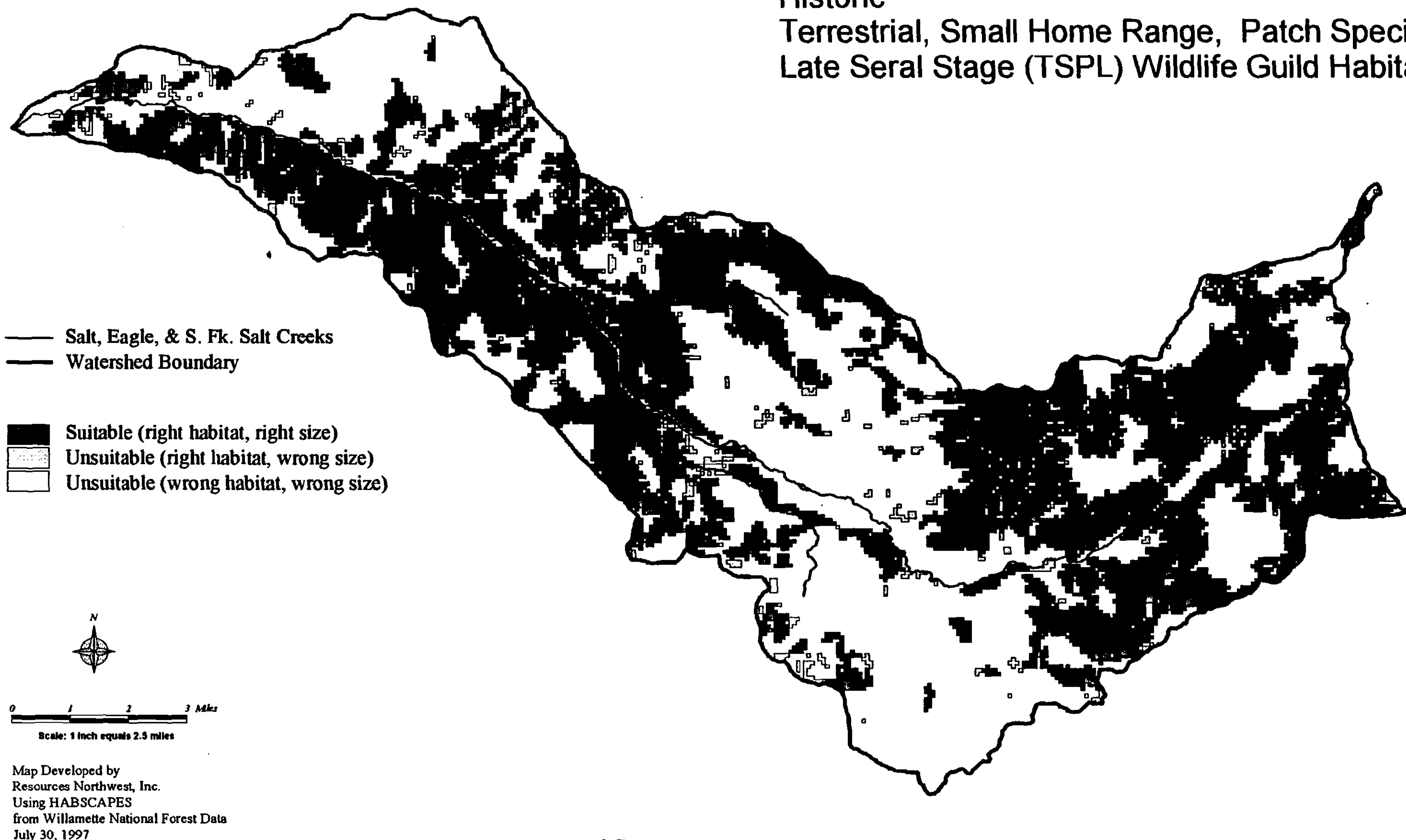
July 30, 1997

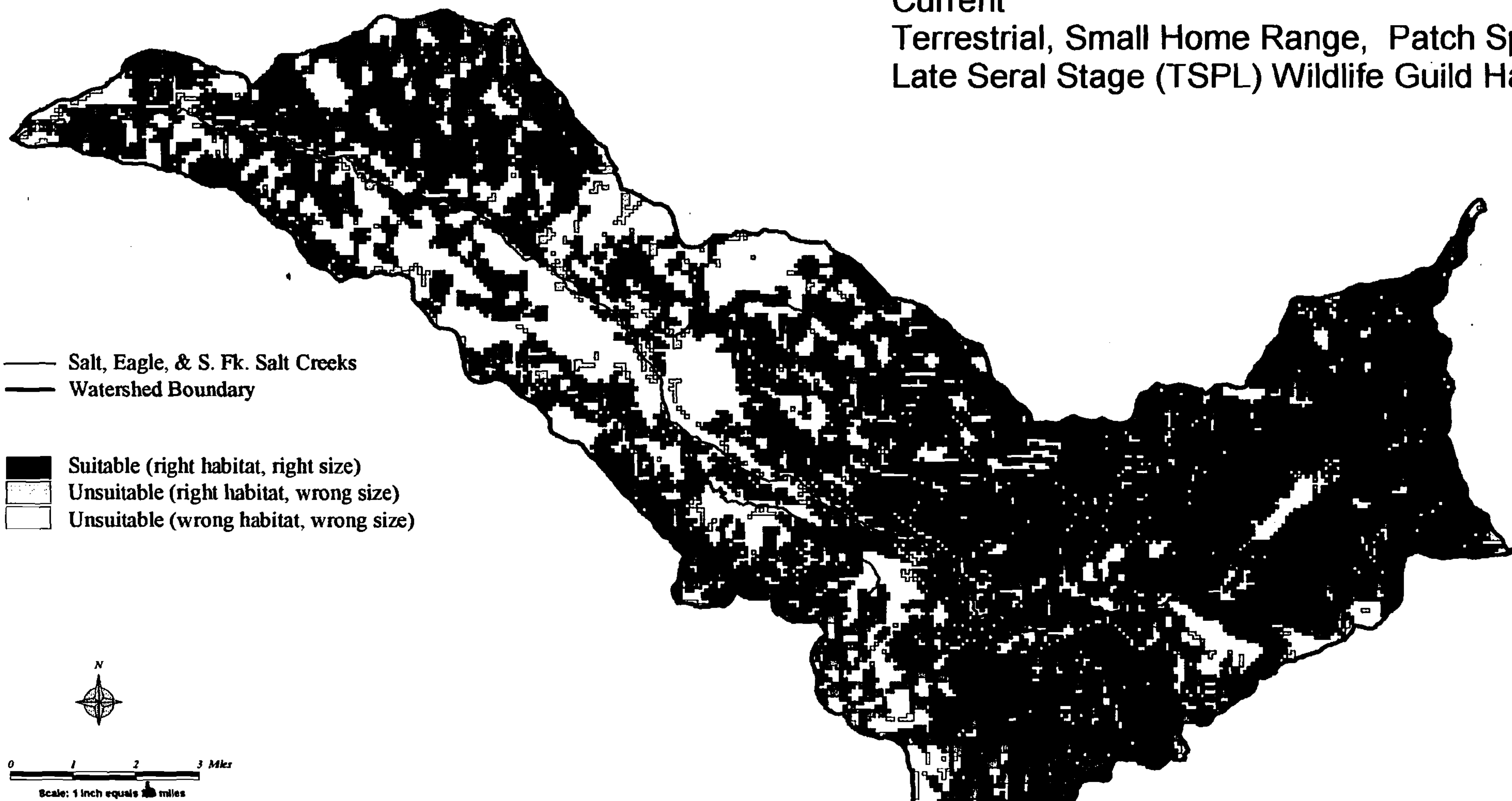
Salt Creek Watershed Analysis

Historic
Terrestrial, Small Home Range, Patch Species
Late Seral Stage (TSPL) Wildlife Guild Habitat



Salt Creek Watershed Analysis

Current
Terrestrial, Small Home Range, Patch Species
Late Seral Stage (TSPL) Wildlife Guild Habitat



Map Developed by
Resources Northwest, Inc.
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August 19, 1997

APPENDIX F: Wet and Special Habitat Types by Subwatershed

Habitat Feature	Acres	Subwatershed
MB, MW, MS	75.8	20 3
MB, MW, MM	12.2	20 2, 20 3
MB, MW, MS, MM	90.4	20 2, 20 3
MP	0.7	20 2
MP, WS	62.1	20 2
MS	68.2	20 1, 20 2, 20 3
MS, MW	2.1	20 3
MS, WP, UC, RC, GD, RT, HD, RO	4.5	20 1
MS, WR, MP, HD, MW	8.5	20 1
MW	151.7	20 2, 20 3
MW, HD	2.2	20 1
MW, MB	32.5	20 3
MW, MM	255.3	20 2, 20 3
MW, MM, SA	6.1	20 2
MW, MS	9.7	20 1, 20 2
MW, MS, MM	7.6	20 2
MW, MS, MM, MB	70.6	20 2
WH, MS	59.9	20 1
WP	147.9	20 1, 20 2, 20 3
WP, MM	0.4	20 3
WP, MS	32.0	20 1, 20 2
WP, MS, MP, HD, MM, MW	15.7	20 1
WP, WT, MM	0.7	20 2
WS	120.7	20 2
WT	102.8	20 2
WT, RO	6.4	20 1
WT, RT, ST, MD, SA	10.6	20 2
WT, WS	174.3	20 2
WX	477.0	20 1, 20 2, 20 3

HD = Hardwood inclusion
MB = Bog
MD = Dry meadow
MM = Mesic meadow
MS = Sedge meadow
MP = Swamp
MW = Wet meadow
RC = Cliff
RO = Rock outrcop
RT = Talus
GD = Dry rock garden
SA = Sitka alder
ST = Vine maple (talus)
UC = Cave
WH = Headwater
WP = Pond
WS = Seep
WT = Small stream
WX = Open water

APPENDIX G: Herpetile Habitat

Species	Life History Stage	Habitat	Elevation Range (ft)	Prey	Predators
Tailed Frog (Ascaphus truei)	Adult & Larvae	In fast flowing permanent stream; adults in/near cold, clear streams. Headwaters	0-6562	Adults: snails, ticks spiders, mites, insects. Larvae: diatoms, conifer pollen, algae, small insects	Pacific Giant Salamander
Western Toad (Bufo boreas)	Adult & Larvae	Large lakes, small ponds, shallow marshes; adults: forested areas possibly away from water	0-11812+	Flying insects, crayfish, sowbugs, earthworms	Birds, garter snakes, aquatic insects
Pacific Chorus Frog (Pseudacris Regilla)	Adult & Larvae	Variety: coastal sloughs, old-growth, deserts; adults quite terrestrial	0-9843+	Beetles, flies, ants, spiders, isopods, various insects	Garter snakes, bullfrogs, birds, mammals. Larvae: aquatic insects, salamanders
Red-Legged Frog (Rana aurora)	Adult & Larvae	Permanent bodies of quiet water, ponds, pools, reservoirs, springs, lakes, marshes; adults hang out on land near water's edge	<2789	Many insect species, arachnids, mollusks	Snakes, raccoons, herons, NW Salamander, bullfrogs, Roughskin Newts, cutthroat trout, owls, hawks, ducks, skunks, minks, cats. Larvae: giant water bugs, Dytiscid beetles, Odonate nymphs...
Foothills Yellow-Legged Frog (Rana boylii)	Adult & Larvae	Near streams & rivers w/rocky or gravely substrate	<5906	Insects, snails	Garter snakes, fish, birds, mammals. Eggs: Rough-skin Newts
Cascades Frog (Rana cascadae)	Adult & Larvae	Montane meadows, marshes, ponds, relatively small water bodies, along creeks, lakeshore alcoves	>2625	Aquatic insects	salamanders, fish, snakes, birds
Western Spotted Frog (Rana pretiosa)	Adult & Larvae	Marshes, near edges of ponds and lakes, colder waters	?-9843	Insect species, arachnids, mollusks	Garter snakes
Western Aquatic Garter Snake (Thamnophis couchii)	Adults & Neonates	Permanent streams w/rocky substrate, stream margins	0-8006	Fish, amphibians	Otters, herons, hawks, osprey, Steller's jay
Western Pond Turtle (Clemmys mammorata)	Adults & Juveniles	Marshes, sloughs, lakes, ponds, slow portions of creeks/rivers.	0-6004	Various aquatic inverts/verts., algae, cattail/tule roots	Adults/Eggs: Otters, raccoons, coyotes, foxes. Juveniles: Bullfrogs, bass
Northwestern Salamander (Ambystoma gracile)	Terrestrial (Adult) Aquatic (Adult/Larvae)	Coniferous forests, inland valleys, subalpine areas Ponds, lakes, slow parts of semi-permanent streams	<10171	Larvae: aquatic inverts	Trout, aquatic beetle larvae
Roughskin Newt (Taricha Granulosa)	Terrestrial (Adult) Aquatic (Adult/Larvae)	Farmland, grassland, uplands, forests. Ephemeral/permanent ponds/lakes/streams w/slow areas with veg.	0-9187	Small inverts. & verts, amphib eggs & larvae Zooplankton, aquatic insects	Few predators due to skin toxicity, some predation by trout
Pacific Giant Salamander (Dicamptodon tenebrosus)	Terrestrial (Adult) Aquatic (Adult/Larvae)	Moist conifer forest, in/near streams, talus roadcuts. High gradient streams w/coarse substrate	0-7087	Terrestrial invertebrates & vertebrates. Aquatic inverts. & vertebrates	Fish, weasels, shrews, other Pacific Giant Salamanders, Western Aquatic Garter snakes.
Clouded Salamander (Aneides ferreus)	Terrestrial (Adult/Larvae)	Rock faces (talus), 2 different age classes of large downed logs, often Douglas fir	0-5578	Anthopods, ants	–
Oregon Slender Salamander (Batrachoseps wrighti)	Terrestrial (Adult/Larvae)	Mature fir forests, rotting logs/stumps, wood fragments, substrate temp 51-570 Fahrenheit	49-4397	–	–

