Endangered Species Act – Section 7 Consultation, Informal Concurrence and Formal Biological Opinion and Conference

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

Oregon Department of Transportation's OTIA III Statewide Bridge Delivery Program, Oregon

Agency:	Federal Highway Administration and U.S. Army Corps of Engineers
Consultation Conducted By:	USFWS & NOAA Fisheries, Northwest Region
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D. Robert Lohn Regional Administrator	Kemper M. McMaster State Supervisor

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Fourth Order Headings	Three Decimal Places	**1.1.1.1**
Fifth Order Headings	Underlined	<u>Surveys</u>
Sixth Order Headings	Bold	**Nesting Habitat**
Seventh Order Headings	Italics	*South Santiam*

Note: Italics are also used throughout the document text for scientific names, specific Latin terminology, and when referring to specific program elements, activities, or environmental performance standards as defined in the proposed action section.

LIST OF ACRONYMS

A-run	Snake River steelhead of early run timing stock
AC	Alvord Chub
ADT	Average Daily Traffic
API	Area of Potential Impact
B-run	Snake River steelhead of late run timing stock
BA	Biological Assessment
BCHUB	Blue Chub
BEWTOW	Bald Eagle Working Team for Oregon and Washington
BFW	Bank Full Width
BLM	Bureau of Land Management
BO	Biological Opinion
BPM	Bridge Program Management
BR	Brown Trout
BT	Brook Trout
BUT	Bull Trout
Can	Candidate Species
CFR	Code of Federal Register
CH	Critical Habitat
CHF	Chinook Salmon, Fall
CHR	Chinook Salmon, Summer
CHS	Chinook Salmon, Spring
CMCS	Comprehensive Mitigation/Conservation Strategy
CO	Coho Salmon
Corps	U. S. Army Corps of Engineers
CR	Columbia River
CS	Chum Salmon
CT	Cutthroat Trout
CTC	Catlow Tui Chub
CWA	Clean Water Act
dB	decibels
dBh	decibels relative to human hearing
dbh	diameter breast height
DPS	Distinct Population Segment
DO	Dissolved Oxygen
E	Endangered
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
EPS	Environmental Performance Standards
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FEMAT	Forest Ecosystem Management Assessment Team
FHWA	Federal Highway Administration
FPW	Flood Prone Width

FR	Federal Register
ft	feet
FTP	File Transfer Protocol
GCB	Goose Lake Chub
GIS	Geographic Information Systems
GLAM	Goose Lake Lamprey
GSUC	Goose Lake Sucker
HUC	Hydrologic Unit Code
in litt	*in litteris,* In correspondence or communicated in writing but not in literature
IRMP	Integrated Resource Management Program
JCRT	Jenny Creek Red Band Trout
JCS	Jenny Creek Sucker
JUV	Juvenile Salmonids
K	Kokanee
KLS	Klamath Largescale Sucker
LAA	Likely to Adversely Affect
lb	pound
LCR	Lower Columbia River
LCT	Lahonton Cutthroat Trout
LOP	Limited Operating Period
LRS	Lost River Sucker
LSR	Late Successional Reserve
MAR	Various Marine Species of Fish
MBTA	Migratory Bird Treaty Act
MBTSG	Montana Bull Trout Science Group
MCR	Middle Columbia River
MD	Millicoma Dace
mi	mile
MMPA	Marine Mammal Protection Act
MMS	Malheur Mottled Sculpin
MP	Mile Point
MSA	Magnuson-Stevens Act
NAP	Noise Attenuation Plan
NF	National Forest
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRF	Nesting, Roosting, Foraging Habitat
NWFP	North West Forest Plan
OC	Oregon Coast
ODEQ	Oregon Department of Environmental Quality
ODOT	Oregon Department of Transportation
ODSL	Oregon Department of State Lands
OHW	Ordinary High Water
ONPBO	Olympic National Park Biological Opinion
Opinion	This Biological Opinion

OR	Oregon
OTIA	Oregon Transportation Investment Act
PCA	Pre-Construction Assessment
pH	*pondus hydrogenii* a measure of potential of hydrogen ions or acidity
PRCH	Pit Roach
Prop	Proposed for Listing
Prop CH	Proposed Critical Habitat
PSCL	Pit Sculpin
RB	Rainbow Trout
RGP	Regional General Permit
RHA	Rivers and Harbors Act
RT	Red Band Trout
SHL	Various Marine Shell Fish
SLOPES	Standard Local Operating Procedures for Endangered Species
SNS	Shortnose Sucker
SOER	State of the Environment Report
SONC	Southern Oregon/Northern California
SR	Snake River
SRB	Snake River Basin
SS	Sockeye Salmon
STS	Steelhead, Summer
STW	Steelhead, Winter
T	Threatened
UCR	Upper Columbia River
UKL	Upper Klamath Lake
UPRR	Union Pacific Rail Road
US	United States
USBR	U. S. Bureau of Reclamation
USDA	U. S. Department of Agriculture
USDC	U. S. Department of Commerce
USDI	U. S. Department of Interior
USFWS	U. S. Fish and Wildlife Service
USGS	U. S. Geologic Service
UWR	Upper Willamette River
WDF	Washington Department of Forestry
WDFW	Washington department of Fish and Wildlife
WW	Various Warm Water Game Fish
λ	Lambda

1.0 INTRODUCTION

1.1 Consultation History and Background

In 2001, the Oregon State Legislature passed the Oregon Transportation Investment Act (OTIA), which provided $500 million to improve pavement conditions, increase lane capacity, and improve bridges throughout the State. Many of the projects funded by this legislation are currently in progress. In 2003, the State Legislature passed the third Oregon Transportation Investment Act (OTIA III) as House Bill 2041, which provides $1.3 billion for the repair and replacement of bridges on State highways. From this legislation and Federal funding provided by the Federal Administration (FHWA), the Oregon Department of Transportation (ODOT) has developed the OTIA III Statewide Bridge Delivery Program (Bridge Program), an aggressive program of 430 bridge repair and replacement projects throughout the State that will be completed over the next 8 to 10 years. This program also includes a comprehensive regional mitigation and conservation strategy including the co-development and issuance of a Regional General Permit (RGP) by the Army Corps of Engineers (Corps). Thus, the Corps has participated in the development of the later portions of the BA, specifically, the relationship between the BA and RGP.

Many of the bridge repair or replacement projects funded by OTIA III were constructed during the 1950s and 1960s building boom associated with the creation of I-5 and I-84. Due to their age and the heavy traffic volumes they now carry, many of the more vital bridges are nearing the end of their expected 50-year life span, and are in need of replacement or extensive repair. To identify bridge replacement and repair needs for the State, ODOT prepared an Economic and Bridge Options Report in August 2003 (ODOT 2003). This report summarized the condition of each bridge in the Bridge Program and provided recommendations of either repair or replacement over the next 10 years. The report also established a priority for projects along freight routes of statewide significance.

In addition to the Economic and Bridge Options Report, ODOT conducted a Statewide Bridge Assessment to begin the planning and design process for the Bridge Program. The purpose of this study was to collect environmental and engineering baseline data at each bridge, verify repair or replacement recommendations, refine cost estimates, and develop regulatory compliance strategies for the Bridge Program. The environmental and engineering baseline data and reports from the Statewide Bridge Assessment are available on ODOT's File Transfer Protocol or FTP site or from the newly formed Bridge Delivery Unit at ODOT.

To meet the aggressive construction schedule of the Bridge Program, one of the principal requirements identified by ODOT was the timely completion of environmental regulatory permitting. To facilitate this, FHWA and ODOT began working with a number of Federal and State regulatory and resource agencies in late 2002 to develop permitting strategies that meet the dual goals of providing timely review of individual project permit applications and protecting or enhancing the natural and built environments.

The Services consider certain criteria when evaluating the suitability of actions for inclusion in programmatic Biological Opinions. The effects of proposed actions must be uniform and predictable, be fully minimized and minor, and be no different than if they had undergone individual review. The Services must be able to clearly define limits for the included actions/activities and to develop conservation standards that narrow the range of possible outcomes to those reasonably likely to occur without substantial adverse effects.

Batched Biological Opinions are typically comprised of multiple actions of similar type or location batched together under one document to capitalize on economies of scale. Through negotiations with the Services, and ODFW, a batched biological assessment with programmatic elements (batched-programmatic) was determined to be the most appropriate and efficient ESA consultation process.

A key element of the Bridge Program is the adoption of a program management strategy that emphasizes context sensitive designs (i.e., bridge designs that address key environmental issues) with consideration of the landscape, and monitoring at all levels of program administration, including design, construction, and restoration.

A private-sector program management firm (Bridge Program Management Firm [BPM Firm]) will assist ODOT in the development and implementation of a Bridge Program Management Strategy. This management strategy will include the implementation and evaluation of Environmental Performance Standards (EPS) designed to avoid and minimize adverse effects to natural resources, including Federally-listed species, State-listed species, State sensitive species, and their habitats.

The EPS were cooperatively developed with the various Federal and State regulatory and resource agencies in an effort to provide design and construction sideboards resulting in context sensitive bridge repair and replacement projects. Thus, the EPS became the framework of the consultation strategy to avoid long-term adverse effects, avoid and minimize short-term adverse effects, and promote beneficial effects in a manner meaningful to promote recovery of listed species and their habitats. The EPS also were intended to benefit non-listed species across Oregon.

This consultation is in response to the March 1, 2004 FHWA/Corps request for consultation and ODOT's 2003 OTIA III Statewide Bridge Delivery Program BA. An ambitious streamlined consultation process began in 2003 with the development of a multi-team, three-tiered, approach, with managerial policy and dispute resolution oversight. Level 1 team participation included personnel from the following: ODOT; ODOT's primary consultant leading their ESA consultation effort, Mason, Bruce and Girard Inc. (MB&G); ODOT's consultant leading the Clean Water Act permitting process, Parametrix Inc.; Oregon Department of Fish and Wildlife (ODFW); NOAA Fisheries; and USFWS. Towards the later portion of the pre-consultation process and during the RGP development, a representative from the Corps participated at Level 1 team meetings. Representation from other State and Federal agencies and individuals with needed expertise were consulted regarding specific issues. The Level 2 and 3 Teams were developed to assist with policy-level discussions and act as a dispute resolution mechanism. The Corps agreed to apply the terms and conditions of this Opinion to bridge repair/replacement projects permitted through the bridge program RGP, an individual Section 404 of the CWA, or a Section 10 of the RHA permit and therefore became a Federal partner with the FHWA for this consultation.

An accelerated consultation process to develop the draft BA began in June of 2003, with early involvement from the Services. An iterative process of weekly Level 1 team meetings occurred to discuss issues and process; followed by MB&G drafting sections of the BA for ODOT, behalf of FHWA, for Corps and the Service's review; and MB&G edits addressing review comments and further discussions and/or development of a section or moving on to a new issue/section was followed. A draft BA was provided by MB&G to the Services and ODOT for review on January 30, 2004. Internal Service meetings were held to discuss the proposed action in the draft BA. Informal comments were provided via electronic mail and verbally to MB&G.