Herpetile Habitat CONTINUED

Species	Life History Stage	Habitat	Elevation Range (ft)	Prey	Predat'
Ensatina (Ensatina eschscholtzii)	Terrestrial (Adult/Larvae)	Conifer/deciduous forests of diff. ages, under surface debris, decaying logs, small mammal burrows	–	Invertebrates	Gartei Steller's jay
Dunn's Salamander (Plethodon dunni)	Terrestrial (Adult/Larvae)	Semi-aquatic, associated w/rocks, moss covered rubble and seeps. Under rocks/logs, moist talus	0-3281 absent in most Willamette Valley	–	–
Western Red-Backed Sal. (Plethodon vehiculum)	Terrestrial (Adult/Larvae)	Coniferous forests, soft shale/sandstone outcrops, decaying logs, bark piles. Damp soils rather than wet situations	–	–	–
Long-Toed Salamander (Ambystoma macrodactylum	Terrestrial (Adult) Aquatic (Adult/Larvae)	Lowland forest, disturbed pastures, high elevation lakes/ponds. Lakes/ponds, temporary water sources	0-8120	Larvae: variety of invertebrates, copepods, fairy shrimp, young Chorus Frog tadpoles, smaller NW Sal. larvae	Introduced fish species

*Adapted from Blaustein et al., 1995; except for Long-Toed Salamander which is from Leonard et al., 1993.
NOTE: Shading indicates species known to occur in the Salt Creek watershed

Amphibian Distribution and Sensitivity in the Westslope Cascades Province

Species	Occurrence In Province	ODFW Status	ONH Status	BLM Status	USFS Status	USFWS Status
Northwestern Salamander	throughout					
Long-Toed Salamander	throughout					
Roughskin Newt	throughout					
Cope's Giant Salamander	few localities	Pr-S/u	2	AS		
Pacific Giant Salamander	throughout					
Cascade Torrent Salamander	few localities	Pr-S/v	4	TS		
Clouded Salamander	throughout	S/u	3			
Oregon Slender Salamander	few localities	S/u	1			
Ensatina	throughout					
Dunn's Salamander	throughout					
Larch Mountain Salamander	few localities	S/v	3	ROD	ROD	C2
W. Red-Backed Salamander	few localities					
Western Toad	few localities	S/v				
Pacific Chorus Frog	throughout				S	
Tailed Frog	throughout	Pr-S/v	4	AS		
Red-Legged Frog	throughout	S/u	4	TS	S	C2
Cascades Frog	throughout	Pr-S/v	3	AS		
Spotted Frog	few localities	Pr-S/c	2	BS		C1
Foothill Yellow- Legged Frog	few localities	Pr-S/v	4	TS		C2
Bullfrog	few localities					

Key to the Different Status Codes: (from Corkran and Thoms, 1995)

ODFW (Oregon Department of Fish and Wildlife)
- Pr = Protected c= Critical
- S = Sensitive v= Vulnerable
- p = Peripheral, naturally rare u= undetermined status

OHN (Oregon Natural Heritage Database)
- 1 = Threatened throughout range 3 = Review
- 2 = Threatened in Oregon only

BLM (Bureau of Land Management) and USFS R6
- TS = Tracking Species AS = Assessment Species
- S = USFS Sensitive Species BS = BLM Sensitive Species

USFWS (U.S. Fish & Wildlife Service)
- C1 = Candidate, sufficient information
- C2 = Candidate, insufficient information

ROD = Record of Decision for Amendments to USFS and BLM Planning Documents within Range of the Northern Spotted Owl, April 1994; survey & manage species

APPENDIX H: Aquatic Habitat and Species Lists

Streams surveyed in the Salt Creek Watershed

Stream	Subwatershed	Miles surveyed	Reference Survey Year	Current Survey Year	Method
Salt Creek	20 1, 20 2, 20 3	18.9, 27.5, 19.93, 5.3	1937	1964, 1990, 1996	? ,ODFW, Reg, Reg
Tumble	20 1	spot check @ mouth		1964	ODFW
Sage	20 1	spot check @ mouth		1964	ODFW
Pepper	20 1	spot check @ mouth		1964	ODFW
Sugar	20 1	spot check @ mouth		1964	ODFW
Gobel	20 1	0.1		1964	ODFW
Basin	20 1	spot check @ mouth		1964	ODFW
Fin Roberts	20 1	spot check @ mouth		1964	ODFW
Warner	20 1	mouth, 1.9		1964, 1996	ODFW, Reg
McCredie	20 1	mouth, 1.33		1964, 1992	ODFW, Reg
T20e 36.7	20 1	at least 0.4		1992	Reg
T20e 38.6	20 1	N/A		1992	Reg
T20f 41.3	20 1	at least 0.16		1992	Reg
T20f 41.5	20 1	0.8		1992	Reg
T20f 43.3	20 1	0.2		1992	Reg
T20f 45.3	20 2	0.1		1992	Reg
T20f 46.3	20 2	1.1		1992	Reg
T20w 11.8	20 2	1.3		1992	Reg
Eagle	20 2	0.9, 3.5, 5.3	1937	1964, 1992	? ,ODFW, Reg, Reg
Coyote	20 2	mouth, 1.4		1964, 1992	ODFW, Reg
S. Fk. Salt	20 2	3.9, 7.3		1964, 1996	ODFW, Reg
Fall	20 2	4.3		1996	Reg
Diamond	20 2	2.5		1996	Reg
Deer	20 3	2.05		1996	Reg

NOTE: For Mainstem Salt Ck., apparently 32 miles were surveyed by the Oregon State game commission in 1970 - no data are available

Observed Pool Values and Objectives for Mainstem Salt Creek (1937, 1964, 1990, 1996 Data)

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (feet)	Residual Depth (feet)	Width/ Depth Ratio	% Area in Pools	Observed Pools/mile	Min.Obj. PACFISH	Min. Obj. Forest Plan
Salt Creek 1937	Station A-B	5.7	1.97	52*	—	—	—	15.3	26	14
	Station B-C	5.5	1.47	77*	—	—	—	12.2	23	12
	Station C-D	1.8	2.47	33*	—	—	—	20.6	35	34
	Station D-E	1.9	13	29*	—	—	—	7.4	45	14
	Station E-F	4	5.77	35*	—	—	—	20	40	30

* Widths are not averages for 1937 but rather assumed to be single measurements at each station (A - F)
Station A = confluence of Salt Creek with Middle Fork of Willamette River
Station B = 2nd bridge above confluence
Station C = Eagle Creek confluence with Salt Creek
Station D = South Fork Salt Creek confluence with Salt Creek
Station E = 1.5 miles upstream of UPRR trestle
Station F = Salt Creek Falls (1 mile from Abernathy)

Aquatic Habitat and Species Lists CONTINUED

Observed Pool Values and Objectives for Mainstem Salt Creek Continued

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (ft)	Residual Depth (ft)	Width/ Depth Ratio	% Area in Pools	Observed Pools/ Mile	Minimum Objective PACFISH	Minimum Objective Forest Plan
Salt Creek 1964	1	5	1 to 6	40	-----	-----	-----	16**	35	-----
	2	5.5	1 to 6	20	-----	-----	-----	11**	56	-----
	3	6.9	4 to >6	20	-----	-----	-----	11**	56	-----
	4	5	4 to >6	15	-----	-----	-----	11**	70	-----
	5	3.5	4 to 6	30	-----	-----	-----	8**	45	36
	6	1.6	4 to 6	9	-----	-----	-----	16**	115	119
Salt Creek 1990 (lower only)	1	6.9	2	50.1	4.6	8.5	2	2.7	26	21
	2	8.4	4	43.3	3.7	10.7	8	7.5	35	23
	3	2.9	5	32.3	3.5	7	6	7.1	35	32
	4	1.7	5	35.4	2.7	9.7	3	6.2	40	30
	5			A 5th reach	was never	delineated				
Salt Creek 1996 (Upper only)	6	0.7	2.7	26	2.8	32.5	36.6	10.9	47	41
	7	1.1	3.2	23.8	2.8	-----	23.7	13.9	50	45
	8	0.56	0.8	18.9	2.9	11.4	71.3	21.3	56	46
	9	1.14	0.6	17.6	2.1	42.9	44.1	11.4	61	50
	10	1.76	4.8	21.1	2	-----	19.9	5.3	53	50

** *Calculated from pools per yardage data (size of pool not noted, only depths ≥ 3-4 ft & 4-5 ft)*

Observed Pool Values and Objectives for Streams Located in Subwatershed 20 1

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (ft)	Residual Depth (ft)	Width/ Depth Ratio	% Area in Pools	Observed Pools/ Mile	Minimum Objective PACFISH	Minimum Objective Forest Plan
Tumble 1964	Mouth	——	>6	3	——	——	——	——	184	352
Sage 1964	Mouth	——	>6	3	——	——	——	——	184	352
Pepper 1964	Mouth	——	>6	2	——	——	——	——	184	528
Sugar 1964	Mouth	——	>6	2	——	——	——	——	184	528
Gobel 1964	Station 1	0.1	>6	6	——	——	——	——	164	181
Basin 1964	Mouth	——	>6	5	——	——	——	——	184	211
Fin Roberts 1964	Mouth	——	>6	DRY	——	——	——	——	-----	-----
McCredie 1964	Mouth	——	>6	3	——	——	——	——	184	352
McCredie 1992	1	0.25	6	6.3	1.9	-----	1.7	-----	138	141
	2	0.11	7	5.2	1.6	-----	6.6	——	122	125
	3	0.1	7	8.1	------	3.2	0	------	130	132
	4	0.12	7	8.4	——	-----	0	——	122	125
	5	0.15	6	10.8	——	-----	0	——	90	98
	6	0.14	10	5.2	——	6	0	——	184	240
	7	0.15	11.3	3.8	——	2	0	——	184	280
	8	0.25	30	5.9	——	10.9	0	-----	184	190
T20e 36.7 1992	1	0.4	2	7	——	3.2	0	0	145	151
	2	——	——	——	——	——	——	——	——	——
	3	——	——	——	——	——	——	——	——	——
	4	——	——	——	——	——	——	——	——	——
	5	——	——	——	——	——	——	——	——	——
T20e38.6 1992	1	——	——	——	——	——	——	——	——	——