A formal request for initiation of consultation with an accompanying final BA was submitted to the Services on March 1, 2004.

The FHWA/Corps requested concurrence with their determinations that the proposed OTIA III Statewide Bridge Delivery Program "may affect, are not likely to adversely affect" the Canada lynx, Columbian white-tailed deer, brown pelican, vernal pool fairy shrimp, Willamette daisy, golden paintbrush, Gentner's fritillary, Water howellia, large-flowered meadowfoam, Bradshaw's lomatium, Cook's lomatium, Kincaid's lupine, rough popcornflower, Nelson's checker-mallow, Steller sea lion, Upper Columbia River Steelhead, Upper Columbia River Chinook salmon, Snake River Fall-run Chinook salmon, Snake River sockeye salmon and their designated critical habitats, otherwise referred to as informal consultation.

The FHWA/Corps requested initiation of formal consultation with their determinations that the proposed OTIA III Statewide Bridge Delivery Program "may affect, likely to adversely affect" determinations for the marbled murrelet, northern spotted owl, bald eagle, Oregon chub, bull trout, Lost River sucker, short-nosed sucker, Fender's blue butterfly, Columbia River chum salmon, Southern Oregon/Northern California Coast coho salmon, Oregon Coast coho salmon, Lower Columbia River coho salmon, Upper Willamette River steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River Chinook salmon, and Lower Columbia River Chinook salmon. The FHWA/Corps is requesting initiation of conferencing with their determinations that the proposed OTIA III Statewide Bridge Delivery Program "may affect, likely to adversely affect" bull trout proposed critical habitat, and Lower Columbia River coho salmon. The FHWA/Corps made these requests in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.) and as detailed in Table 1-1.

Table 1-1. Species addressed in this Opinion, listing status, and effects determinations (ODOT 2004a)

Species	Scientific name	Federal Status	Determination
Mammals			
Canada lynx	*Felis lynx canadensis*	T	NLAA
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	E	NLAA
Stellar sea lion (Eastern population)	*Eumetopias jubatus*	T	NLAA
Birds			
Marbled murrelet	*Brachyramphus marmoratus*	T/CH	LAA
Bald eagle	*Haliaeetus leucocephalus*	T	LAA
Brown pelican	*Pelecanus occidentalis*	E	NLAA
Northern spotted owl	*Strix occidentalis caurina*	T/CH	LAA
Fish			
Chum salmon (Columbia River ESU)	*Oncorhynchus keta*	T	LAA
Coho salmon (Southern OR/Northern CA Coast ESU)	*Oncorhynchus kisutch*	T	LAA
Coho salmon (Oregon Coast ESU)	*Oncorhynchus kisutch*	T	LAA
Coho salmon (Lower Columbia River ESU)	*Oncorhynchus kisutch*	Prop T	LAA
Steelhead (Upper Columbia River ESU)	*Oncorhynchus mykiss*	E	NLAA
Steelhead (Lower Columbia River ESU)	*Oncorhynchus mykiss*	E	LAA
Steelhead (Middle Columbia River ESU)	*Oncorhynchus mykiss*	T	LAA
Steelhead (Snake River ESU)	*Oncorhynchus mykiss*	T	LAA
Steelhead (Upper Willamette River ESU)	*Oncorhynchus mykiss*	T	LAA
Sockeye salmon (Snake River ESU)	*Oncorhynchus nerka*	E	NLAA
Chinook salmon (Snake River Spring/Summer-Run ESU)	*Oncorhynchus tschawytscha*	T	LAA
Chinook salmon (Snake River Fall-Run ESU)	*Oncorhynchus tschawytscha*	T	NLAA
Chinook salmon (Upper Willamette River ESU)	*Oncorhynchus tschawytscha*	T	LAA
Chinook salmon (Upper Columbia River Spring-Run ESU)	*Oncorhynchus tschawytscha*	E	NLAA

Chinook salmon (Lower Columbia River ESU)	*Oncorhynchus tschawytscha*	T	LAA
Lost River sucker	*Deltistes luxatus*	E/Prop CH	LAA
Shortnose sucker	*Chasmistes brevirostris*	E/Prop CH	LAA
Oregon chub	*Oregonichthys crameri*	E	LAA
Bull trout	*Salvelinus confluentus*	T/Prop CH	LAA
Invertebrates			
Vernal pool fairy shrimp	*Branchinecta lynchi*	T	NLAA
Fender's blue butterfly	*Icaricia icarioides fenderi*	E	LAA
Plants			
Willamette daisy	*Erigeron decumbens* var. *decumbens*	E	NLAA
Gentner's fritillary	*Fritillaria gentneri*	E	NLAA
Water howellia	*Howellia aquatilis*	T	NLAA
Large-flowered meadowfoam	*Limnanthes floccosa* ssp. *grandiflora*	E	NLAA
Bradshaw's lomatium	*Lomatium bradshawii*	E	NLAA
Cook's lomatium	*Lomatium cookii*	E	NLAA
Kincaid's lupine	*Lupinus sulphureus* var. *kincaidii*	T	NLAA
Rough Popcornflower	*Plagiobothrys hirtus*	E	NLAA
Nelson's checker-mallow	*Sidalcea nelsoniana*	T	NLAA

(E) – Endangered…(T) –Threatened (Can) – Candidate (CH) - designated Critical Habitat (Prop) – proposed for listing (Prop CH) – proposed Critical Habitat (NLAA) – May affect, not likely to adversely affect (LAA) - May affect, likely to adversely affect

This biological opinion (Opinion) is based on information provided in the BA for the OTIA III Statewide Bridge Delivery Program (ODOT 2004a) and supporting reference information; regular meetings and discussions between the Federal agencies, the Level 1 team members, the Clean Water Act/River and Harbors Act permit team members, experts in specific fields, and file information and reference material located at the USFWS' Oregon Fish and Wildlife Office and NOAA Fisheries' Oregon State Habitat Office. A complete administrative record of this consultation is on file at the Oregon Fish and Wildlife Office and Oregon State Habitat Office. This document also includes relevant discussion and assessment under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Marine Mammal Protection Act (MMPA), the Migratory Bird Treaty Act (MBTA), and the Fish and Wildlife Coordination Act (F&WCA).

1.2 Action Area

The diverse actions involved with the OTIA III Statewide Bridge Delivery Program required a series of definitions for the action area. The resulting definitions address the overall program, the conservation and mitigation strategy, and the individual bridge actions.

Larger bridges tend to require greater ground disturbance for activities such as equipment staging and traffic control, and thus have greater potential for adverse effects such as downstream effects from turbidity. To account for bridge size in the evaluation process, the bridge length was rotated to form a circle; therefore, a short bridge would have a smaller area representing the structure than a long bridge. The Area of Potential Impact (API), which was defined by ODOT to provide survey boundaries to the crews collecting data for the environmental baseline reports, was modified to represent the area of potential project activities. A circular 2,000-foot buffer was placed around the bridge circles. For the purposes of this Opinion, the action area for project impact analysis and estimation of take is the immediate bridge site (rotated) and its associated 2-mile buffer. The action area is defined as the 2-mile buffer around each rotated bridge site to encompass any downstream effects or other staging or detour related effects that may exceed the API as clarified below.

The action area for the Compensatory Mitigation/Conservation Strategy includes all areas within 4th field Hydrologic Unit Codes (HUCs) populated by program bridges in the sense that specific conservation and mitigation site locations have not yet been determined. The limited design detail (e.g., the unknown location of detour routes and staging areas) resulted in the action area being defined as the area encompassed by a 2-mile buffer around each bridge within this Program (Appendix A) of this Opinion. As a result, the environmental baseline conditions are presented starting at the ecoregion scale and increasing in detail as appropriate for analysis of effects and effects conclusion per species or functional grouping of species analyzed (Section 4.1.4) of this Opinion.

The scale of the action area for the overall Statewide Bridge Delivery Program could encompass the entire State highway system because of the short-term potential interrelated effects of shifting importance and reliance of existing travel corridors as alternate routes for freight and passenger vehicle traffic.

2.0 PROPOSED ACTION

For the purposes of this Opinion, the Federal actions are the FHWA's program funding and the Corp's issuance of an RGP, individual 404 permit under the CWA, or section 10 permit under the RHA. The OTIA III Statewide Bridge Delivery Program involves the repair and replacement of 430 bridges throughout Oregon. Oregon bridges built between 1947 and 1961 using a concrete girder design were designed to last approximately 50 years, and cracking has been found on many of these older bridges. The Bridge Program will utilize a "corridor-based" strategy throughout the State, as practicable.

2.1 Statewide Action

The Bridge Program bridges were examined and an initial designation recommendation for either repair or replacement was made. Currently, 86 bridges have been designated for repair and 344 bridges have been designated for replacement. These designations may change upon closer examination of each bridge; it is assumed that it is more likely bridges designated for repair may need to be replaced than bridges designated for replacement to be repaired. The construction contracts will be released over eight to nine construction seasons. As a result of the corridor-based strategy, the construction will tend to occur in clusters. The specific bridges and bridge locations are identified in Appendix A of this Opinion.

The Bridge Program is comprised of four categories of project specific components: (1) Specific bridge repair and replacement actions, including specific project activities and elements; (2) conservation and mitigation actions; (3) compliance, communication, monitoring, and reporting procedures; and (4) performance and design standards related to each of the above.

The success of this Bridge Program requires the mutual cooperation of each of the Federal and State governmental agencies, each in its appropriate role, to fund, permit, and administrate the statewide action. The FHWA is providing Federal funds and is the lead action agency with the Corps acting as a co-applicant based on the need to consult on the issuance of a Regional RGP under section 404 of the CWA and section 10 of the RHA. ODOT led the effort to complete the BA and RGP on behalf of the FHWA and Corps for the OTIA III Statewide Bridge Delivery Program and will be the State agency responsible for ensuring administration of design, implementation, monitoring and reporting on the progress and compliance of the actual bridge repair and replacements.

2.2 Specific Bridge Repair and Replacement Actions

Specific bridge repair and replacement actions are comprised of different combinations of bridge repair and replacement elements (Section 2.2.1) depending on the specific project objective or site conditions. These elements are basic components of bridge related transportation construction and are first described individually to document the various mechanisms or pathways for potential affects to listed species or designated critical habitat.

Because specific bridge repair and replacement elements are often mutually associated with larger scale or specific bridge repair and replacement activities (Section 2.2.2), these activities are also individually described as more complex components of bridge related transportation construction. Depending on nature of these activities, they may also result in the potential for additive effects to listed species or designated critical habitat.