Aquatic Habitat and Species Lists CONTINUED

Observed Pool Values and Objectives for Streams Located in Subwatershed 20 1

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (ft)	Residual Depth (ft)	Width/ Depth Ratio	% Area in Pools	Observed Pools/ Mile	Minimum Objective PACFISH	Minimum Objective Forest Plan
T20f 41.3 1992	1	0.16	1	2	——	——			184	>350
	2	——	14	3.5	——	——	——	——	184	308
	3	——	8	3	——	——	——	——	184	352
	4	——	6	3.5	——	——	——	——	184	308
T20f 41.5 1992	1	0.1	4	——	——	——	——	——	——	——
	2	0.3	9	——	——	——	——	——	——	——
	3	0.4	16	——	——	——	——	——	——	——
T20f 43.3 1992	1	0.2	5	12	——	——	——	——	91	94
Warner 1964	Station 1	mouth	>6	2	——	——	——	——	184	352
Warner 1996	1	0.5	14	8.1	1.1	22.4	20	3.9	130	132
	2	0.5	14	7.6	1.2	21.1	26.4	0	138	141
	3	0.9	21	5.8	0.8	11.36	-----	168.96*	184	190

* *1996 Reach 3 modified Level II survey resulted in elevated pools/mile because every pool is considered*

Observed Pool Values and Objectives for South Fork Salt Creek, Subwatershed 20 2 (1964, 1996 data)

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (ft)	Residual Depth (ft)	Width/ Depth Ratio	% Area in Pools	Observed Pools/ Mile	Minimum Objective PACFISH	Minimum Objective Forest Plan
S.Fk. Salt Creek 1964	1	0 - 0.9	>6	8	——	——	——	-----	130	132
	2	0.9 - 2.9	<4	9	——	——	——	21.4*	115	119
	3	2.9 - 3.9	>6	6	——	——	——	107.3*	138	141
S.Fk. Salt Creek 1996	1	0.8	9	17.4	2.3	35.6	25.9	11.5	61	61
	2	1	1	private land—denied access						
	3	1.1	3	9.5	1.8	23.9	66.7	5.4	106	112
	4	0.1	42	Poor access—not surveyed						
	5	1	13	11.2	1.5	20	——	114.97**	90	96
	6	0.6	12	10.7	1.1	19	——	11.81**	90	98
	7	1.1	3	6.3	1.3	25	——	90.2**	153	170
	8	1	11	7.5	0.9	19	——	184.8**	145	151
	9	0.6	8	4.3	0.5	18	——	188.1**	184	230

* *Calculated from pools per yardage data*

* * *1996 modified Level II survey resulted in elevated pools/mile because every pool is considered*

Aquatic Habitat and Species Lists CONTINUED

Observed Pool Values and Objectives for Streams Located in Subwatershed 20 2

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (feet)	Residual Depth (feet)	Width /Depth Ratio	% Area in Pools	Observed Pools/mile	Min.Obj. PACFISH	M[illegible] Fo[illegible] Plan
T20f 45.3 1992	1	0.1	7	3.6	1.8	—	4.7	21	184	310
T20f 46.3 1992	1	0.36	6	6.3	—	—	0	0	153	170
	2	0.24	5	4.6	—	—	0	0	184	240
	3	—	—	—	—	—	—	—	—	—
	4	—	15	—	—	—	—	—	—	—
T20w 11.8 1992	1	0.6	3	—	—	—	0	0	—	—
	2	0.7	4	—	—	—	—	—	—	—
Eagle 1937	Station A-B	0.9	—	—	—	—	—	—	—	—
Eagle 1964	Station 1	Mouth	>6	25	—	—	—	—	47	40
	Station 2	at 2 miles	>6	15	—	—	—	—	70	81
	Station 3	at 3.5 miles	>6	10	—	—	—	—	96	106
Eagle 1992	1	0.8	2	26.9	3.15	5	50.8	16.3	45	41
	2	0.3	5	22.5	3.2	6.73	16.9	16.7	50	48
	3	1	12	25.8	2.7	8.89	9	24	47	40
	4	0.3	3	19.2	2	—	32.9	3.3	56	56
	5	0.3	4	20.7	2	5.33	0	3.3	56	50
	6	0.4	3	14.7	2.7	—	2.1	5	70	72
	7	0.7	5	12.4	2.6	5.63	6.8	0	91	94
	8	1	3	7.3	4.3	5.17	0.9	2	145	151
	9	0.3	9	6.3	1.3	—	89.9	3.3	164	18[illegible]
	10	0.2	12	3.9	—	—	—	—	184	[illegible]
Coyote 1964	Station 1	mouth	>6	3	—	—	—	—	184	[illegible]
Coyote 1992	1	0.6	3	1.8	0.4	—	2.3	3.3	184	528
	2	0.8	20	3	—	—	—	—	184	352
Fall 1996	1	0.9	16	17.6	2.3	28.3	33.1	10.6	61	58
	2	0.6	6	12.5	1.6	13.3	20.6	4.7	91	94
	3	0.5	16	10.5	1.9	9.4	16.6	11.6	93	102
	4	1.1	10	7.2		Poor access—not surveyed			145	151
	5	0.9	12	11.1	1.3	5.8	—	89.76*	90	96
	6	0.3	2	12.8	3.6	7.5	—	32.27*	91	94
Diamond 1996	1	0.8	4	10.6	1.4	16.4	29.7	58	122	125
	2	0.9	7	9.9	1.9	13.7	17.4	45	102	110
	3	0.8	7	9.2	1.3	12.2	21.4	2.5	106	112

* *1996 modified Level II survey resulted in elevated pools/mile because every pool is considered*

Aquatic Habitat and Species Lists CONTINUED

Observed Pool Values and Objectives for Deer Creek, Subwatershed 20 3 (1996 data)

Stream Name	Reach No.	Reach Length (miles)	Gradient (%)	Average Width (feet)	Residual Depth (feet)	Width /Depth Ratio	% Area in Pools	Observed Pools/mile	Min.Obj. PACFISH	Min. Obj. Forest Plan
Deer 1996	1	0.7	6	12.2	1.5	11.3	32.4	2.8	91	94
	2	1.2	10	9.4	1.8	——	8.4	——	106	112
	3	0.2	2	10.3	1.1	5.11	——	112.2*	93	102

* *1996 modified Level II survey resulted in elevated pools/mile because every pool is considered*

Instream Large Woody Material (LWM) for Mainstem Salt Creek (1990, 1996 Stream Survey Data) *

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Minimum LWD/mile Forest Plan
Salt Creek 1990 (lower)	1**	6.9	14	8	4	12	80	105
	2**	8.4	17	16	15	31	80	105
	3	2.9	30	14	3	17	80	105
	4	1.7	14	14	1	15	80	105
	5	Not Surveyed						
Salt Creek 1996 (Upper)	6	0.7	36.6	16.6	5	21.6	80	105
	7	1.1	27.3	0.9	2.7	3.6	80	105
	8	0.56	110	38.3	20	58.3	80	105
	9	1.14	120.7	17.7	0.77	18.5	80	105
	10	1.76	77.6	12.9	7.6	20.5	80	105

* *1937 and 1964 surveys lack detailed LWM data*

** *Additional large and medium woody material from habitat structures*

Instream Large Woody Material (LWM) for Streams in Subwatershed 20 1 (1992 Stream Survey Data)

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Minimum LWD/mile Forest Plan
McCredie 1992	1	0.25	55.5	27.7	19.8	47.5	80	105
	2	0.11	18.9	37.9	75.8	113.7	80	105
	3	0.1	38.7	------	------	------	80	105
	4	0.12	16.2	24.3	8.1	32.4	80	105
	5	0.15	62.7	48.7	13.9	62.6	80	105
	6	0.14	24	48.1	8	56.1	80	105
	7	0.15	78.4	47.1	15.7	62.8	80	105
	8	0.25	91.7	116.7	66.7	183.4	80	105
T20 e 36.7 1992	1	0.4	------	------	------	------	80	105
	2	-----	------	------	------	------	80	105
	3	-----	------	------	------	------	80	105
	4	-----	------	------	------	------	80	105
	5	-----	------	------	------	------	80	105
T20 f 41.3	1	0.16	76	151.9	227.9	------	80	105
	2	-----	------	------	------	------	80	105
	3	-----	------	------	------	------	80	105
	4	-----	------	------	------	------	80	105

NOTE: **Small LWM** is 12 inch dbh and 25 feet in length; **Medium LWM** is 24 in. dbh and 50 feet in length; **Large LWM** is 36 inch dbh and 50 feet in length

Aquatic Habitat and Species Lists CONTINUED

Instream Large Woody Material (LWM) for Warner Creek, Subwatershed 20 1 (1996 Stream Survey Data)

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Mi[illegible] LWD/mile Forest Plan
Warner 1996	1	0.5	128	60	10	70	80	105
	2	0.5	120	66	28	94	80	105
	3	0.9	107	61	13	74	80	105

Instream Large Woody Material (LWM) for S.Fk.Salt Creek, Subwatershed 20 2 (1996 Stream Survey Data)

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Minimum LWD/mile Forest Plan
SFk Salt Ck 1996	1	0.8	63.75	26.25	13.75	40	80	105
	2	1		Denied access - not surveyed			80	105
	3	1.1	48.2	16.4	6.4	22.8	80	105
	4	0.1		Not surveyed			80	105
	5	1	53	14	3	17	80	105
	6	0.6	17	3	0	3	80	105
	7	1.1	35	23	3	26	80	105
	8	1	20	16	1	17	80	105
	9	0.6	48	12	3	15	80	105

Instream Large Woody Material (LWM) for Streams in Subwatershed 20 2 (1992 Stream Survey Data)

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Minimum LWD/mile Fores[illegible]
T20 f 45.3 1992	1	0.1	175.3	133.2	49.1	182.3	80	1[illegible]
T20 f 46.3 1992	1	0.36	87.9	76.9	41.2	118.1	80	105
	2	0.24	72.8	44.5	12.1	56.6	80	105
	3	-----	-----	-----	-----	-----	80	105
	4	-----	-----	-----	-----	-----	80	105
T20 w 11.8 1992	1	0.6	9.4	4	0	4	80	105
	2	0.7	-----	-----	-----	-----	80	105
Eagle 1992	1	0.8	971.8*	722.3*	302*	1024.3*	80	105
	2	0.3	312.5*	312.5*	0	312.5*	80	105
	3	1	46*	43.2*	21.2*	64.4*	80	105
	4	0.3	0*	0	0	0	80	105
	5	0.3	271.3*	162.8*	54.3*	217.1*	80	105
	6	0.4	43.7*	21.8*	21.8*	43.6*	80	105
	7	0.7	82.1*	83.7*	40.2*	123.9*	80	105
	8	1	36.1*	22.6*	12*	34.6*	80	105
	9	0.3	9139*	5415.4*	3046.2*	8461.6*	80	105
	10	0.2	21120*	31680*	31680*	63360*	80	105
Coyote 1992	1	0.6	51.7	6	2	8	80	105
	2	0.8	-----	-----	-----	-----	80	105

* 1992 Eagle Creek LWM data are suspect

Aquatic Habitat and Species Lists CONTINUED

Instream Large Woody Material (LWM) for Streams in Subwatershed 20 2 (1996 Stream Survey Data)

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Minimum LWD/mile Forest Plan
Fall 1996	1	0.9	27.8	27.8	2.2	28.9	80	105
	2	0.6	21.7	5	0	5	80	105
	3	0.5	18	8	0	8	80	105
	4	1.1	No Access - not surveyed				80	105
	5	0.9	69	4	0	4	80	105
	6	0.3	76	0	0	0	80	105
Diamond 1996	1	0.8	35	13.8	0	13.8	80	105
	2	0.9	30	7.8	4.4	12.2	80	105
	3	0.8	26.3	5	1.25	6.25	80	105

Instream Large Woody Material (LWM) for Deer Creek, Subwatershed 20 3 (1996 Stream Survey Data)

Stream Name	Reach No.	Reach Length (miles)	No. Small LWM/mile	No. Medium LWM/mile	No. Large LWM/mile	No. Med+Large LWM per mile	Minimum LWD/mile PACFISH	Minimum LWD/mile Forest Plan
Deer 1996	1	0.7	22.8	15.7	0	15.7	80	105
	2	1.2	33	13	1	21	80	105
	3	0.2	40	0	0	0	80	105

Physical Information for Mainstem Salt Creek (1990, 1996 Stream Survey Data)

Stream	Reach No.	Reach Length (miles)	Valley Segment Type	Dominant Substrate	Subdominant Substrate	Channel Stability Rating	# Failures (Average Size)	# Wood Debris Jams	Rosgen Channel Type
Salt Creek 1990 (lower)	1	6.9	M2	CO	SB	--	--	--	B
	2	8.4	M2	CO	SB	--	--	--	B
	3	2.9	M2	CO	SB	--	--	--	B
	4	1.7	M2	SB	CO	--	--	--	G
	5	No Survey							

				Wetted Channel Substrates								
				% SA	% GR	% CO	% BO	% BR				
Salt Creek 1996 (upper)	6	0.7	V1	9	31	28	11	22		--	--	B
	7	1.1	M1	14	21	20	19	25				B
	8	0.6	F6	44	37	17	1	0				DA
	9	1.1	F3	31	38	24	6	2				C
	10	1.8	V2	7	27	31	21	13				A

Aquatic Habitat and Species Lists CONTINUED

Physical Information for Streams Located in Subwatershed 20 1

Stream	Reach No.	Reach Length (miles)	Valley Segment Type	Dominant Substrate	Subdominant Substrate	# Failures (Average Size)	# Failures (Average Size)	# Wood Debris Jams	Ro. Channel Type
Tumble, 1964	Sta 1	Mouth	--	BO	GR	--	--	--	
Sage, 1964	Sta 1	Mouth	--	BO	GR	--	--	--	
Pepper, 1964	Sta 1	Mouth	--	BO	GR	--	--	--	
Sugar, 1964	Sta 1	Mouth	--	BO	GR	--	--	--	
Gobel, 1964	Sta 1	0.1	--	BO	GR	--	--	--	
Basin, 1964	Sta 1	Mouth	--	BO	CO	--	--	--	
Fin Roberts 1964	Sta 1	Mouth	--	BO	CO	--	--	--	
McCredie, 1964	Sta 1	Mouth	--	BO	CO	--	--	--	
McCredie 1992	1	0.25	F4	CO	SB	FAIR	Some MW	--	
	2	0.11	U2	CO	SB	FAIR	Some MW	--	
	3	0.1	U2	SB	CO	FAIR	Some MW	--	
	4	0.12	U2	SB/CO	CO	FAIR	Some MW	--	
	5	0.15	U2	GR	CO	FAIR	small failures	1	
	6	0.14	V4	CO	GR	FAIR	--	--	
	7	0.15	H1	CO	GR	FAIR	--	--	
	8	0.25	H2	CO	GR/CO	N/A	--	--	
T20e 36.7	1	0.4	val code 1	SA	GR	--	--	--	
	2	--	--	--	--	--	--	--	
	3	--	--	--	--	--	--	--	
	4	--	--	--	--	--	--	--	
	5	--	--	--	--	--	--	--	
T20f 41.3	1	0.16	val code 1	SA	GR	FAIR	--	0	
	2	--	V4	--	--	FAIR	--	2	
	3	--	V4	--	--	FAIR	--	5	
	4	--	H2	--	--	FAIR	0	0	
T20f 41.5 1992	1	0.1	val code 1	SA	GR	--	--	--	
	2	0.3	M2	GR	SA	--	--	--	
	3	0.4	H2	SA	GR	--	--	--	
T20f 43.3 1992	1	0.2	M2	CO	SB	--	--	10	
Warner, 1964	Sta 1	Mouth	--	BO	GR				

Stream	Reach No.	Reach Length (miles)	Valley Segment Type	Wetted Channel Substrates % SA	% GR	% CO	% BO	% BR	# Failures (Average Size)	# Failures (Average Size)	# Wood Debris Jams	Ro. Channel Type
Warner, 1996	1	0.5	V2	16	26	31	25	0.8	--	14 (22X4)	6	
	2	0.5	V2	16	31	31	22	0	--	2 (6X1)	3	
	3	0.9	H2			D	SD		--	18 (3.8% of Reach)	20+	Aa+

D = dominant, SD = subdominant

Aquatic Habitat and Species Lists CONTINUED

Physical Information for South Fork Salt Creek, Subwatershed 20 2 (1964 and 1996 Data)

Stream	Reach No.	Reach Length (miles)	Valley Segment Type	Dominant Substrate			Subdominant Substrate		Channel Stability Rating	# Failures (Average Size)	# Wood Debris Jams	Rosgen Channel Type
S.Fk. Salt 1964	Sta 1	0.9	--	CO/BR			BR		--	--	--	--
	Sta 2	2.0	--	GR			SA		--	--	4	--
	Sta 3	1.0	--	BR			BO		--	--	1	--
				Wetted Channel Substrates								
				% SA	% GR	% CO	% BO	% BR				
S. Fk. Salt	1	0.8	U2	21	18	36	25	0.2	FAIR	10 (50x10)	5	B
	2	1.0	U1	23	43	28	6	0.5	--	--	--	C
	3	1.1	U1	--	--	--	--	--	FAIR	6 (27x4)	15	B
	4	0.1	V3							No Survey		Aa+
	5	1.0	V2			SD		D	FAIR	6 (23X11)	25	Aa+
	6	0.6	U2		D		SD		FAIR	5 (18X5)	25	B
	7	1.1	U1		D	SD			POOR	14 (20X4)	20	C
	8	1.0	V2		D	SD			FAIR	17 (19X5)	15	A
	9	0.6	F6		D		SD		GOOD	2 (7X4)	25	B

D = dominant, SD = subdominant

Physical Information for Streams Located in Subwatershed 20 2

Stream Name	Reach No.	Reach Length (miles)	Valley Segment Type	Dominant Substrate	Subdominant Substrate	Channel Stability Rating	# Failures (Average Size)	# Wood Debris Jams	Rosgen Channel Type
T20f 45.3 1992	1	0.1	M2	SA	CO	--	--	1	
T20f 46.3 1992	1	0.36	H1	SA	GR/SB	--	--	--	
	2	0.24	U1	SA	GR	--	--	--	
	3	--	H2	SA	SB	--	--	--	
	4	--	H2	SA	SA	--	--	--	
T20w 11.8 1992	1	0.6	H1	GR	CO	--	--	--	
	2	0.7	H1	GR	SA	--	--	--	
Eagle 1937	Sta A-	0.9	--	large CO	small CO	--	--	--	
Eagle 1964	Sta 1	Mouth	--	CO/BO	GR	--	--	--	
	Sta 2	@ 2 mi	--	CO/BO	GR	--	--	--	
	Sta 3	@ 3.5 mi	--	CO/BO	GR	--	--	--	
Eagle 1992	1	0.8	F2	CO	GR	--	--	--	
	2	0.3	V4	SB	CO	--	--	1	
	3	1.0	V2	SB	GR	--	1 (50x100)	2	
	4	0.3	V4	GR	SB	--	--	--	
	5	0.3	M2	CO	GR	--	--	--	
	6	0.4	V4	CO	GR	--	--	3	
	7	0.7	V4	CO	GR	--	--	blowdwn	
	8	1.0	V4	GR	SB	--	4 (20x30)	3	
	9	0.3	M2	SA	GR	--	--	1	
	10	0.2	H2	GR	SA	--	--	blowdwn	
Coyote 1964	Sta 1	Mouth	--	BO/CO	GR	--	--	--	
Coyote 1992	1	0.6	F6	SA	GR	--	--	--	
	2	0.8	H1	CO	SB	--	1 (10x4)	--	

Aquatic Habitat and Species Lists CONTINUED

Physical Information for Streams Located in Subwatershed 20 2

Stream Name	Reach No.	Reach Length (miles)	Valley Segment Type	Wetted Channel Substrates % SA	% GR	% CO	% BO	% BR	Channel Stability Rating	# Failures (Average Size)	# Wood Debris Jams	Rosgen Channel Type
Fall 1996	1	0.9	V2	3	35	41	12	0.9	–	3 (28 ft)	5	Aa+
	2	0.6	V1	19	30	43	13	13	–	1 (15 ft)	1	A
	3	0.5	U2	19	17	25	25	32	–	1 (15 ft)	–	Aa+
	4	1.1	U1							No Survey		A
	5	0.9	V2				D	SD	–	4 (0.7% of Reach)	1	Aa+
	6	0.3	F5	D	SD				–	–	–	B
Diamond 1996	1	0.8	F5	10	35	28	15	12	–	(105 ft)	–	B
	2	0.9	V1	11	27	22	10	30	–	(195 ft)	–	A
	3	0.8	U2	8	24	24	22	22	–	(165 ft)	–	Aa+

D = dominant, SD = subdominant

Physical Information for Deer Creek, Subwatershed 20 3

Stream Name	Reach No.	Reach Length (miles)	Valley Segment Type	Wetted Channel Substrates % SA	% GR	% CO	% BO	% BR	Channel Stability Rating	# Failures (Average Size)	# Wood Debris Jams	Rosgen Channel Type
Deer 1996	1	0.7	M1	6	26	32	11	25	FAIR	7 (15x10)	3	A
	2	1.2	V2	3	18	23	12	44	FAIR	5 (20x5)	3	Aa+
	3	0.2	H1		SD	D			FAIR	3 (6x1)	0	F

D = dominant, SD = subdominant

Biological Information About Species Located in the Riparian Area of Mainstem Salt Creek (1937, 1964, 1980, 1987 Data)

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
Salt Creek 20 1,20 2	8/28/37	Sta A-B	—	—	HA, HX, maple	—	—	CX	51 (1000)	CH, ONXX	—
		Sta B-C	—	—	HA, HX, maple	—	—	CX	50 (1100)	CH, ONXX	—
		Sta C-D	—	—	HA, HX, maple	—	—	CX	50 (1230)	CH, ONXX	—
		Sta D-E	SS	—	HA, HX, maple	—	—	CX	50 (1445)	CH, ONXX	—
		Sta E-F	SS	—	HA, HX, maple	—	—	CX	52 (1630)	CH, ONXX	—
Salt Creek 20 1- 20 3	8/64	1	—	—	HA, HX, maple	—	—	CX	56 (1115)	RB, CT	—
		2	—	—	HA, HX, maple	—	—	CX	58 (1440)	RB, CT	—
		3	—	—	HA, HX, maple	—	—	CX	52 (1100)	RB, CT	—
		4	—	—	HV, CX	—	—	CX	52 (1110)	CT	—
		5	—	—	HX, CX	—	—	CX	51 (1000)	CT	—
		6	—	—	HA	—	—	CX	50 (1000)	CT	—
Salt Creek 20 3	8/20/80	6	—	—	HA, HV, CD	—	—	—	50 (1400)	—	—
	8/20/80	7	—	—	—	—	—	—	63 (1600)	RB	—
	8/21/80	?	—	—	—	—	—	—	59 (1100)	RB, BT	—
	8/21/80	10	—	—	GF, CD	—	—	—	61 (1345)	RB, BT	—
	8/21/80	10	—	—	GF, HA	—	—	—	50 (1600)	RB, BT	—
	9/17/80	11	—	—	GF, HW	—	—	—	46 (1200)	BT	—
Salt Creek 20 2	8/3/87	wicopee	—	—	HX, CX	—	—	—	62 (1100)	RB,CT,SC, SD	—
	8/3/87	wicopee	—	—	HX,CX	—	—	—	62 (1400)	RB,CT,SC	—

Aquatic Habitat and Species Lists CONTINUED

Biological Information About Species Located in the Riparian Area of Mainstem Salt Creek (1990, 1996 Data)

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
Salt Creek 20 1, 20 2 (Lower)	7/9/90	1	LT	100	CC, HA	LT	100	CD, CC	58	CT,RB, BT, SC, MW,LM	
		2	LT	48	CD,HA	LT	62	CD, CC	53	BT	—
		3	SP	58	HA,CD	LT	58	CD, CC	51	—	—
		4	SP	90	HA,HV	LT	50	CD, CC	55	—	—
	8/10/90	2	—	—	—	—	—	—	50	CT,RB,MW,SC	—
	8/10/90	2	—	—	—	—	—	—	—	CT,RB,MW	—
	8/10/90	2	—	—	—	—	—	—	—	CT,RB,MW	—
Salt Creek 20 3	8/9/96	6	SS	100	HA,HW,HX	LT	100	CD, CC	50	—	—
		7	SS	100	HA,HW,HX	LT	100	CD, CC	55 (1330)	CT,RB,BT	—
		8	SS	100	HA, ,HX	LT	67	CD,CF,CH	56 (1530)	BT	—
		9	SS	100	HA,HW,HX	LT	100	CF,CH,CW	54	—	—
		10	SS	75	HA,HX,CW,CX	LT	100	CD,CH,CF	3	—	Unk frog