Each section of specific bridge repair and replacement elements and activities includes a paragraph titled potential effects. These effects discussions were provided in the BA to familiarize the reader with typical bridge construction effects associated with the specific elements and activities outside the context of both site-specific project information and prior to avoidance and minimization measures in the EPS (Section 2.5). Only after context sensitive consideration and the EPS are applied to design and construction, are the realized or residual effects of projects and the program as a whole discussed and analyzed in the Analysis of Effects (Section 4.1.4).

2.2.1 Bridge Repair/Replacement Elements

This section describes the constituents of Bridge Program construction activities. These *elements* are referenced throughout the Bridge Repair/Replacement Activities section (Section 2.2.2) to eliminate repetition of detailed descriptions of common construction practices and methods. For the same reason, some elements are referenced within the descriptions for other elements. References to the various construction elements are printed in *italics* and include the appropriate section number as it appears in this Opinion (e.g., *pre-construction*, Section 2.2.1.1) to direct the reader to the detailed descriptions of the construction element being discussed.

Table 2-1 is a matrix showing which EPS are applicable to the various bridge elements discussed in this section. This table provides the reader an "at-a-glance" indication of the prevalence of various construction methods constraints (i.e., *environmental performance standards*) relative to the list of bridge repair and replacement elements. The EPS are referenced in this section to illustrate the "realized effect" of the various construction elements.

Table 2-1. Matrix of Bridge Repair / Replacement Elements and Environmental Performance Standards

	2.2.1 Bridge Repair / Replacement Elements:	2.2.1.1 Preconstruction	2.2.1.2 Clearing	2.2.1.3 Equipment Control	2.2.1.4 Construction Material Containment	2.2.1.5 Earthwork	2.2.1.6 Foundations	2.2.1.7 In-water Work	2.2.1.8 Roadwork	2.2.1.9 Stormwater Management	2.2.1.10 Illumination	2.2.1.11 Planting and Seeding	2.2.1.12 Exclusionary Devices
2.5 Performance Standards:													
Program Administration[1]													
Species Avoidance		x		x	x		x	x	x		x		x
Habitat Avoidance		x	x	x		x		x	x			x	
Water Quality		x		x	x	x	x	x	x	x		x	
Site Restoration									x	x			
Compensatory Mitigation[2]													
Fluvial						x	x						

[1] The Program Administration environmental performance standard is primarily relevant at the program scale.

[2] The Compensatory Mitigation environmental performance standard is applied as necessary to off set potential unavoidable long-term adverse effects and thus is primarily relevant at the project scale.

2.2.1.1 Pre-Construction

For the purposes of the proposed action, the pre-construction phase of the project is defined as consisting of all surveying activities necessary to plan the work required to construct the project to the lines and grades as shown, specified, or established as described in ODOT's Standard Specifications for Construction (ODOT 2002a). Pre-construction activities may involve environmental surveys, flagging, geotechnical investigations, and hydraulic investigations. Geotechnical drilling and surveying activities will follow the Terms and Conditions presented in the biological opinion issued by NOAA Fisheries (2003c). Pre-construction activities will follow the EPS for *Species Avoidance, Habitat Avoidance*, and *Water Quality* (Section 2.5).

<u>Surveys</u>

Surveying involves demarcating and flagging boundaries within the project action area that are important to construction. Some of these areas include environmentally sensitive areas such as streams or other waterbodies, riparian and wetland areas, and species habitat areas. Construction activities in these areas are limited in order to minimize and avoid adverse effects, and are restricted to seasonal periods. Other environmentally important areas that require surveying and flagging include but are not limited to the limits of construction, "no-work zones", clearing and grubbing limits (*earthwork*, Section 2.2.1.5), erosion control limits, environmental impact mitigation features, settling basins, waters of the U.S., ordinary high water elevations, and other drainage and water quality structures and facilities (*in-water work,* Section 2.2.1.7) (ODOT 2002a).

<u>Geotechnical Investigations</u>

Geotechnical investigations are necessary for any type of construction work that requires a level of underground stability. For bridge work, geotechnical investigations are normally needed to determine appropriate designs for bridge foundations. ODOT has prepared a statewide programmatic biological assessment entitled Programmatic Consultation for Statewide Drilling, Surveying, and Hydraulic Engineering Activities in Oregon (ODOT 2002b). Minimization and avoidance of adverse effects from geotechnical drilling will be accomplished through application of the Terms and Conditions included in the programmatic Biological Opinion (NOAA Fisheries 2003b) and EPS developed to minimize and avoid these effects.

<u>Hydraulic Surveys</u>

Hydraulic surveys are critical to a determination of the safety, stability, and long-term function of any water crossing. Hydraulic measurements that require access to the wetted channel will be completed outside of spawning seasons, or a fisheries biologist will confirm that no spawning redds are present within the project area. If dye must be used, surveyors will only use non-toxic vegetable dyes to determine flow patterns; short pieces of plastic ribbon are prohibited (NOAA Fisheries 2003a).

Potential Effects

The nature and extent of the potential effects of pre-construction activities depend on the type of activity being performed. Effects associated with ground survey work would typically be limited to minor vegetation clearing. Geotechnical surveys (drilling) may contribute sediment-laden fluids to receiving waters, if not properly contained. In-water surveys, such as hydraulic surveys, could result in physical damage to salmonid redds (i.e., incidental take) if they are within a project action area and adequate care is not taken to avoid them or to prevent sedimentation. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program dministration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, and *Compensatory Mitigation* (Section 2.5).

2.2.1.2 Clearing

The purpose of clearing is to prepare the project action area for construction activities. Clearing consists of cutting and removing above-ground vegetation such as weeds, grasses, crops, brush, and trees; removing down timber and other vegetative debris; preserving trees and other vegetation designated to remain in place; and salvaging marketable timber (when required by the ODOT Standard Specifications and Special Provisions) (ODOT 2002a). Clearing is often followed by grubbing (*earthwork*, Section 2.2.1.5) operations to remove any remaining surface vegetation and buried debris. Clearing typically requires less ground disturbance than grubbing.

Clearing generally takes place within pre-marked areas in the project action area necessary for construction purposes. Clearing activities typically take place during construction staging (*equipment control*, Section 2.2.1.3), *roadwork* (Section 2.2.1.8), and other bridge work. In sensitive areas, clearing would be conducted by hand rather than with heavy equipment.

Clearing Operations

The contractor is required to cut trees and brush so that they fall into the areas intended to be cleared (ODOT 2002a). Removal of all evidence of clearing matter and debris is the responsibility of the contractor. This includes removal of:

- Sod, weeds, and dead vegetation;
- Downed timber, brush, and other vegetation;
- Sticks and branches with diameters greater than 1/2 inch;

- Dead trees, downed timber, stumps, and specified trimmings from areas where live trees and other vegetation are designated to remain.

Potential Effects

The potential effects associated with clearing activities carried out during bridge replacement and repair vary. Clearing activities are likely to result in some degree of ground disturbance and compaction, generating the potential for soil erosion, and consequently, temporary turbidity and sedimentation. Additionally, adverse effects may result from the loss of large woody material (LWM) recruitment potential. LWM in channels creates channel complexity and provides refuge habitat for fish, as well as habitat for macroinvertebrates. Tree loss may allow increased penetration of solar radiation into streams, potentially increasing water temperatures. Tree removal may also decrease the amount of available nesting/denning, foraging, and roosting habitat available to birds and mammals. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, and *Compensatory Mitigation* (Section 2.5).

2.2.1.3 Equipment Control

For the purposes of the proposed action, equipment control includes the proper maintenance and control of construction equipment in order to minimize the potential for pollutant leaks and spills. Additionally, equipment control involves the minimization and avoidance of physical disturbance to the environment resulting from operation of equipment in sensitive areas such as streams, wetlands, riparian areas, and steep slopes.

Potential Effects

The primary effect associated with the storage and maintenance of construction equipment on construction sites is the potential for leaks and spills of fuel, hydraulic fluids, lubricants, and other chemicals from equipment and storage containers. Additional effects could include soil compaction, ground disturbance, and vegetation loss in construction staging areas. Discharge of vehicle and equipment wash water, concrete wash-out, etc. can also add pollutants to the soil that are then delivered to waterways. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, and *Water Quality* (Section 2.5).

2.2.1.4 Construction Material Containment

Construction activities such as bridge demolition, construction, sandblasting, and painting will inadvertently cause falling debris (such as lead paint chips, sandblasting grit, treated wood, structural debris, and concrete) that requires containment. The safe storage, handling, and disposal of hazardous wastes will be conducted as required in ODOT's Standard Specifications for Construction (ODOT 2002a).

Debris Containment

Prior to bridge removal, bridge painting, or other activities with the potential for chemical contamination, debris containment measures will be employed in accordance with the EPS for *Water Quality* (Section 2.5). The purpose of debris containment is to prevent falling material generated during these processes from entering sensitive environments. Containment measures may include the use of a flexible or rigid material. When stripping paint from an existing bridge the use of vacuum shrouded tools, in addition to other containment systems, is normally required under ODOT Standard Specifications for Construction (ODOT 2002a).

Lead Paint

If the existing paint coating contains a lead component (considered hazardous), the contractor will take special precautions to contain, recover, and properly dispose of all waste, including hazardous waste, generated during bridge removal (ODOT 2002a). No spent abrasive will be allowed to contaminate the aquatic or terrestrial environment. The contractor will contain and collect waste material in an approved area in the same manner as if it were a hazardous material (ODOT 2002a). Simple debris containment, as described above, may be adequate to prevent lead-based paint debris from entering the aquatic or terrestrial environment. All onsite temporary storage, handling, and labeling will be in accordance with 40 CFR Parts 262 and 265. The contractor will prevent the escape of dust or paint, which may create a nuisance or hazard in the vicinity of the structure. At no time will any debris be allowed to escape into the environment.

Potential Effects

Possible effects associated with contamination by construction materials and debris stem primarily from the contamination of water and substrate by toxic materials or by debris falling into water. Debris such as lead-based paint chips and treated wood poses the threat of chemical contamination, and the improper disposal of waste material is a potential vector of effects to listed species and habitat. The potential effects of contamination increase if species occurrence is high. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, and *Compensatory Mitigation* (Section 2.5).

2.2.1.5 Earthwork

For the purposes of the Bridge Program, earthwork is defined as work consisting of excavation, ditching, backfilling, embankment construction, augering disking, ripping, grading, leveling, borrow, and other earth-moving work required in the construction of the project (ODOT 2002a). Blasting is also a form of earthwork and as such, it is addressed in this section.

Earthwork may be conducted as part of the preparation of staging areas, bridge approaches, alignments, embankments, fills, backfills, foundations, toe trenches, road grades, utility relocation, falsework, stormwater treatment, ditch construction, bank stabilization, landscaping, restoration, and mitigation. Earthwork normally requires the use of mechanical equipment such as tracked excavators, backhoes, bulldozers, and grading equipment.