Biological Information About Species Located in the Riparian Area of Streams in Subwatershed 20 1

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
Tumble	9/9/64	------	------	------	------	------	------	CX	------	------	------
Sage	9/9/64	------	------	------	------	------	------	CX	49 (1230)	------	------
Pepper	9/9/64	------	------	------	------	------	------	CX	49 (1230)	------	------
Sugar	9/9/64	------	------	------	------	------	------	CX	49 (1230)	------	------
Gobel	9/9/64	------	------	------	------	------	------	CX	49 (1300)	------	------
Basin	9/9/64	------	------	------	------	------	------	CX	47 (1300)	------	------
Fin Roberts	9/9/64	------	------	------	------	------	------	CX	------	------	------
McCredie	9/9/64	------	------	------	------	------	------	CX	49 (1300)	------	------
McCredie	4/21/92	1	------	------	------	------	------	------	47 (1100)	------	------
		2	------	------	------	------	------	------	------	------	------
		3	SP	100	CC, CH	------	------	------	------	------	------
		4	------	------	------	------	------	------	43 (1400)	------	------
		5	------	------	------	------	------	------	47 (1230)	------	------
		6	SS	100	CC, HW	------	------	------	------	------	------
		7	SS	100	CH, CC	------	------	------	44 (0915)	------	------
		8	SP	100	CH, CD	------	------	------	44 (1000)	------	------
T20e 36.7	5/5/92	1	LT	99	CC, HV	------	------	------	50 (0900)	—	unk frog
		DATA NOT AVAILABLE FOR REACHES 2 -5									
T20e 38.6	5/6/92	1	------	------	------	------	------	------	------	------	------
T20f 41.3	5/12/92	1	SS	------	HW	------	------	------	------	CT	—
		2		------	------	------	------	------	------	------	------
		3	GF	------	------	------	------	------	------	------	------
		4	GF	------	------	------	------	------	------	------	------

Aquatic Habitat and Species Lists CONTINUED

Biological Information About Species Located in the Riparian Area of Streams in Subwatershed 20 1

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
T20f 41.5	5/13/92			NO DATA FOR REACHES 1-3							
T20f 43.3	5/20/92	1	NV	----	----	----	----	—	—	0	----
Warner	1964	Sta 1	----	----	----	----	----	CX	48 (1300)	----	----
Warner	7/3/96	1	SP	47	HA, HV	ST	73	CC, CF	55	CT	DITE
		2	ST	67	CF, CH	ST	67	CC,CH	56	ONXX	----
		3	LT	67	CC, CF	LT	57	CC, CF	50	----	DITE, ASTR, RAAU

Biological Information About Species Located in the Riparian Area of S. Fk. Salt Creek
(1964, 1970, 1995, 1996 Stream Survey Data)

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
S. Fk. Salt	1964	Sta 1	-----	------	HX, CX	-----	------	—	54 (1300)	CT, SC	------
		Sta 2	-----	------	HV,HW,HX	-----	------	—	56 (1653)	CT	—
		Sta 3	-----	------	CX	-----	------	—	46 (1345)	-----	—
S. Fk. Salt		1	-----	------	-----	-----	------	—	57	CT	—
S. Fk. Salt	8,9/85	1-2	-----	------	-----	-----	------	—	49.5	CT, UNK, SC	—
		5	-----	------	-----	-----	------	—	----	—	—
		7	-----	------	-----	-----	------	—	56	—	DIT RAC ASTR
		9	-----	------	-----	-----	------	—	----	—	RACA, ASTR
S. Fk. Salt	8/15/96	1	SS,LT	86	HA,HW, CC,CF	LT	57	CF,CC	55	—	—
		2				DENIED ACCESS - NOT SURVEYED					
		3	SS	91	HA,HV, HW,HD	SP	73	CF, CF	68	CT	ASTR
		4				NOT SURVEYED					
		5	ST	57	CC, CF	ST	57	CC, CF	47	0	ASTR,RACA DITE, TAGR
		6	SP	94	HA, HW	ST	57	CF, CF	----		ASTR
		7	SS,LT	76	HA,HV, CF, CH	LT	67	CF, CH	43		RACA, ASTR
		8	SS	80	HW, HW	LT	52	CF, CH	48.5		RACA, ASTR
		9	ST	80	CF, CH	ST	80	CF, CH	45		RACA, ASTR

Aquatic Habitat and Species Lists CONTINUED

Biological Information About Species Located in the Riparian Area of Streams in Subwatershed 20 2

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
T20f 45.3	5/20/92	1	—	—	—	—	—	—	—	—	—
T20f 46.3	1992	1	—	—	—	2nd grow	—	—	44 (1000)	—	RAAU
		2	—	—	—	2nd grow	—	—	—	—	—
		3	—	—	—	LB3, RB3	—	—	—	—	—
		4	—	—	—	LB3, RB3	—	—	—	—	—
T20w 11.8	8/25/92	1	ST	100	CD, HA	—	—	—	47 (1100)	—	—
		2	—	—	—	—	—	—	—	—	—
Eagle	1937	Sta A-B	—	—	—	—	—	—	—	—	—
Eagle	1964	Sta 1	—	—	—	—	—	CX	42 (1430)	RB, SC	—
		Sta 2	—	—	—	—	—	CX	42 (1500)	0	—
		Sta 3	—	—	—	—	—	—	—	—	—
Eagle	5/28/92	1	SP	100	HA, CC	—	—	—	48	—	—
		2	ST	100	CH, CC	—	—	—	47 (1200)	—	—
		3	LT	100	CC, CS	—	—	—	44 (1140)	—	—
		4	—	—	—	LB4, RB2	—	—	—	—	—
		5	MT	100	CD, CC		—	—	43 (1100)	—	—
		6	—	—	—	LB6, RB6	—	—	47 (1150)	—	—
		7	ST	100	HV, CH		—	—	—	—	—
		8	LT	100	CD, HW		—	—	52 (1520)	—	—
		9	—	—	—	LB1, RB1	—	—	—	—	RAAU
		10	—	—	—	LB1, RB6	—	—	—	—	—
Coyote	1964	—	—	—	—	—	—	CX	52 (1330)	—	—
Coyote	8/4/92	1	ST	100	CD, HA	—	—	—	55 (1000)	unk. species	—
		2	—	—	—	Reprod	—	—	—	—	—
Fall	1995	1	—	—	—	—	—	—	44 (1300)	CT, unk	ASTR
		2	—	—	—	—	—	—	—	BT	—
		3	—	—	—	—	—	—	—	—	—
		4	—	—	—	—	—	—	—	—	—
		5	—	—	—	—	—	—	—	—	—
Fall	1996	1	SS	83	HA, HB, CF	LT	100	CF, CH	46	—	ASTR, RACA
		2	SS	50	HA, CF	LT	67	CF, CH	48	BT	—
		3	SS	84	HA, CH	LT	100	CF, CH	43	—	—
		4					NO ACCESS - NOT SURVEYED				
		5	SS	100	HA, CH	LT	100	CF,CM	39	0	—
		6	—	—	—	LT	100	CF,CM	40	0	—
Diamond	1995	1	—	—	—	—	—	—	46 (1130)	CT, BT	—
Diamond	1996	1	SS	100	HA,HW, HV,CH	LT	94	CH, CF	64	UNK	RACA
		2	SS	90	HA,CH,CF	LT	100	CH, CF	60	—	—
		3	SS	100	HA,CH,CF	LT	100	CF, CH	55	—	—

Aquatic Habitat and Species Lists CONTINUED

Biological Information About Species Located in the Riparian Area of Deer Creek , Subwatershed 20 3
(1995, 1996 Stream Survey Data)

Stream & Location	Survey Date	Reach No.	Seral Stage Inner	% Inner Riparian	Inner Riparian Species	Seral Stage Outer	% Outer Riparian	Outer Riparian Species	Water Temp (F) (Time)	Fish Species	Amphib. Species
Deer	9/95	1	------	------	------	------	------	------	42	0	
		2	------	------	------	------	------	------	42	BT	-----
		3	------	------	------	------	------	------	-----	0	-----
Deer	9/96	1	SS	100	HA, HX	LT	73	CH, CF, CS	48	0	RACA, ASTR
		2	SS	100	HX, HX	LT	91	CF, CH	42	BT	RACA, ASTR
		3	------	------	-----	SP	100	CF, CH	39	-----	-----

BT = Brook trout (*Salvelinus fontinalis*)
CH = Chinook salmon (*Oncorhynchus tshawytscha*)
CT = Cutthroat trout (*Oncorhynchus clarki*)
LM = Lamprey (*Lampetra spp.*)
MW = Mountain whitefish (*Prosopium williamsoni*)
ONXX = Unknown salmonid species
RB = Rainbow trout (*Oncorhynchus mykiss*)
SC = Sculpin species (*Cottus spp.*)
SD = Speckled dace (*Rhinicthys osculus*)
UNK = Unknown fish species

Wolman Pebble Counts (1996)

Salt Creek Wolman Pebble Count (20 1)

Reach Number	D50 (mm)	D84 (mm)	Dominant Substrate	Subdominant Substrate
6	70	148		
7	117	567		
8	6	35		
9	34	86		
10	131	355		

South Fork Salt Creek Wolman (20 20)

Reach Number	D50 (mm)	D84 (mm)	Dominant Substrate	Subdominant Substrate
1	126	415		
2	--	--		
3	40	104		
4	--	--		
5				
6	Modified	Level II	Survey	
7	Wolman	Counts	Not Taken	
8				
9				

Warner Creek Wolman Pebble Count (20 1)

Reach Number	D50 (mm)	D84 (mm)
1	57	201
2	45	159
3	--	--

Fall Creek Wolman Pebble Count (20 2)

Reach Number	D50 (mm)	D84 (mm)
1	35	119
2	238	3399
3	117	3370
4	--	--
5	Modified	Survey
6	No	Wolman

Deer Creek Wolman Pebble Count (20 3)

Reach Number	D50 (mm)	D84 (mm)
1	94	561
2	265	1834.25

Diamond Creek Wolman Pebble Count (20 2)

Reach Number	D50 (mm)	D84 (mm)
1	45	254
2	64	334
3	Modified Survey	No Wolman

APPENDIX I: High lakes Fish Stocking Records

Betty Lake

Year	Species	Number
1994	RB	7242
1995	RB	1920
1996	RB	4000

Lower Betty Lake

Year	Species	Number
1994	RB	578
1996	RB	4462

Birthday Lake

Year	Species	Number
1993	BT	411
1995	BT	480

Boo Boo Lake

Year	Species	Number
1993	CT	303
1995	RB	300
1995	CT	600

LeMay Lake

Year	Species	Number
1993	RB	788
1995	CT	469
1995	RB	1260
1996	RB	413

Lorin Lake

Year	Species	Number
1993	RB	788
1995	CT	1125
1995	RB	800

Lucas Lake

Year	Species	Number
1993	CT	505
1993	RB	506
1996	RB	319
1996	CT	500

Horsefly Lake

Year	Species	Number
1993	BT	294
1995	BT	360
1996	RB	207
1996	BT	300

Howkum Lake

Year	Species	Number
1995	CT	563
1996	RB	207
1996	CT	400

Lower Island Lake

Year	Species	Number
1993	CT	606
1995	CT	750

Upper Island Lake

Year	Species	Number
1993	RB	788
1995	RB	720

JoAnn Lake

Year	Species	Number
1993	CT	808
1995	CT	1313

Verde Lake

Year	Species	Number
1993	CT	303
1995	CT	375

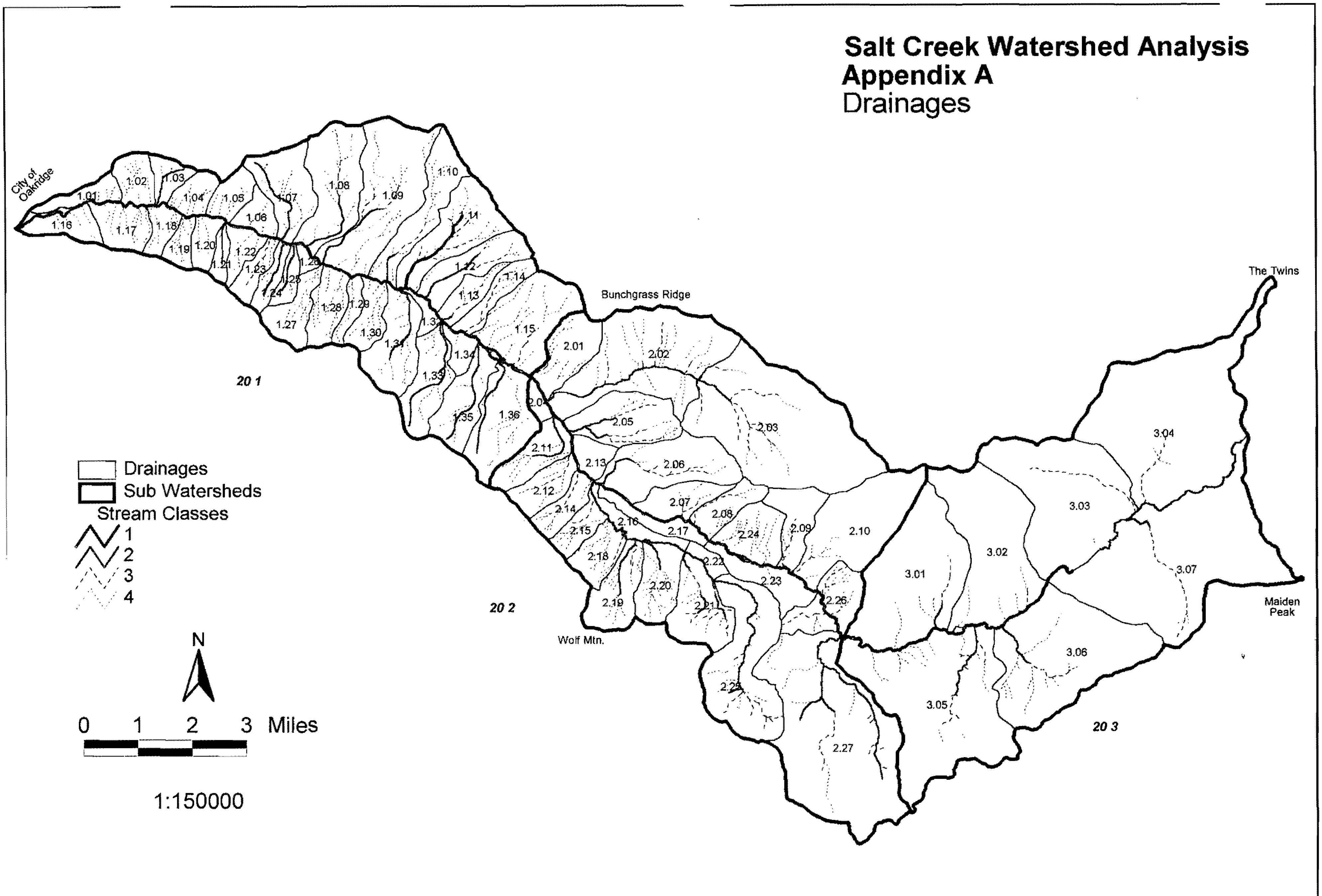
Vivian Lake

Year	Species	Number
1993	BT	1528
1995	BT	1680

BT = Brook trout (*Salvelinus fontinalis*)
CT = Cutthroat trout (*Oncorhynchus clarki*)
RB = Rainbow trout (*Oncorhynchus mykiss*)

APPENDIX J: Aggregate Recovery Percentages by Drainage

Drainage	Code	Weighted Recovery Rate	Drainage	Code	Weight Recovery Rate
20	1.01	44.64	20	1.36	68.53
20	1.02	86.35	20	2.01	80.91
20	1.03	89.40	20	2.02	76.87
20	1.04	74.25	20	2.03	85.71
20	1.05	91.77	20	2.04	50.28
20	1.06	85.38	20	2.05	83.04
20	1.07	81.23	20	2.06	70.42
20	1.08	82.24	20	2.07	74.38
20	1.09	84.52	20	2.08	76.05
20	1.10	81.48	20	2.09	88.85
20	1.11	84.09	20	2.10	94.45
20	1.12	79.32	20	2.11	67.44
20	1.13	84.77	20	2.12	73.45
20	1.14	78.12	20	2.13	49.19
20	1.15	80.61	20	2.14	68.03
20	1.16	79.82	20	2.15	78.56
20	1.17	74.57	20	2.16	78.03
20	1.18	75.12	20	2.17	73.01
20	1.19	72.46	20	2.18	76.85
20	1.20	73.83	20	2.19	75.74
20	1.21	87.36	20	2.20	55.46
20	1.22	71.28	20	2.21	80.62
20	1.23	87.10	20	2.22	71.14
20	1.24	79.53	20	2.23	86.16
20	1.25	74.70	20	2.24	87.86
20	1.26	75.09	20	2.25	75.82
20	1.27	81.82	20	2.26	82.37
20	1.28	86.29	20	2.27	84.87
20	1.29	80.05	20	3.01	78.80
20	1.30	79.35	20	3.02	83.17
20	1.31	84.00	20	3.03	78.68
20	1.32	76.97	20	3.04	94.70
20	1.33	88.57	20	3.05	85.25
20	1.34	80.10	20	3.06	62.72
20	1.35	65.41	20	3.07	82.13



Salt Creek Watershed Analysis
Appendix A
Drainages
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
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3.04
3.05
3.06
3.07
Drainages
Sub Watersheds
Stream Classes
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Appendix L: Glossary

Many of the definitions in this glossary are referenced to the following sources. The sources are identified by a number in parentheses following the definition. This number corresponds to the list below. Some other terms will be referenced to Forest Service Manuals (FSM), Forest Service Handbooks (FSH), or other sources which are too numerous to list. Finally, many other definitions are not referenced, but are those in general use on the Forest.

Source List

1) CFR 219 National Forest Management Act Regulations.
2) Regional Guide for the Pacific Northwest Region, 1984.
3) SAF Dictionary of Forestry Terms, 1971.
4) The Random House College Dictionary, Revised Edition, 1975.
5) Webster's New International Dictionary, 1957.
6) Wildland Planning Glossary, 1976.
7) Webster's Third New International Dictionary, 1981.
8) Wildlife Habitats in Managed Forests, The Blue Mountains of Oregon and Washington, 1979.
9) A Glossary of Terms Used in Range Management.
10) Forest Service Manual or Forest Service Handbook.

- A -

Age class - An interval, usually 10 to 20 years, into which the age ranges of vegetation are divided for classification or use. (3)

Aggregate Recovery Percent (ARP) - Measure of the vegetative condition related to its ability to intercept rain, snow, and wind and its ability to modify snow accumulation and melting.

Airshed - A geographic area that, because of topography, meteorology, and climate, shares the same air. (2)

Alluvium, Alluvial - Sediments deposited by water.

Anadromous Fish - Those species of fish that mature in the sea and migrate into streams to spawn. Salmon, steelhead, and searun cutthroat trout are examples.

Andesite - A moderately hard light colored rock produced by volcanic eruption.

Appropriated Funds - Moneys authorized by an act of Congress which permit Federal agencies to incur obligations and to make payments out of the US Treasury for specified purposes.

Aquifer - Underground strata containing water.

Aquatic ecosystems - Stream channels, lakes, marshes or ponds, and the plant and animal communities they support.

Artifact - An object made or modified by humans. (4)

Available forest land - Land which has not been legislatively or administratively withdrawn by the Secretary of Agriculture or Forest Service Chief from timber production.

- B -

Background - In visual management terminology, refers to the visible terrain beyond the foreground and middleground where individual trees are not visible, but are blended into the total fabric of the stand. Also a portion of a view beyond three to five miles from the observer, and as far as the eye can detect objects. (6)

Bald Eagle Management Area (BEMA) - An area allocated by the Willamette National Forest Plan to be managed for the benefit of American Bald Eagles.

Basaltic - A hard generally dark and dense rock type produced by volcanic eruption.

Base Flow - The portion of a stream or river flow attributable to ground water interception, usually a very constant amount.

Bedload - The coarse sediment moved by a stream or river which moves along the bed of the stream.

Beneficial uses - In water use law the reasonable use of water for a purpose consistent with the laws and best interest of the people and the state.

Best Management Practices - A practice or combination of practices that is determined by a State (or designated areawide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation, to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals (Federal Register, Volume 40, No. 230 dated 11/28/75).

Big game - Large mammals hunted for sport. On the National Forest these include animals such as deer, elk, antelope, and bear. (8)

Big Game Emphasis Area (BGEA) - An area of land designated by the Willamette National Forest Plan with prescriptions for specific habitat qualities for deer and elk.

Big game summer range - A range, usually at higher elevation, used by deer and elk during the summer. Summer ranges are usually much more extensive than winter ranges. (8)

Big game winter range - A range, usually at lower elevation, used by migratory deer and elk during the winter months; usually more clearly defined and smaller than summer ranges. (8)

Biological diversity - Terms used in the Forest Plan to provide goals and direction for evaluating the significance of old growth stands, minimizing fragmentation of existing old growth forests, and maintaining many of the structural components of unmanaged stands in managed stands.

Board foot (BF) - The amount of wood equivalent to a piece of wood one foot by one foot by one inch thick. (3)

Broadcast Burn - Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of fuel hazard or as a silvicultural treatment, or both.

Browse - Twigs, leaves, and young shoots of trees and shrubs on which animals feed; in particular, those shrubs which are used by big game animals for food. (6)

Browse Enhancement - The act of cutting down brush or hardwood vegetation when it is too tall, decadent, or low in nutritional value to increase its future value to browsing animals, usually big game. This cutback allows the vegetation to resprout and become more available and or higher quality.

- C -

Canopy - The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth. (3)

Cavity - The hollow excavated in trees by birds or other natural phenomena; used for roosting and reproduction by many birds and mammals. (2)

Char - A group of fish in the Salmonid family - in this watershed, brook trout and bull trout.

Clearcutting - The cutting method that describes the silviculture system in which the old crop is cleared over a considerable area at one time. Regeneration then occurs from (a) natural seeding from adjacent stands, (b) seed contained in the slash or logging debris, (c) advance growth, or (d) planting or direct seeding. An even-aged forest usually results. (3)

Climax - The culminating stage in plant succession for a given site where the vegetation has reached a highly stable condition. (6)

Collurturn - Material (soil and rock) that has been deposited through gravity (as opposed to water).

Commercial Forest Land - Land that is producing, or is capable of producing, crops of industrial wood and (1) has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service; (2) land where existing technology and knowledge is available to ensure timber production without irreversible damage to soil productivity or watershed conditions; and (3) land where existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be obtained within 5 years after final harvesting. See also "Tentatively Suitable Forest Land."

Commercial thinning - Any type of tree thinning that produces merchantable material at least equal in value to the direct costs of harvesting. (3)

Compaction - The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Conk - The woody fruiting body of fungal species, that usually grow on dead or live tree stems.

Connectivity - A measure of the extent to which conditions among late-successional and/or old growth (LS/OG) areas provide habitat for breeding, feeding, dispersal, and movement of LS/OG associated wildlife and fish species.

Corridor - A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries. (1)

Course sediment - Sands, gravels, cobbles, boulders.

Cultural resource - The remains of sites, structures, or objects used by humans in the past--historic or prehistoric. (2)

Cumulative effects or impacts - Cumulative effect or impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR 1508.7 - these regulations use effects and impacts synonymously.)

- D -

Debris Torrent - A large debris slide that is charged with water and confined to a steep stream channel. Debris torrents may travel several thousand feet, but are generally shallow as opposed to deep-seated mass movement.

Deep-seated Mass Movement - The downhill movement of deep soils and weathered bedrock, usually under saturated conditions. Such events usually do not move as far as a debris torrents do.

Designated Area (Air Quality) - Those areas delineated in the Oregon and Washington Smoke Management Plans as principal population centers of air quality concern.