Earthwork may also include grubbing, which is the removal of brush stems remaining above the ground surface after the *clearing* work, tree stumps, roots, and other vegetation found below ground surface, as well as partially buried natural objects (ODOT 2002a). *Clearing* and grubbing are often required prior to earthwork in order to remove vegetative and other debris from work areas so that design specifications (e.g., for compaction) can be met. Within excavation and embankment limits, contractors will remove tree stumps, roots, and other vegetation. The contractor will remove all extraneous matter and will dispose of this matter and debris on- or off-site by chipping, burying, or other methods of proper disposal, excluding burning (ODOT 2002a).

<u>Potential Effects</u>

The effects associated with earthwork activities vary. Turbidity and sedimentation may result from ground disturbance and soil erosion. Hydraulic effects may result from instream excavation and fill, potentially altering the hydraulic opening under bridges. Chemical contamination may occur as a result of fluid spills from mechanized equipment conducting earthwork activities near waterways and from the time lag between when a stormwater treatment system is constructed and is operational. Riparian habitat may be impacted during *clearing* and grubbing activities that remove vegetation. Although unlikely, direct effects on listed species may occur as a result of excessive turbidity or sedimentation during earthwork activities. Indirect effects are more likely to occur, due to habitat loss. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation, and Fluvial* (Section 2.5).

<u>Blasting</u>

Blasting consists of excavating in rock to achieve smooth, unfractured backslopes and produce a free surface in the rock along the specified excavation backslope; it can also involve production blasting to facilitate excavation (ODOT 2002a). Blasting may be an option during roadwork and bridgework activities. *Roadwork* may use blasting techniques to clear obstructions and provide access for new roadways or road realignments. Bridgework may require blasting during the construction or removal of bridge abutments.

The effects of blasting include those described for *earthwork*. Additionally, high noise levels may affect both terrestrial and aquatic species. Blasting noise may displace birds, fish, mammals, and other biota. Sound pressure waves produced by blasting can damage or even kill adult and juvenile fish and damage incubating eggs.

A blasting plan that details the drilling and blasting patterns, the controls the contractor proposes to use, the timing, and the anticipated noise effects will be prepared. As specified in ODOT's Standard Specifications for Construction (2002a), blasting is prohibited underwater.

The contractor will follow the *Species Avoidance* EPS (Section 2.5) to minimize or avoid noise effects and disturbances to wildlife species during blasting. In addition, ground vibrations will be controlled by using properly designed delay sequences and allowable charge weights per delay (ODOT 2002a). Additional measures, as appropriate, will include dampening measures such as blasting mats, or alternatives to blasting such as expanding compounds. The contractor will monitor each blast with an approved seismograph and airblast monitoring system according to ODOT Standard Specifications for Construction (ODOT 2002a).

2.2.1.6 Foundations

Foundations are required elements of every bridge construction and replacement project. Bridge foundations consist of three general types: 1) Drilled shafts; 2) columns on spread footings; and 3) driven piles and pile-supported caps or walls. Driven piles by themselves are normally used to support temporary structures such as detour bridges and work bridges. However, driven piles are also often used to provide additional support to spread footings.

<u>Drilled Shafts</u>

Drilled shafts are used where the underlying substrate will provide the necessary end-bearing or friction-bearing capacity. Drilled shaft columns are constructed on land or in water. Shaft drilling is accomplished by placing drilling equipment adjacent to the column location and drilling through underlying substrates. This may require the construction of a drill pad using fill materials (placed on the ground) or a work platform (constructed above ground or over water). Impacts associated with drill pad construction are described under *in-water work* (2.2.1.7). Shaft drilling generates a slurry mixture of water and substrate that can create turbid stream conditions if released to flowing waters.

Containment of drilling spoils will utilize a variety of methods (e.g., multiple drill casings) to meet the environmental performance standard for *Water Quality* (Section 2.5). Following shaft drilling, concrete is poured to form the column. Containment of concrete methods would meet or exceed measures described under *equipment control* (Section 2.2.1.3) and *construction material containment* (Section 2.2.1.4) and the *Water Quality* EPS (Section 2.5).

<u>Columns on Spread Footings</u>

Spread footings are constructed where substrates are not firm enough to support a bridge column. Spread footing construction requires excavation (*earthwork,* Section 2.2.1.5) of the footing location. If this occurs below the ordinary high water mark (OHW) where fish are present, then work area isolation, dewatering, and fish capture and release are required (*in-water work,* Section 2.2.1.7). Driven piles are often used to provide additional support for spread footings. Normally, these are driven within an isolation or containment area, following excavation for the footing. Concrete forms are constructed and concrete is poured. Containment of green concrete is accomplished according to *equipment control* (Section 2.2.1.3) and *construction material containment* (Section 2.2.1.4) and the *Water Quality* EPS (Section 2.5)

<u>Driven Piles and Pile Supported Structures</u>

Pile driving is accomplished using one of two methods: impact hammer or vibratory hammer (NOAA Fisheries 2003a). Typically, harder substrates require the use of impact hammers, and bearing capacity can only be determined with impact hammers. Pile driving requires the application of EPS for *Species Avoidance* (Section 2.5) which include noise dampening measures and/or timing restrictions (for wildlife avoidance).

Pile-supported caps or retaining walls can be incorporated into bridge design as abutments (end bents) or as interior bents. These structures will not be constructed within aquatic habitats where floodplain and fluvial functions would be inhibited as a result (*Fluvial* EPS [Section 2.5]). Bent construction of this nature would require pile driving and concrete work. For some program bridges, blasting may also be required where foundations must rest on bedrock. Bank stabilization measures such as riprap may be employed in bridge repair projects conducted as part of the proposed action. Pile driving and the construction of pile-supported structures will incorporate construction methods and standards for *earthwork* (Section 2.2.1.5), *equipment control* (Section 2.2.1.3)*,* and *construction material containment* (Section 2.2.1.4).

<u>Potential Effects</u>

The effects associated with bridge foundations can be either temporary (when effects stemming from the construction process) or permanent (when effects stem from hydraulic effects and the loss of stream, floodplain, and wetland habitat).

Temporary effects are those associated with *in-water work* (Section 2.2.1.7) activities necessary to demolish existing structures and construct new ones. These effects are primarily related to the displacement of streambed materials, which generates turbidity and sedimentation. Chemical contamination may result from concrete pouring in or near streams. Noise effects to fish and wildlife species may occur due to pile driving.

Long-term effects may result when there is direct habitat loss due to the footprint of foundation structures; e.g., if the footprint of the new bridge is larger than that of the one that it is replacing. Hydraulic effects result when foundation structures alter the flow dynamics of streams and/or floodplains. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality, Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

2.2.1.7 In-water Work

In-water work may take place during many activities associated with bridge replacement and repair projects. *In-water work* refers to any project-related action occurring within aquatic habitat—i.e., below the OHW elevation[1]. The OHW elevation for any bridge project is demarcated by one of several reference points or areas, but typically refers to the annually inundated portions of streams, lakes, or wetlands. OHW elevation boundaries may be defined by channel morphology (e.g., break in slope or bankfull width), which is readily detectable in the field. This boundary is defined specifically for each bridge project.

Typical in-water work activities include but are not limited to the following:

- work area isolation;
- flow diversion and rewatering;
- concrete/spread footing removal;
- fish rescue and salvage;
- streambank protection;
- excavation of streambed materials;
- pile driving and removal;
- shaft drilling;
- habitat restoration/creation (streambed construction);
- geotechnical exploration (drilling);
- water pumping and discharge.

The timing of all work within the aquatic habitat will generally correspond with the preferred in-water work timing guidelines established for specific watersheds incurring Bridge Program activities. ODOT construction activities will follow timing guidelines

[1] OHW elevation is synonamous with the high, high tide elevation in tidally influences systems.

established in this consultation to help minimize potential effects to fish, wildlife, and habitat resources. The preferred in-water work periods are established to avoid the vulnerable life stages (spawning, rearing, and migration) of fish and other aquatic species. Specific preferred in-water work periods are listed by drainage in Appendix B.

Alterations of these preferred in-water work periods require written approval by the Services, because activities conducted outside of these periods may result in changes of the magnitude or scope of effects that exceed the effects allowed within this Opinion. Written requests for alteration of specific preferred in-water work periods must demonstrate through the variance process (Section 2.5) that project specific effects of in-water work outside the preferred in-water work period are within the magnitude and scope of those analyzed in this Opinion (Section 4.1.4). Any written requests that cannot demonstrate project specific consistency with the effects analyzed in this Opinion will require separate individual consultation.

Under the Bridge Program consultation, the following activities are prohibited, unless approved in writing by the Services:

- Underwater blastin;
- Water jetting;
- Releasing petroleum products or toxic chemicals in the water;
- Disturbing spawning beds;
- Obstructing stream channels;
- Blocking adult and juvenile fish passage.

<u>In-Water Work Area Isolation</u>

The contractor will isolate in-water bridge structures (e.g., bents and abutments) from the waterbody prior to removal and reconstruction. Work area isolation is normally accomplished by surrounding in-water work zones with materials that will prevent the entry of water and that are sturdy enough to withstand the flows likely to be encountered. Typical materials include sandbags, straw bales, concrete barriers, heavy tarp, sheet piling, and specially constructed devices such as water-filled bladders, solid barriers or other coffer dam structures.

<u>Flow Diversion</u>

Streamflow may be diverted in situations where complete isolation is not necessary to achieve effective isolation from flowing water. This diversion may be accomplished by placing barrier materials in the channel, encompassing two or more sides of an in-water work activity. If water is shallow and flows can be sufficiently deflected from the work area, it can be effectively dewatered without the need for complete isolation, pumping, and fish capture and release. Sediment control measures must be implemented to prevent a release of turbid water into downstream areas which would exceed regulated allowances.

Fish Capture and Release

Before (and sometimes during) the dewatering of an isolated in-water work area, an attempt will be made to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods that minimize the risk of injury to fish. A fisheries biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish will conduct or supervise the fish capture and release operation. If electrofishing equipment is used to capture fish, the capture team will comply with the most recent NOAA Fisheries-approved electrofishing guidelines (NOAA Fisheries 2000a), and will handle ESA-listed fish with extreme care, keeping fish in oxygenated water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling. Captured fish will be released in a location that will promote their safe recovery. ESA-listed fish will not be transferred to anyone except NOAA Fisheries or USFWS personnel, unless otherwise approved in writing by the Services. Site specific post-capture and release report forms will be completed and submitted as necessary to the Services and/or appropriate authority.