Developed recreation - Recreation that requires facilities that, in turn, result in concentrated use of an area. Examples of developed recreation areas are campgrounds and ski areas; facilities in these areas might include roads, parking lots, picnic tables, toilets, drinking water, ski lifts, and buildings. (2)

Diameter at breast height (d.b.h.) - The diameter of a tree measured 4 feet 6 inches above the ground. (6)

Dispersed recreation - A general term referring to recreation use outside developed recreation sites; this includes activities such as scenic driving, hiking, backpacking, hunting, fishing, snowmobiling, horseback riding, cross-country skiing, and recreation in primitive environments. (2)

Diversity - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan. (2) (1)

Douglas-Fir Type - An association of tree species in which Douglas-fir is recognized as one of the principal seral species.

Duff - Organic matter in various stages of decomposition on the floor of the forest. (4)

- E -

Edge - An area where plant communities meet or where successional stages or vegetation conditions within the plant communities come together. (2)

Effects - Environmental changes resulting from a proposed action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance, but which are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effects and impacts as used in this document are synonymous. Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic quality, historic, cultural, economic, social, or healthy effects, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effects will be beneficial. (40 CFR 1508.8, 2)

Ejecta - Material expelled forcibly from an erupting volcano, as opposed to lava flows.

Endangered species - Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.(6)

Environmental Analysis - A comprehensive evaluation of alternative actions and their predictable short- and long-term environmental effects, which include physical, biological, economic, social, and environmental design factors and their interactions. (2)

Environmental Assessment - The concise public document required by the regulations for implementing the procedural requirements of the National Environmental Policy Act. (40 CFR 1508.9, 2)

Environmental Impact Statement (EIS) - A statement of the environmental effects of a proposed action and alternatives to it. It is required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal. (6)

Ephemeral draw - A drainage way which conveys surface water for short periods of time in direct response to snowmelt or rainfall runoff.

Even-aged stands - Stands in which all trees are of about the same age. (A spread of 10 to 20 years is generally considered one age class.) Cutting methods producing even-aged stands are clearcut, shelterwood, or seed tree systems.

- F -

Fire management - All activities required for protection of resources from fire and for the use of fire to meet land management goals and objectives. (6)

Fire return interval - The length of time between major, landscape level, stand replacement fire occurrences within a watershed or other large landscape. This term does not apply to a given acre and does not indicate the maximum age that forests attain in the area. It is simply an indication of the periodicity of large fires in the watershed.

Fire rotation - The time period between stand-replacing fire events on a given acre, stand, or site. While this figure may be most accurately used as an average of the periods between stand replacing fires, it is most frequently used to refer to the time between the last two events since dates of all fires which have affected a given site are usually not known.

Fisheries habitats - Streams, lakes, and reservoirs that support fish populations.

Flood plain - The lowland and relatively flat area adjoining inland waters, including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year. (2)

Floristic - Relating to flowering plants.

Forage - All browse and nonwoody plants that are available to livestock or game animals and used for grazing or harvested for feeding. (6)

Foreground - A term used in visual management to describe the portions of a view between the observer and up to 1/4 to 1/2 mile distant. (6)

Forest system roads - Roads that are part of the Forest development transportation system, which includes all existing and planned roads as well as other special and terminal facilities designated as Forest development transportation facilities. (See arterial roads, collector roads, and local roads.)

Fuel management - The practice of planning and executing the treatment or control of living or dead vegetative material in accordance with fire management direction. (10)

Fuel treatment - The rearrangement or disposal of natural or activity fuels (generated by management activity, such as slash left from logging) to reduce fire hazard. Fuels are defined as both living and dead vegetative materials consumable by fire.

Fuels - Combustible wildland vegetative materials. While usually applied to above ground living and dead surface vegetation, this definition also includes roots and organic soils such as peat. (10)

- G -

Geomorphic - The formation of geologic and topographic features.

Glaciation - Erosion and deposition of soil and rocks by movement of glacial ice.

Guilds, Guilding - Classes of wildlife relating to their habits and environment.

Group selection cutting - See Uneven-aged silvicultural systems.

- H -

Habitat Effectiveness Indices - A numerical quantification of various big-game habitat qualities.

Headwaters - The upper tributaries of a river. (4)

Herpetile - Any amphibian or reptile.

Hiding cover - Vegetation that will hide 90 percent of an adult deer or elk from the view of a human at a distance of 200 feet or less. The distance at which the animal is essentially hidden is called a "sight distance."

Historic site - Site associated with the history, tradition, or cultural heritage of national, state, or local interest, and of enough significance to merit preservation or restoration. (6)

Hydrology - The scientific study of the properties distribution and effects of water in the atmosphere, on the earth's surface, and in soil and rocks.

- I -

ID Team - See Interdisciplinary team.

Impacts - See Effects.

Indicator species - See Management indicator species.

Infrastructure - The collection of facilities (roads, campgrounds, structures, transportation corridors, power transmission lines, antenna) constructed to facilitate administration of land.

Interdisciplinary Team - A team of specialists talking and debating from the viewpoint of all relevant resources throughout scoping, developing alternatives, estimating effects, and comparing alternatives as a part of the NEPA environmental analysis process.

Interior habitat - Forest habitat that is not affected by adjacent non-forest or young forest. Forest habitat with no edge effects.

Intermittent Stream - A stream that runs water in most months, but does not run water during the dry season during most years.

Issue - A point, matter, or question of public discussion or interest to be addressed or decided through the planning process. (2)

- J,K -

Key Watershed - A Watershed containing populations of species at risk, containing potential habitat, or especially high quality water as designated by the Northwest Forest Plan.

- L -

Landing - Any place where round timber is assembled for further transport, commonly with a change of method. (3)

Lands Not Suited (Unsuitable) for Timber Production - Includes lands that: 1) are not forest land as defined in CFR 219.3; 2) are likely, given current technology, to suffer irreversible resource damage to soils productivity, or watershed conditions; 3) cannot be adequately restocked as provided in 36 CFR 219.27(c) (3); or, 4) have been withdrawn from timber production by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service. In addition, Forest lands other than those that have been identified as not suited for timber production shall be reviewed and assessed prior to formulation of alternatives to determine the costs and benefits of a range of management intensities for timber production. (1)

Landtype - A portion of the Forest mapped in the Soil Resource Inventory that has a defined arrangement of specific landforms that reacts to management activities in generally predictable ways. Landtypes range from 60 to 600 acres in size.

Large woody material (LWM) - Fallen large trees in streams or on the ground in terrestrial environments.

Late Successional - A vegetation type, usually forest, that is mature or old. Also old-growth.

Late Successional Reserve (LSR) - An area set aside from harvest and road building for species requiring late-succession habitat or interior habitat. An allocation specified for implementing the Northwest Forest Plan.

Lichens - Any of a large group of plants consisting of symbiotic fungi and algae.

Lithology, Lithologic - relating to rocks.

Low Flow - Minimum stream flows in summer or fall.

- M -

Management Area - An area with similar management objectives and a common management prescription. (1) (10)

Management direction - A statement of multiple use and other goals and objectives, and the associated management prescriptions, and standards and guidelines for attaining them. (1)

Management indicator species - A species selected because its welfare is presumed to be an indicator of the welfare of other species using the same habitat. A species whose condition can be used to assess the impacts of management actions on a particular area. (8)

Mass movement - A general term for any of the variety of processes by which large masses of earth material are moved downslope by gravitational forces - either slowly or quickly. (6) See Debris torrent and Deep-seated mass movement.

Mass wasting - Mass movement.

Matrix - That land outside of various reserves which is to be managed for timber production, among other objectives; designated by the Northwest Forest Plan.

Mature timber - Trees that have attained full development, particularly height, and are in full seed production. (3)

Maximum modification - See Visual quality objective.

Mesic - Moist, referring to a soil or site.

Middleground - A term used in visual management to describe the portions of a view extending from the foreground zone out to 3 to 5 miles from the observer. (6)

Mineral soil - Weathered rock materials usually containing less than 20 percent organic matter. (6)

Mitigation - Mitigation includes: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or elimination the impact over time by preservation and maintenance operations during the life of the action; and, (e) compensating for the impact by replacing or providing substitute resources or environments. (40 CFR Part 1508.20)

Modification - See Visual quality objective.

Monitoring and evaluation - The periodic evaluation of Forest Plan management practices on a sample basis to determine how well objectives have been met.

Morphometry - Measurement of the morphology or form, as in lake bottom shapes.

Municipal Watershed - A watershed which provides water for human consumption, where Forest Service management could have a significant effect on the quality of water at the intake point, and that provides water utilized by a community or any other water system that regularly serves: 1) at least 25 people on at least 60 days in a year, or 2) at least 15 service connections. In addition to cities, this includes campgrounds, residential developments, and restaurants. (10)

- N -

National Environmental Policy Act (NEPA) of 1969 - An Act to declare a National policy which will encourage productive and enjoyable harmony between humankind and the environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality. (The Principal Laws Relating to Forest Service Activities, Agriculture Handbook No. 453, USDA, Forest Service, 359 pp.)

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Regional Guides and Forest Plans and the preparation of regulations to guide that development.

Natural regeneration - Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

Nephalometric Turbidity Unit - A relative quantification of water turbidity.

Nonpoint source pollution - Pollution whose source is general rather than specific in location. It is widely used in reference to agricultural and related pollutants-- for example, production of sediments by logging operations, agricultural pesticide applications, or automobile exhaust pollution. (6)

Northwest Forest Plan - Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl, Volume I, February 1994. Sometimes called the "President's Plan."

Noxious weeds - Undesirable, usually non-native, plant species that are unwholesome to the range or to animals or compete with native plants. (6)

- O -

Objective - A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals. (1)

Occasion (recreation) - one person involved in recreation activity.

Old-growth stand (old growth) - Any stand of trees 10 acres or greater generally containing the following characteristics: contain mature and overmature trees in the overstory and are well into the mature growth stage; 2) will usually contain a multilayered canopy and trees of several age classes; 3) standing dead trees and down material are present; and 4) evidences of man's activities may be present, but do not significantly alter the other characteristics and would be a subordinate factor in a description of such a stand. (2)

Oligotrophic - Referring to bodies of water, a condition of very low levels of dissolved or suspended nutrients.

Optimal cover - Habitat for deer and elk which has tree overstory and understory, shrub and herbaceous layers; the overstory canopy generally exceeding 70% crown closure and dominant trees generally exceed 21 inches d.b.h.; provides snow intercept, thermal cover, and forage.

Overstory - That portion of the trees, in a Forest or in a stand of more than one story, forming the upper or uppermost canopy. (3)

- P -

PAOT - Persons at one time.

Partial retention - See Visual quality objective.

Particulates - Small particles suspended in the air and generally considered pollutants. (5)

Perennial stream - A stream that flows year round.

Peak flow - The highest amount of stream or river flow accruing in a year or from a single storm event.

Pests - Any animal or plant that, during some portion of its life cycle, inhibits the establishment or growth of some other species of plant or animal favored by man.

Phonology - The science dealing with the influence of climate on the recurrence of such annual phenomena of animal and plant life as bird migrations, budding, etc. (4)

Planning area - The area of the National Forest System covered by a Regional guide or forest plan. (1)

PM10 emissions - Particulate Matter smaller than 10 micrometers in size. A criteria pollutant comprised of airborne solid and liquid particles that are 10 micrometers or smaller in size. Because of its small size, PM10 readily lodges in the lungs, thus increasing respiratory and cardiac diseases in humans and other organisms.

Prehistoric site - An area which contains important evidence and remains of the life and activities of early societies which did not record their history.

Prescribed fire - A wildland fire burning under specified conditions which will accomplish certain planned objectives. The fire may result from either planned or unplanned ignitions. Proposals for use of unplanned ignitions for this purpose must be approved by the Regional Forester. (2)

Prescription - A written direction for harvest activities and regeneration methods.

Pre-commercial Thinning - See Young Stand Density Management.

Primary cavity excavators - Wildlife species that excavate cavities in snags.

Primary productivity - the portion of biological activity and production attributed to plant life.

Pruning - Removing of limbs from the lower portion of a tree.

Public Involvement - A Forest Service process designed to broaden the information base upon which agency decisions are made by (1) informing the public about Forest Service activities, plan, and decisions, and (2) encouraging public understanding about and participation in the planning processes which lead to final decision making. (10)

Pumice - A light, frothy volcanic rock formed by explosive eruptions.

Pyroclastic - Rock formed in volcanic eruptions that is composed of broken fragments.

- Q -

Quark - Smallest subatomic particle known to man.