Streambank Protection

Riprap is often used for streambank and stormwater treatment outfall protection where water velocities or safety considerations prevent the use of natural vegetation or seeding. Riprap may be used as ballast to anchor or stabilize large woody material (LWM), to construct flow-redirection structures to fill scour holes, and to protect *existing* structures that will be repaired. Riprap provides an erosion-resistant cover for protecting slopes and basins. ODOT Standard Specifications for Construction (2002a) detail techniques for the preparation of slopes prior to placing riprap. Retaining walls provide another form of streambank protection. These are typically concrete and/or mechanically stabilized earth. Permanent replacement structures will not incorporate riprap or retaining walls. Riprap, as a method of streambank protection, will only be allowed to replace existing armored banks (as outlined in the *Habitat Avoidance, Compensatory Mitigation, and Fluvial* EPS [Section 2.5]) and with repair of existing bridges under this consultation. Retaining walls, as a method of streambank protection, will only be allowed above the ordinary high water elevation with repair of existing bridges.

Streambank protection may also be achieved by bioengineering techniques that utilize live vegetative material to provide stability. Additionally, habitat elements such as root wads and logs may be incorporated into streambank protection designs. The *Habitat Avoidance* EPS (Section 2.5) will be applied to minimize and avoid adverse effects associated with riprap.

Streambed Excavation

Heavy equipment may be used to excavate and remove streambed material (e.g., for the placement of spread footings or the addition of riprap). Work area isolation will be implemented prior to any streambed excavation unless it can be demonstrated that work area isolation will cause more resource harm that the excavation activity.

Pile Driving and Removal

See *Foundations* (Section 2.2.1.6).

Shaft Drilling

See *Foundations* (Section 2.2.1.6).

Geotechnical Drilling

The methods, minimization and avoidance measures, and effects associated with geotechnical drilling are incorporated by reference to the Programmatic Biological Opinion entitled Federal Highway Administrations' Programmatic Consultation for Statewide Drilling, Surveying, and Hydraulic Engineering Activities in Oregon (NOAA Fisheries 2003b).

Pumping and Discharge

The pumping and discharge of sediment-laden water or fluids is often required during *in-water work* area isolation and *earthwork* where groundwater may be encountered. Sediment-laden water must be allowed to clear before it can re-enter any waters of the U.S. Normally, turbid water is pumped to upland settling ponds where it may infiltrate through the soil prior to reentry to waterways. Alternatively, sediment-laden water may be allowed to sheet flow over vegetated ground, or may be pumped into tanks and hauled off-site for proper disposal.

Pumps may be required to dewater the work isolation area. When the pumps are required, the intake(s) will be screened, operated, and installed following NOAA Fisheries screening criteria. The pump system will be monitored during periods of operation and an operational backup pump will be available on site for rapid deployment.

Potential Effects

By its nature, in-*water work* can have a wide variety of effects. Ground-disturbing work below the ordinary high water level (and outside the wetted channel) may still contribute to turbidity and sedimentation, chemical contamination, vegetation loss, and soil compaction. Project activities requiring equipment operating in or near the water may increase the potential for fluid leaks and spills, potentially contaminating soils and water. Work within the wetted channel often requires work area isolation and containment, fish capture and release, the pumping and discharge of sediment-laden water, and the return of pumped water.

Streambank protection hardens and simplifies stream channels, sometimes creating conditions more conducive to non-native piscivorous fish than to native species. It also can result in a long-term loss of riparian vegetation and habitat development. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

2.2.1.8 Roadwork

Roadwork may include temporary access or maintenance roads, detour routes, roadway removal and construction for bridge approaches, and the replacement or installation of guardrails and barriers. Elements such as *clearing* (Section 2.2.1.2), *earthwork* (Section 2.2.1.5), and wearing surfaces would be incorporated into *roadwork*. Blasting may be required at certain bridge sites.

<u>Temporary Access Roads</u>

Temporary access roads within riparian areas are constructed by *clearing* (Section 2.2.1.2) vegetation, grading as described under *earthwork* (Section 2.2.1.5), and placing aggregate rock as specified in ODOT's Standard Specifications and Special Provisions (ODOT 2002a).

<u>Roadway Removal</u>

Culverts, sewers, siphons, and other conduits will be removed according to ODOT's Standard Specifications and Special Provisions (ODOT 2002a). Roadway excavations include, but are not limited to bridge approaches. Roadway removal also follows similar practices as *earthwork*.

<u>Roadway Alterations</u>

Within the roadbed cross section, the contractor will trim, shape, and finish the sub-grade, ditches, slopes, and other graded surface areas to the lines, grades, cross sections, and condition specified. Outside the new roadbed cross section, the contractor will obliterate existing roadway surfaces by removing existing paved surfaces, and then will loosen, break up, and spread the existing bases and blend them into the adjacent terrain (ODOT 2002a).

<u>Wearing Surfaces</u>

Different wearing surfaces may be laid as the last step to finalizing roadway surfaces. Depending on the function or purpose of the roadway, wearing surfaces such as gravel may be used for temporary roads (e.g., detour and access routes), whereas an asphalt surface will be laid for permanent roadways and bridge approaches.

Guardrail Installation

Guardrail construction may require augering (*earthwork* [Section 2.2.1.5]), hydraulic punching, or impact/vibratory hammers for installation of posts. This activity will occur outside flood-prone areas, but may occur at the top of embankments adjacent to waterways and wetlands.

Potential Effects

The effects of roadwork vary. Roadway removal and roadbed preparation generally require ground disturbance, which can cause erosion, turbidity, and sedimentation in receiving streams. If the project includes new road construction or roadway widening, vegetation removal (*clearing*) may be required. New and wider roads also generate new impervious surfaces, which increase stormwater runoff, which subsequently affects the hydrologic regimes and water quality in receiving waterways. Wider roadways located near waterways may require additional bank armoring or scour protection, which can lead to channel simplification and loss of habitat. Paving can introduce toxic substances to waterways. Construction of temporary access roads can result in soil compaction and reduced permeability. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

2.2.1.9 Stormwater Management

All program bridges will require *stormwater management.* Existing bridges are often equipped with deck drains to convey stormwater from the structures; deck drains (i.e., scuppers) usually allow stormwater runoff to fall directly onto streambanks and waterways. Replacement bridge designs will eliminate the use of deck drains, in favor of systems that promote some level of stormwater treatment prior to discharge to waterways. Favored systems will be those that require minimal maintenance, such as bioswales and wide-bottomed ditches. These systems tend to promote infiltration of pre-treated stormwater, which allows pollutant treatment via biological activity and runoff retention. Other possible systems include engineered facilities such as detention ponds and water quality manholes. Engineered facilities will be designed to meet the *Water Quality* EPS (Section 2.5).

Stormwater treatment systems will convey such large volumes of runoff that complete infiltration may not be possible. In such cases, stormwater must be conveyed to ditches or streams. Outfalls must be constructed so that they do not create erosion problems at the point of discharge. Stormwater outfalls will be constructed above the OHW elevation, but scour protection may be required below the OHW elevation, where unavoidable. Construction methods presented under *clearing* (Section 2.2.1.2), *earthwork* (Section 2.2.1.5), and sometimes *in-water work* (Section 2.2.1.7) may be necessary to construct adequate drainage ways, ditches, and engineered facilities for sufficient *stormwater management*.

Potential Effects

The effects of stormwater treatment are primarily beneficial, though there may be some adverse short-term effects resulting from the necessary *earthwork* (Section 2.2.1.5) and *in-water-work* (Section 2.2.1.7) activities. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Habitat Avoidance*, *Water Quality,* and *Fluvial* (Section 2.5).

The long-term objective of stormwater management is an improvement in water quality and quantity, with possible reduction in peak flows (where detention is also a function of the facility) and enhanced summer base flow (where infiltration is also a function of the facility). This can aid in a return to more natural water quality conditions and channel-forming processes in watersheds where the new facilities occur.

2.2.1.10 Illumination

The use of lighting to illuminate project work involves activities related to furnishing and installing highway illumination and traffic signal projects. In the case of low light situations, lighting may be required in order to conduct construction activities, especially during the evening and nighttime hours.

Potential Effects

Lighting is typically staged on the roadway and/or at other staging areas. It may interfere with the normal patterns of fish and wildlife species, especially during the nighttime hours. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects (e.g., limited operating periods). Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration* and *Species Avoidance* (Section 2.5).

2.2.1.11 Planting and Seeding

Planting will include area preparation; the selection and application of topsoil, soil conditioners, bio-amendments, and mulch; plant selection and placement; and watering. Planting typically takes place to offset project effects, to stabilize slopes and control erosion, and/or to provide aesthetics. Planting usually takes place at the project action area—or in the case of certain projects, at a planned offsite location. After planting, *exclusionary devices* (Section 2.2.1.12) such as browse protectors, tree stakes and ties, or trunk wrap may be used to protect plants (ODOT 2002a). Planting occurs when the following *earthwork* (Section 2.2.1.5) measures are complete:

- The tops of cutbanks are blended with the adjacent terrain.
- All roadbeds, ditches, waterway channels, and other excavations and embankments are trimmed and finished to the lines, grades, and cross sections established.
- Debris and foreign matter of all kinds are cleaned up on the entire right-of-way area, and disposed of as directed.
- Sub-grade is finished to a tolerance of plus or minus 3/4 inch and is free of ruts, depressions, and irregularities.
- Rocks, boulders, and vegetative matter are removed as needed in planting and seeding areas.

Seeding includes all associated tasks to develop plant growth for erosion control, environmental mitigation, and roadside development. Affected areas can encompass the area within construction limits, including the *in-water work* (Section 2.2.1.7) area (e.g., wetland and riparian areas) and staging areas.

Potential Effects

Planting activities require ground disturbance (*earthwork* [Section 2.2.1.5]). Ground preparation for planting and seeding can affect water quality by generating turbidity and sedimentation. The importation of soil and other material can introduce seeds of non-native plant species that could compete with native plants. Fertilizers will not be applied within 50 feet of any stream channel and herbicides will not be applied within 150 feet of any stream channel. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Water Quality*, *Site Restoration*, and *Compensatory Mitigation* (Section 2.5).

2.2.1.12 Exclusionary Devices

Exclusionary devices are intended to prevent fish, wildlife, and domestic livestock from entering active construction areas or restoration and mitigation areas. Such devices include fences, netting, hazing devices (such as those designed to prevent bird nesting on bridge structures), and management plans, such as the continuous removal of unfinished nests. Exclusionary devices are normally used during the staging, restoration, or maintenance phases of a construction project, but may also be used in the spring, prior to any construction activity, to prevent migratory bird nesting or bat colonizing on bridges. Hazing devices such as propane cannons may be used to prevent bird nesting where netting is not feasible. During staging, fences may be erected to increase public safety on site, as a means of erosion and sediment control, to exclude “no-work” areas, and/or to protect vegetation. During the restoration or maintenance phases of construction, fences may be constructed to protect seeding or planting areas in the early stages of plant establishment.