- R -

Raptors - Predatory birds, such as falcons, hawks, eagles, or owls.

Reforestation - The natural or artificial restocking of an area with forest trees. (2)

Regeneration - The renewal of a tree crop, whether by natural or artificial means. Also, the young crop itself, which is commonly referred to as reproduction. (2)

Rehabilitation - Action taken to restore, protect, or enhance site productivity, water quality, or other resource values over a period of time .

Release - The cutting of competing and unwanted vegetation to free conifers for growth.

Residual stand - The trees remaining standing after some activity such as selection cutting or an occurrence such as fire or windthrow. (2)

Retention - See Visual quality objective.

Riparian - Pertaining to areas of land directly influenced by water or influencing water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Stream sides, lake borders, or marshes are typical riparian areas. (3)

Riparian Reserve - A protected area along streams and wetlands.

Roadless Area - Areas studied during the Roadless Area Review and Evaluation process (RARE II) which are roadless and at least 5,000 acres in size.

Rotation - Planned number of years between the formation of a generation of trees and its final harvest at a specified stage of maturity. Appropriate for even-aged management only. (6)

Rotational failure - A general term for a mass movement landform and a process characterized by a slope in which shearing takes place on a well defined, curved shear surface, concave upward, producing a backward rotation in the displaced mass. The landform may be single, successive (repeated up- and down-slope), or multiple (as the number of slide components increases).

RVD - Recreation Visitor Day; one RVD equals 12 visitor hours which may be aggregated continuously, intermittently, or simultaneously by one or more persons.

- S -

Salmonid - The family of fish species including salmon, trout, and char (whitefish).

Salvage cuttings - Intermediate cuttings made to remove trees that are dead or in imminent danger of being killed by injurious agents. (10)

Scarified - Land in which the topsoil has been broken up or loosened in preparation for regenerating by direct seeding or natural seedfall. Also refers to ripping or loosening road surfaces to a specified depth for obliteration or "putting a road to bed." (3)

Second growth - Forest growth that has become established following some interference, such as cutting, serious fire, or insect attack, with the previous Forest crop. (6)

Sediment - Earth material (rocks, gravels, sands, silts, clays) transported, suspended, or deposited by water. (6)

Seed tree cutting - Removal in one cut of the mature timber from an area, except for a small number of seed bearers left singly or in small groups. (3)

Selection cutting - The annual or periodic removal of trees (particularly mature trees), individually or in small groups, from an uneven-aged forest, to realize the yield and establish a new crop of irregular constitution. (3)

Sensitive species - Plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on an official State list, or that are recognized by the Regional Forester as needing special management to prevent placement on Federal or State lists. (2)

Sensitivity analysis - A determination of the effects of varying the level of one or more factors, while holding the other factors constant. (6) (10)

Seral - A stage in plant community development.

SHAB, Special Habitats - Areas set aside by the Willamette National Forest Plan to protect unique plant and animal habitats.

Shelterwood - The cutting method that describes the silvicultural system in which, in order to provide a source of seed and/or protection for regeneration, the old crop (the shelterwood) is removed in two or more successive shelterwood cuttings. The first cutting is ordinarily the seed cutting, though it may be preceded by a preparatory cutting, and the last is the final cutting. Any intervening cutting is termed removal cutting. An even-aged stand results. (3)

Silviculture - The art and science of controlling the establishment, composition, and growth of forests. (2)

Site preparation - 1) An activity (such as prescribed burning, disking, and tilling) performed on a reforestation area, before introduction of reforestation, to ensure adequate survival and growth of the future crop; or 2) manipulation of the vegetation or soil of an area prior to planting or seeding. The manipulation follows harvest, wildfire, or construction in order to encourage the growth of favored species. Site preparation may include the application of herbicides; burning, or cutting of living vegetation that competes with the favored species; tilling the soil; or burning of organic debris (usually logging slash) that makes planting or seeding difficult.

Skidding - A general term for hauling loads by sliding, not on wheels, as developed originally from stump to roadside, deck, skidway, or other landing. (3)

Skyline Logging - A system of cable logging in which all or part of the weight of the logs is supported during yarding by a suspended cable.

Slash - The residue left on the ground after tree felling and tending, and/or accumulating there as a result of storm, fire, girdling or poisoning. It includes unutilized logs, uprooted stumps, broken or uprooted stems, the heavier branchwood, etc. (3)

Snag - A standing dead tree.

Soil productivity - The capacity of a soil to produce a specific crop such as fiber or forage under defined levels of management. Productivity is generally dependent on available soil moisture and nutrients, and length of growing season.

Soil resource inventory - See Landtype.

Special Interest Areas - Areas managed to make recreation opportunities available for the understanding of the earth and its geological, historical, archeological, botanical, and memorial features. (6)

Special Forest Products (SFPs) - Forest resources that are not associated with timber sale contracts. May be for commercial or personal use. Some common SFPs include greenery, mushrooms, live plants, cones, berries, etc.

Special Wildlife Habitat - A habitat which is unique and has a special function not provided by plant communities or Successional stages; includes riparian zones, wetlands, cliffs, caves, talus, and meadows.

Stand (tree stand, timber stand) - An aggregation of trees or other vegetation occupying a specific area and sufficiently uniform in species composition, age arrangement, and condition as to be distinguishable from the forest or other vegetation or land cover on adjoining areas. (2)

Stand diversity - Any attribute that makes one timber stand biologically or physically different from other stands. This difference can be measured by, but not limited to: different age classes; species; densities; or non-tree floristic composition.

Stand replacement fire - Fire that kills most or all of a stand of trees, creating space for a new stand to begin.

Standards and Guidelines - Principles specifying conditions or levels of environmental quality to be achieved.

Stream Buffer - Vegetation left along a stream channel to protect the channel or water from the effects of logging, road building, or other management activity.

Stream Class - Classification of streams based on the present and foreseeable uses made of the water, and the potential effects of on-site changes on downstream uses. Four classes are defined:

Class I - Perennial or intermittent streams that: provide a source of water for domestic use; are used by large numbers of anadromous fish or significant sports fish for spawning, rearing or migration; and/or are major tributaries to other Class I streams.

Class II - Perennial or intermittent streams that: are used by fish for

spawning, rearing or migration; and/or may be tributaries to Class I streams or other Class II streams.
Class III - All other perennial streams not meeting higher class criteria.
Class V - All other intermittent streams not meeting higher class criteria. (10)

Stream Structure - The arrangement of logs, boulders, and meanders which modify the flow of water, thereby causing the formation of pools and gravel bars in streams. Generally, there is a direct relationship between complexity of structure and fish habitat. Complex structure is also an indication of watershed stability.

Subdrainage - Areas used for planning and analysis. It is based on tributary drainage boundaries and averaging 2000 to 4000 acres.

Subwatershed - A subdivision of a watershed equivalent to the 6th field subwatersheds as presented in the PACFISH report. These are larger than subdrainages.

Suitability - The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices. (1) (2) (FSM 1905)

Succession - A series of changes by which one group of organisms succeeds another through stages leading to a potentially stable climax community.

Suppression - The process of extinguishing or confining fire. (2)

System Road - A road meant to be used in the future with an established maintenance schedule.

- T -

Territory - The area which an animal defends, usually during breeding season, against intruders of its own species.

T. E. and S. species - Threatened, endangered and sensitive species, both plant and animal.

Thermal cover - Cover used by animals to ameliorate effects of weather.

Thinning - A felling made in an immature stand primarily to maintain or accelerate diameter increment and also to improve the average form of the remaining trees without permanently breaking the canopy. An intermediate cutting. (3)

Threatened and Endangered (T&E) species - See Threatened species; see Endangered species.

Threatened species - Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future. See Endangered species. (2)

Till - An unsorted mixture of clays, silts, sands, gravels and rocks deposited by glaciers.

Tractor logging - Any logging method which uses a tractor as the motive power for transporting logs from the stumps to a collecting point--whether by dragging or carrying the logs. (3)

Transient snow zone - That area where snowfall tends to melt soon after it falls, such that accumulation waxes and wanes through the winter .

Travel Corridor - A route followed by animals along a belt or band of suitable cover or habitat.

Tuff, Tuffaceous - Material made up of volcanic ash deposits.

Turbidity - The degree of opaqueness, or cloudiness, produced in water by suspended particulate matter, either organic or inorganic. Measured by light filtration or transmission and expressed in Jackson Turbidity Units (JTUs).

- U -

Ultra oligatrophic - Very, very clean, clear water.

Underburn - Fire, natural or prescribed, which burns only on the forest floor with an intensity such that dominant trees are typically not killed.

Understory - The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth. (6)

- V -

Viewshed - Portion of the Forest that is seen from a major travel route, or high use location.

Visual quality objective (VQO) - Categories of acceptable landscape alteration measured in degrees of deviation from the natural-appearing landscape.

Preservation (P) - Ecological changes only.
Retention (R) - Management activities should not be evident to the casual Forest visitor.
Partial Retention (PR) - Management activities remain visually subordinate to the characteristic landscape.
Modification (M) - Management activities may dominate the characteristic landscape but must, at the same time, follow naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.
Maximum Modification (MM) - Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.
Enhancement - A short-term management alternative which is done with the express purpose of increasing positive visual variety where little variety now exists. (2)

Visual resource - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors. (2)

- W -

Watershed - The entire land area that contributes water to a major drainage system or stream as designated by the FEMAT Report.

Wetlands - Areas that are inundated by surface or ground water often enough to support, and usually do support, primarily plants and animals that require saturated or seasonally saturated soil conditions for growth and reproduction. (E.O. 11990)

Wild and Scenic river - Those rivers or sections of rivers designated as such by Congressional action under the 1968 Wild and Scenic Rivers Act, as supplemented and amended, or those sections of rivers designated as wild, scenic, or recreational by an act of the legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories:

Wild River Areas - Those rivers or sections of rivers that are free of impoundment's and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.
Scenic River Areas - Those rivers or sections of rivers that are free of impoundment's, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Recreational River Areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past. (2) (6)

WIN, Watershed Improvement needs - A systematic survey of watershed conditions.

Winter Range - An area used by deer and elk during the winter months; usually at lower elevation and/or on south and west exposures.

Woody Material - Organic materials necessary for stream channel stability and maintenance of watershed condition. It includes large logs and root wads.

- X,Y,Z -

Xeric - Dry, referring to soil or site.

Yarding - Hauling timber from the stump to a collection point. (2)

Young Stand Density Management (Pre-commercial Thinning) - Thinning of small trees when no income is derived from the trees and cut trees are generally not removed from the site.

APPENDIX M: Salt Creek Watershed Analysis Team Members

Team Members	**Team Function**
David Murdough, Soil Scientist	Team Leader
Barbara Ledbetter, Hydrologic Technician	Editor

Terrestrial Group

Dick Davis, Wildlife Biologist	Terrestrial Group Leader and Wildlife
Dede Steele, Wildlife Biologist	Terrestrial Group Leader and Wildlife
Tim Bailey, Silviculturist	Vegetation
Dennis Sullivan, Supervisory Forestry Technician	Fire
Mike Williams, Civil Engineering Technician	Transportation
Kim McMahan, Botonist	Botany

Aquatic Group

Al Johnson, Hydrologist	Aquatic Group Leader and Hydrology
Nikki Swanson, Fisheries Biologist	Fisheries
Mark Leverton, Geologist	Geology

Social Group

Carol Winkler, Archeologist	Cultural and Historical Resources

GIS (Geographic Information Systems) Support

Jim Minogue, GIS Specialist	GIS Coordinator
Karen Meza, GIS Specialist	GIS Analyst

Information Management Support

Debby Murdough, Computer Specialist	Information Coordinator and Computer Support

With Contributions From

Resources Northwest, Inc.	Reference and Current Conditions, Chapter III* Appendices*

*edits by US Forest Service personnel

APPENDIX N: Public and Agency Contacts

The following individuals, groups, businesses, and/or government agencies provided information during this Watershed Analysis.

State and Federal Agencies:

- Oregon Department of Fish and Wildlife; Jeff Ziller, & Bill Castillo
- U.S. Forest Service, Willamette Forest
- U.S. Geological Survey Water Resources Division; Jo Miller
- Oregon Department of Transportation (ODOT)
- Oregon Department of Environmental Quality; Roberta Lindberg