Potential Effects

Fence installation requires minor ground disturbance, which may contribute loose soil to waterways, thus generating temporary turbidity and possible sedimentation. Wildlife and fish passage may be hindered if improperly installed fences or other exclusionary devices block migratory corridors. The use of hazing devices could generate noise-related effects to nesting birds. EPS were developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation to minimize and avoid these effects. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, and *Water Quality* (Section 2.5).

2.2.2 Bridge Repair/Replacement Activities

Bridge repair and replacement activities are grouped under four primary phases common to most bridge repair and replacement projects: (1) Design; (2) pre-construction; (3) construction; and (4) post-construction site restoration and maintenance[2]. Bridge repair projects may not always include the fourth phase if the repair work involved no ground-disturbing activities. The design phase occurs prior to any on-the-ground pre-construction or construction activity. Decisions made in the design phase strongly influence the long-term effects of a bridge replacement or repair project. The activities that constitute the latter three (construction) phases primarily account for short-term or acute effects of the bridge replacement and repair process. The construction phases are made up of the various *elements* described in Section 2.2.1 which will be referenced (in *italics*) in this discussion to provide the necessary detail regarding construction methods, potential effects, and the applicable EPS presented in Section 2.5. Table 2-2 presents a matrix showing which bridge repair/replacement elements are included in the various bridge repair/replacement activities discussed in this section. This table is intended to give the reader an "at-a-glance" indication of the prevalence of various construction methods and procedures (i.e., *elements*) relative to the bridge repair/replacement activities. The EPS (Section 2.5) are referenced in the *Bridge Repair/Replacement Elements* (Section 2.2.1) to illustrate the "realized effect" of the various construction elements.

There are typically a variety of methods and materials available for completing any given project element. The following is an outline of the aforementioned phases and activities of a bridge replacement project, along with a brief discussion of the biologically significant elements (i.e., those with the potential to affect species or habitat in the short- or long-term) and/or available options. Bridge repair projects are not discussed individually because nearly any repair activity, with some exceptions, could also be carried out during a bridge replacement. Therefore, repair activities are primarily addressed in the discussion of bridge replacement.

[2] This does not include maintenance of the structure, rather of the vegetation plantings and other habitat elements.

Table 2-2. Matrix of Bridge Repair / Replacement Activities and Elements

2.2.1 Bridge Repair / Replacement Elements:	2.2.2 Bridge Repair / Replacement Activities:	2.2.2.1 Design	2.2.2.2 Preconstruction	2.2.2.3 Construction	<u>Construction and Traffic Staging</u>	<u>Bridge Removal</u>	2.2.2.4 Bridge Construction	2.2.2.5 Site Restoration	2.2.2.6 Maintenance
2.2.1.1 Preconstruction			x						
2.2.1.2 Clearing			x		x		x		
2.2.1.3 Equipment Control			x		x	x	x		
2.2.1.4 Construction Material Containment						x	x		
2.2.1.5 Earthwork			x		x	x	x	x	x
2.2.1.6 Foundations							x		
2.2.1.7 In-water Work			x			x	x		x
2.2.1.8 Roadwork					x		x		
2.2.1.9 Stormwater Management							x		
2.2.1.10 Illumination							x		
2.2.1.11 Planting and Seeding								x	x
2.2.1.12 Exclusionary Devices			x					x	

There are some activities that will occur during bridge repair that will not be allowed as part of any bridge replacement project. Therefore, some bridge repair activities will have greater potential adverse effects on habitat than would be allowed for a bridge replacement. Such an activity may include scour protection in the form of riprap placed in proximity to an existing bridge structure. This may require *in-water work* and placement of temporary structures in aquatic habitat. Most the time, bridge repair activities will consist of repairs to parts of the structure that will not require access via sensitive habitat areas, and thus the potential for temporary effects is low with most repair activities. Long-term effects may be realized from repair activities because the overall configuration of repaired bridges will not change. For instance, the number of bents located in flowing water will not be reduced as part of a bridge repair project, as it may be for a replacement project. Therefore, the long-term effect of bridge repair may be the maintenance of the *status quo*, which may prolong or intensify a habitat-limiting condition until replacement is necessary.

2.2.2.1 Design

The design phase determines the overall configuration (i.e., number of spans, alignment, hydraulic opening, etc.) of a bridge and thus has the greatest implications regarding its long-term effects. The EPS will act as guiding principles in the design phase of the Bridge Program in order to avoid adverse effects, where possible, to listed species and their habitat. Where complete avoidance of adverse effects is not possible, the standards will be applied in such a way as to minimize potential adverse effects, with the goal of avoiding or offsetting any remaining long-term adverse effects to listed species and their habitat. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

2.2.2.2 Pre-construction

The on-site pre-construction phase of a project consists of two primary activities: project development surveys and geotechnical investigations. Project development surveys may include hydraulic investigations, environmental surveys (e.g., wetland delineations), and boundary and topographic surveys. These activities are necessary for project design, right-of-way acquisition, and permitting, and therefore must be completed in advance of any construction activity. Elements of pre-construction that may influence the type and degree of the project's effects on listed species and habitat include *earthwork, in-water work,* and *equipment control*. Some bridge replacement projects may also require that *exclusionary devices* be employed to prevent nesting on bridges by migratory birds. Pre-construction activities will be conducted in accordance with the EPS which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, and *Compensatory Mitigation* (Section 2.5*)*.

2.2.2.3 Construction

The construction phase of a project typically involves four major activities: 1) Construction and traffic staging; 2) bridge removal; 3) bridge construction; and 4) site restoration. Each activity contains essential elements specific to each project. Under each activity, various available options may be implemented as directed by project plans and specifications.

<u>Construction and Traffic Staging.</u> Construction staging consists of site preparation in advance of primary construction activities. This includes the movement of materials and equipment to the project site and the establishment of areas to be used for construction management, equipment and material storage, and maintenance and refueling. Staging activities also include the preparation and installation of environmental controls (e.g., erosion control measures), access road construction, and utility relocation. In addition, detour routes and/or structures will be constructed during the staging phase. Staging areas will be located so as to minimize effects to, and prevent delivery of sediment and other pollutants to, sensitive resources (e.g., water, wetlands, and riparian areas).

Detour routes, where necessary, will consist of either temporary bridges and roads or the use of existing roadway. Temporary bridges are normally constructed alongside existing structures to minimize the amount of new roadway that must be constructed. Temporary bridges are usually constructed of timber or steel pile substructures and timber decks or concrete beams overlaid with asphalt. Temporary roadway realignment is necessary to route traffic from existing roadway to the detour bridge and will typically require *clearing, earthwork*, and *roadwork.* Use of existing roadways as detours will sometimes require upgrades such as widening and/or resurfacing.

These activities will occur before initiation of primary construction activities. The elements of construction staging that influence the type and degree of the project's effects on listed species and habitat include *clearing*, *earthwork*, *roadwork*, and *equipment control*. Construction and traffic staging activities will be conducted in accordance with the EPS (Section 2.5) which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

<u>Bridge Removal</u>. Bridge removal (demolition) occurs prior to construction on most bridge replacement projects; it involves removal and disposal of the existing superstructure and substructure (foundations and supports). Elements of bridge removal that influence the type and degree of the project's effects on listed species and habitat include *in-water work, construction material containment, earthwork*, and *equipment control*.

In-water work (Section 2.2.1.7) is one of the main activities during bridge removal that requires conservation measures to limit adverse effects. Various types of *in-water work* include flow diversion, work area isolation, fish capture and handling, pile driving, pile removal, shaft drilling, excavation, and backfill. Downstream fish passage will always be maintained during *in-water work* activities. *Construction material containment* is a critical precursor to bridge removal, particularly if the debris will potentially include treated wood or lead-based paint, both of which must be handled in accordance with the *Water Quality* EPS (Section 2.5). *Equipment control* is essential during bridge removal due to the frequent need to operate heavy equipment near or in a waterbody while excavating substructure components or demolishing the superstructure. *Earthwork* is required during excavation of bridge approaches, abutments, and piers where their location might conflict with the new structure or with normative fluvial processes. All bridge removal activities described above will be conducted in accordance with the EPS which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

2.2.2.4 Bridge Construction

Bridges constructed under the proposed action will be built using a wide variety of configurations, methods, and standards. For the purposes of this consultation, the bridge construction process is divided into four major categories. These include: 1) Substructure construction; 2) superstructure construction; 3) approach construction (*roadwork*); and 4) and site restoration.

Elements common to all aspects of bridge construction include *clearing*, *earthwork*, *roadwork*, *foundation*, *in-water work, equipment control,* and *construction material containment*. *Clearing, earthwork,* and *roadwork* may be required to create work space and to construct access roads as well as for bridge and roadway widening for safety upgrades. *Earthwork* is also normally required in order to excavate abutment and footing locations. Blasting, a component of earthwork, may be required for substructure and roadway construction in bedrock substrates. No underwater blasting will occur as part of the proposed action. Falsework or temporary work bridges may be required during substructure and superstructure construction. *In-water work* will be required for nearly all multi-span bridges over water and for single-span bridges with substructures located within the aquatic environment. *In-water work* activities include flow diversion, work area isolation, water pumping, fish rescue/salvage, shaft drilling, pile driving, bank stabilization (e.g., riprap placement). A method of handling and treating waste water generated during construction (e.g., during pile driving, shaft drilling, and work area isolation and dewatering) will be necessary and is outlined under *in-water work*. In the case of low-light situations, the project will require *illumination* in order to facilitate construction activities, especially during the evening and nighttime hours.

<u>Substructure.</u> Bridge substructure configurations are among the most variable components of the overall project. The number of spans and support structures a bridge will have largely determines its potential for effects on aquatic species and their habitat. An objective of the bridge program is to reduce the influence of the structure on normative fluvial processes, which is commonly achieved via a reduction in the number of spans on a given bridge, thereby reducing the number of in-water support structures. The type of support structures designed for a bridge is also a major factor in the level of short-term effects as well as in the long-term influence the structure will exert on fluvial dynamics. For example, drilled shaft columns are preferred to spread footings because they require a smaller overall footprint. However, bridges included in the proposed action will be designed using various combinations of the configurations described below, so long as they are in compliance with the goals and objectives outlined in the EPS. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

Bridge foundations are of four general types: drilled shafts, spread footings, driven piles, and pile-supported caps or walls. Driven piles by themselves are typically used to support temporary structures such as detour bridges, work bridges, and falsework. However, in some systems, driven piles are used to support spread footings, and are always tied together with a pile cap or beam. Permanent bridges will most often employ either spread footings or drilled shafts as their means of support. Construction of the various substructure types involves a variety of elements including *in-water work, foundations, equipment control* (particularly noise attenuation for protection of fish and wildlife)*, earthwork, and construction material containment.* All bridge substructure construction activities will be conducted in accordance with the EPS (Section 2.5) which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation*, and *Fluvial* (Section 2.5).

<u>Superstructure.</u> The bridge superstructure consists primarily of the horizontal structural members and deck. Additionally, the superstructure will include the wearing surface (including striping), guardrails, illumination (deck lighting), and a drainage system.

Bridge superstructures are typically one of two possible designs: box beam or solid beam girders. Both systems are often pre-cast or steel, thus, avoiding the need to pour large quantities of concrete on site. With each of these systems, the structural members often constitute the deck. However, in some cases, long beams and bridge decks are cast-in-place, requiring that green concrete be hauled to the site, then poured and cured in place, often over water, but always with containment systems. Therefore, *construction material containment*, and *equipment control* are key elements of superstructure construction.

Construction of bridge superstructures often requires the use of temporary work bridges and falsework. Temporary work bridges are needed to support construction equipment, while falsework provides direct support to the structure while under construction. Both systems require construction prior to superstructure construction, and are often constructed during staging. Typical elements of this work are *in-water work, pile driving, equipment control,* and *construction material containment.*

Bridge plans require an approved method of *stormwater management*. Stormwater treatment systems often must be able to convey such large volumes of runoff that complete infiltration is not possible. In such cases, stormwater must be conveyed to ditches or streams. Outfalls must be constructed so that they do not create erosion problems at the point of discharge. Stormwater outfalls are usually constructed above the OHW, but scour protection may be required below the OHW. Construction processes presented under *clearing, earthwork*, *streambank protection,* and sometimes *in-water work* will be necessary to construct adequate drainage ways, ditches, and engineered facilities for sufficient *stormwater treatment*.

The final element of superstructure construction is normally signing, striping, guardrail, and pedestrian walkway construction. Striping requires the application of paint to bridge and roadway surfaces. *Construction material containment* measures are commonly required to prevent delivery of hazardous materials to waterways. Guardrails are typically constructed of steel which is bolted onto the structure, or concrete which may consist of pre-fabricated barriers set in place or cast-in-place barriers. Attachment of steel rails or construction of cast-in-place concrete rails may generate dust and/or green concrete which must be contained as described under *construction material containment*.

Guardrails constructed along bridge approaches often consist of driven guardrail posts which may require noise control measures described under *equipment control*.

All superstructure construction activities will be conducted in accordance with the EPS which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, *Site Restoration*, *Compensatory Mitigation,* and *Fluvial* (Section 2.5).

2.2.2.5 Site Restoration

A site restoration plan will be developed and implemented as necessary to ensure that all streambanks, soils, and vegetation disturbed by project activities are cleaned up and restored in accordance with the EPS for *Site Restoration* (Section 2.5). The goal of the restoration plan is to renew habitat and to enhance water quality and the production of habitat elements, including ecosystem processes that form and maintain productive ecosystems. Activities in the plan may include streambank shaping (*earthwork*), revegetation (*seeding* and *planting*), and fencing (*exclusionary devices*). As with other aspects of bridge construction projects, *equipment control* will be important to prevent contamination of sensitive resources (e.g., water, wetlands, and riparian areas) by construction equipment.

The prepared plan will designate the managing party, and will contain baseline information (e.g., watershed analysis, land-use planning), goals and objectives, performance standards, work plan, and a five-year monitoring and maintenance plan. EPS will require the establishment of vigorous native plant growth (capable of competing with non-native species), plant community diversity, minimal bare soil, and soil stabilization. In addition to the 5-year monitoring plan, annual monitoring will take place until the Agency has certified that EPS have been achieved. All planting plans prepared for construction activities conducted under this consultation will be approved by a Landscape Architect registered in the State of Oregon.

Disturbed areas will be seeded and mulched with a permanent erosion control mix. Disturbed riparian areas will be replanted with a diverse assemblage of native shrubs and trees, as appropriate to the site conditions. No herbicide application will be allowed within 150 feet of waters of the U.S. and no surface applied fertilizer (i.e., fertilizer tablets may be approved) will be applied within 50-feet of streams.

Site restoration activities will be conducted in accordance with the EPS which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, and *Site Restoration* (Section 2.5).

2.2.2.6 Site Restoration Maintenance

During the life of a construction contract, which normally includes a period of time following the completion of primary construction activities, contractors will be responsible for the maintenance of project features and site restoration measures. Contractors will replace failed plantings in site restoration areas, and may be required to modify the grading of the mitigation area to ensure that a properly functioning condition is achieved. Erosion problems will also be corrected where necessary. Any damage to facilities due to construction-related actions or natural events such as flooding will also be corrected by construction contractors. Maintenance of project areas will normally require *earthwork* and *planting and seeding* to regrade and stabilize areas of localized erosion. *In-water work* may also be required if structures become susceptible to scour[3]. The ongoing maintenance activities of the structures are not addressed in this consultation.

All maintenance activities addressed under the Bridge Program consultation will be conducted in accordance with the EPS which have been developed with the assistance of the Services during the pre-consultation and technical assistance phases of this consultation. Specific EPS which will guide context sensitive methods and constrain potential adverse effects include *Program Administration*, *Species Avoidance*, *Habitat Avoidance*, *Water Quality*, and *Site Restoration* (Section 2.5).

2.3 Conservation and Mitigation Program

The Bridge Program will include mitigation and conservation plans and actions to identify and implement habitat protection, restoration, and enhancement as appropriate. These actions are intended not only to compensate for unavoidable impacts of bridge projects to species, habitats, and resource sites, but to achieve a "net conservation benefit" consistent with ODOT's stewardship principles. As such, the mitigation and conservation actions allow the Bridge Program to support both 7(a)(1) and 7(a)(2) ESA objectives for listed species, and to achieve compliance related to broader habitat and resource concerns under the Fish and Wildlife Coordination Act, section 404 of the Clean Water Act, and the Oregon Removal/Fill law. Conservation priorities will be developed, the most effective actions will be identified and targeted, and integrated consideration of issues related to all applicable resources and regulations will occur. Methodologies for measuring, tracking, and accounting for implementation and performance of mitigation and conservation actions will also be developed.

For the purposes of the ESA, the Services consider all compensatory mitigation efforts to conserve threatened and endangered species as a major component of the proposed action that will improve the environmental baseline and offset unavoidable incidental take of species covered in this Opinion. The USFWS guidance for establishment, use, and operation of conservation banks acknowledges this incentive-based approach to endangered species conservation (68 FR 24753).

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[3] This refers predominately to repaired facilities because the fluvial performance standards allow no supplemental scour protection for new or replaced structures.

Conservation priorities will be developed based on this premise and the most effective actions will be identified, targeted, and integrated consistent with all applicable resources and regulations, including but not limited to the ESA, FWCA, CWA, RHA, Oregon Removal/Fill law, the Transportation Equity Act (TEA-21), the CETAS Charter Agreement (CETAS 2001), and appropriate USFWS mitigation policies and guidelines. Those laws and policies that do not directly apply to threatened and endangered species, for the purpose of this Opinion, are considered to help define the proposed action in a way as to benefit listed and non-listed species and their habitats.

The Bridge Program facilitated development of a Comprehensive Mitigation and Conservation Strategy (CMCS) to achieve these goals. The CMCS is also expected to help identify impacts and potential avoidance or compensation measures for other projects undertaken by ODOT in the future. While the specific habitat actions associated with future projects are not part of the Bridge Program or this Opinion, the CMCS framework for those projects, including the guidelines, objectives, and principles that will shape them, are being developed concurrent with the Bridge Program. Therefore, the broad, long-term conservation benefits that are expected to accrue from the CMCS are at least partially attributable to the Bridge Program and are given consideration in this Opinion. These long-term benefits will supplement and complement the habitat protection and enhancement actions directly associated with the Bridge Program, thereby increasing benefits to a number of key species and habitats in Oregon. Any specific CMCS actions only associated with future projects beyond the Bridge Program will be evaluated separately from this Opinion with regard to potential effects on listed species or their habitats.

Ongoing development and long-term implementation of the CMCS will be subject to collaboration between ODOT, the Services, FHWA, ODFW, the Corps, and other agencies. The remainder of section 2.3 will describe some expectations and guidelines for application of mitigation and conservation actions and the CMCS to the Bridge Program. Additional information and conditions are contained in the Draft CMCS Program Manual (ODOT 2004b) and Section 2.5 (Environmental Performance Standards) of this Opinion.

2.3.1 Application of Mitigation Actions to the Bridge Program

ODOT will mitigate for unavoidable impacts to wetlands and water resources as required under the CWA and the Oregon Removal/Fill laws and will implement additional actions to address impacts to listed species. The types and scope of compensatory mitigation provided will be based on a functional assessment of adverse effects and replacement of equivalent functional value. It will also be based on the use of "correction" factors to accommodate the risk of failure associated with some habitat projects and in recognition of the long periods of time sometimes necessary for successful habitat projects to provide desired function and conditions.

The *Compensatory Mitigation* (Section 2.5) of the Bridge Repair and Replacement Environmental Performance Standards describes how project specific mitigation actions will be planned and conducted for most species and resources. With respect to Bull trout, short-nose and Lost River suckers, Oregon chub, marbled murrelet, bald eagle, northern spotted owl, and Fender's blue butterfly, the mitigation planning and actions described in section 2.5 will be implemented at the program level, with the habitat quantities listed in amount and extent of take subsection of the incidental take statement (Section 4.2.1) serving as pre-identified targets for function-based habitat protection, restoration, or enhancement actions. While it is likely that these loss projections are an overestimate for some species, ODOT will retain these projections as targets for its habitat actions as a means of providing a benefit above and beyond that necessary to simply offset actual adverse impacts. In accordance with section 7(a)(1) and 7(a)(2) of the ESA, ODOT will develop program level conservation targets to provide habitat based on one of three methods, whichever results in greater function and conservation value for a given species. Greater function and conservation value does not necessarily mean greater quantity of habitat but considers additional factors such as quality, location, distribution, and extent of long-term management protection and management. The three methods for determining program level conservation targets are listed below in order of preference.

a. Estimates of permanent and temporary loss totals listed in the amount and extent of take subsection of this Opinion, regardless of actual loss; or

b. An interagency collaborative approach developed through the CMCS that properly addresses issues associated with uncertainty of success, time-lags, and achievement of net conservation benefit.

c. Actual permanent and temporary loss totals as determined during implementation, and modified as follows:

   - 1.5:1 mitigation to impact ratio to accommodate risk—for impacts to marginal or low quality habitat;

   - 2:1 mitigation to impact ratio to accommodate risk—for impacts to higher quality habitat;

   - Additional time-dependency ratio based on time required to achieve desired future condition through mitigation, regardless of condition/quality of impacted habitat (1.5:1 for 5-10 yrs, 2:1 for 10-20 yrs, 2.5:1 for 20-30 yrs, 3:1 for 30-40 yrs, 4:1 for 40-50 yrs, and 5;1 for > 50yrs).

   Exceptions to the above standards will apply for marbled murrelet and northern spotted owl. For these species, the habitat targets provided will be based on the actual permanent and temporary loss totals determined during implementation, the above risk correction ratios, and the time-dependency ratios not to exceed 2.5:1.

Determinations about which of these options to use will occur collaboratively between ODOT, the Services, and other entities, and will be subject to concurrence from the Services. Decisions must ensure the program meets the goal of net conservation benefit by providing on-ground benefits to these species and their habitats that are greater than necessary to simply compensate for cumulative project-level impacts. The increment of "surplus" benefit is anticipated to be sufficient to advance recovery and conservation goals by providing a meaningful improvement in the size, distribution, and productivity of species populations, or in amount, distribution, and quality of habitats relative to that which existed prior to implementation of the Bridge Program.

All mitigation actions associated with the Bridge Program will comply with the USFWS' Conservation Banking for Threatened and Endangered Species (68 FR 24753), and the Corps' Regulatory Guidance Letter on Compensatory Mitigation (USACE 2002) for compliance with the CWA, as appropriate.

2.3.2 Application of the CMCS to the Bridge Program

Specific methodologies for developing conservation priorities, refining estimates of impacts, and identifying and targeting appropriate mitigation actions are under development. The CMCS may assist in these efforts. It could also help identify opportunities to achieve higher-priority conservation objectives through trade-offs between various mitigation and conservation actions. Such issues will be addressed through the CMCS process, consultation with the Services and other CMCS stakeholders, consideration of conservation objectives contained in recovery plans and other formal conservation strategies, and in accordance with applicable policies and regulations. In general, the greatest benefits will be realized by species/resources most impacted by projects (in terms of amount and/or significance of impact) and by those most "at-risk" within the subject ecoregion

Development and application of the CMCS has not yet resulted in identification of specific priorities or projects for meeting the habitat targets in the amount and extent of take subsection of this Opinion. However, ongoing discussions between ODOT, the USFWS, and other species experts have provided a reasonable expectation of priorities for some species and regions, especially in the Willamette Valley Ecoprovince. To date, ODOT anticipates that the following specific projects will be subject to additional feasibility studies:

- Camas Swale (ODOT) – Approximately 25 acres in Lane County. This site is contiguous with an existing ODOT mitigation project and has wetland and riparian habitat resources, including Upper Willamette River Steelhead ESU species use.

- Santiam Chub Mitigation Property (ODOT) – Approximately 200 acres in Marion and Linn counties. This site has wetland and riparian habitat resources, including Oregon chub species use.

- East Fork Minnow Creek (ODOT) – Approximately 10 acres of beaver pond and forested wetland complex located in Lane County (Middle Fork Willamette River). This site has wetland and riparian habitat resources, including Oregon chub species use.

- Snagboat Bend Property (Private) – Approximately 60 acres in Linn County. This site is privately owned, but has options for acquisition or permanent easement. This site is adjacent to Finley Wildlife Refuge, near confluence of Willamette River and Lake Creek and has wetland, riparian, and terrestrial resources, including Upper Willamette River ESU listed salmonid use, a large population of pond turtles, a gallery riparian cottonwood forest habitat, and stream course restoration potential.

- MDAC Farms Property (Private) – Approximately 600 acres in Linn County. This site is privately owned, but the seller is willing to consider easement or other options. This site has been used for mechanized agriculture and is currently planted in rye grass and has wetland, wet prairie, and riparian habitat resources.

- Skiles Property (Private) – Approximately 120 acres in Linn County. This site is adjacent to the Calapooia River and is privately owned, but the seller is willing to consider easement or other options. This site has wetland, wet prairie, and riparian habitat resources.

- Green Island Complex (McKenzie River Trust) – 1,000+ acres located in Lane County. This site is privately owned by the McKenzie River Trust, which is seeking funding and partnering opportunities for a variety of site restoration/enhancement projects. This site has wetland, wet prairie, gallery riparian forest, Westside oak forest, painted turtles, and Oregon chub habitat resources.

Other projects in the Willamette Valley Ecoprovince may also be considered. Timing for development of priorities for other ecoprovinces will generally correspond to the staged release of Bridge Program contracts.

Application of the CMCS process to the Bridge Program is expected to result in the following general outcomes:

- Allow planners to identify potential minimization/avoidance measures and incorporate these measures into project design;

- Serve as a methodology for tracking and monitoring impacts (and progress/success of associated mitigation and conservation actions) as projects are implemented; and

- Allow ODOT to establish and maintain habitat management areas to compensate for impacts of ODOT actions and achieve a net benefit with respect to the impacted resources/species or overall conservation objectives.

The Draft CMCS Program Manual discusses each of the above in more detail. This section of the Opinion will focus on summarizing some of the expectations and principles that will guide achievement of the last bullet, which is the component of the CMCS most likely to directly supplement actions undertaken through the Bridge Program and which will result in the most visible, predictable on-ground conservation benefits. Any project specific CMCS actions associated with future projects beyond the Bridge Program will need to be evaluated separately from this Opinion with regard to potential effects on listed species or their habitats.

Overall Vision and Principles

ODOT will establish a network of habitat management areas distributed across various ecoregions in the state. The network will be used to help fulfill ODOT's obligation to mitigate for unavoidable impacts of various projects and to provide additional stewardship and conservation benefits. While the exact nature of these areas— their size, location, management focus, and timing of establishment— is not yet known, a number of principles and concepts will guide their development:

- Habitat banking concepts will be used. Many areas will be established before impacts occur, or before specific transportation projects are even planned, to serve as an advance source of mitigation credits against which future impacts will be charged. As impacts occur, their "costs" will be deducted from the "value" of the mitigation bank. Through banking, procedural difficulties associated with planning for, identifying, and implementing mitigation actions on a project-by-project basis are reduced. Resource value is increased because habitat mitigation will be concentrated rather than occurring in small, isolated on-site areas, and actions necessary to attain desired habitat function will have already been implemented before impacts occur, thereby reducing or eliminating potential lag times between impact and benefit.

- Habitat management areas and actions will be designed to provide meaningful benefits to species and resources affected by projects:

    - Landscape-level analyses will be used to identify locations (both at the site scale and watershed scale) where greatest benefits would be realized, to concentrate establishment of habitat management areas and actions in those locations, and to set action priorities.

    - Benefits will be commensurate with the impacts from included projects and focus on "in-kind" compensation. However, there will be some accommodation of tradeoffs in light of opportunities to achieve higher-priority conservation objectives. These tradeoffs and opportunities will be identified through use of the CMCS methodology, consultation with the Services and other CMCS stakeholders, consideration of conservation objectives contained in recovery plans and other formal conservation strategies, and in accordance with applicable policies and regulations. In general, the greatest benefits will be realized by species/resources most impacted by projects (in terms of amount and/or significance of impact) and by those most "at-risk" within the subject ecoregion.

- To accommodate risk of failure associated with some habitat projects and in recognition of the long periods of time sometimes necessary for successful habitat projects to provide desired function or conditions, ODOT may also apply correction factors or ratios to the compensation targets for included projects, as necessary

- For conservation, ODOT will focus on selecting larger, contiguous blocks of habitat, and habitat that is already highly functional or with the greatest potential to be quickly and successfully restored or enhanced. Selected areas will be located and buffered such that desired functions and values are not likely to be significantly reduced by the direct or indirect impacts of management on the adjacent/proximal landscape. Adjacent/proximal land use and land management will be accounted for in the assessment of functional site value.

- Habitat management areas will be secured and protected on a permanent basis, using the legal and procedural tools best suited to doing so. State or Federal ownership of title, and permanent easements and title restrictions will be preferred. Strategies and assurances related to the funding and feasibility of long-term management and maintenance will also be provided.

- Habitat management areas and actions will be designed to achieve a meaningful net conservation benefit:

  - Actions should be designed and the overall CMCS program should be implemented so that on-ground benefits to species/resources at the program scale will always be greater than necessary to simply compensate for cumulative project-level impacts. There should always be a surplus of benefits in support of species recovery and conservation goals.

  - While all habitat areas or actions developed through the CMCS should result in some amount of surplus benefit, the amount and focus of this surplus is not expected to be equally distributed. Some locations and species/resources will benefit more than others. As described above, the greatest benefits should be realized by species/resources most impacted by projects and by those most at-risk within the subject ecoregion.

  - For these high-priority species or resources, the increment of surplus benefit should be sufficient to advance recovery and conservation goals by providing a meaningful improvement in the size, distribution, and productivity of species populations, or in amount, distribution, and quality of habitats relative to that which existed prior to implementation of included ODOT projects.

Implementation Schedule.

The following schedule for development of the CMCS process and activities extends through fall, 2005:

May – June 2004

- Conduct inventory work for key mitigation/conservation sites identified in April for Stage 2 incorporating Ecoprovince Priorities for habitats and species.
- Identify short-list of mitigation sites for further analysis – for Stages 3 and up.
- Refine the CMCS Program Manual based on Agency feedback.
- Finish Ecoprovince Priorities.

June – Sept. 2004

- Finalize Comprehensive Mitigation/Conservation Strategy (CMCS) Program Manual (Draft Mitigation Concept due to Army Corps of Engineers by end of June). CMCS Program Manual defines program infrastructure (Ecoprovince priorities; accounting mechanism, etc.).
- Determine if Stage 2 mitigation sites (focused on wetlands) can address species/habitat issues. If additional sites are needed, identify sites.
- Perform fieldwork for remaining potential mitigation sites – continue through summer.
- Develop conceptual mitigation plans using Ecoprovince Priorities, available impact information, and mitigation site inventory work.

October 2004

- Submit conceptual mitigation plans to CMCS Team and Mitigation Bank Review Team (MBRT) for Stage 2 (and outline for future Stages or Stage concepts/draft plans as available).
- Submit CMCS Program Manual to CMCS Team and MBRT (with any revisions) for approval. The CMCS Program Manual will become part of the Statewide Mitigation Banking Instrument under development by ODOT.

Winter 2004

- Incorporate CMCS Team and MBRT revisions into mitigation/conservation bank designs.

- Finalize mitigation/conservation bank design drawings

Spring/Summer 2005

- Continue planning for mitigation sites for Stage 3 and beyond.

- Begin construction of Stage 2 mitigation/conservation bank sites.

2.3.3 Application of the CMCS to Other Programs and Projects

ODOT also intends for the CMCS to apply to projects other than the Bridge Program, and for that broader application to provide supplementary and complementary affects that benefit a number of key species, habitats, and resources. Future benefits include those listed above in Section 2.3.2 and better, more reliable information for impact assessments, thereby streamlining the development of Biological Opinions and Assessments for future projects;.

2.4 Program Administration (Compliance, Communication, Monitoring, and Reporting)

The FHWA, Corps, and ODOT are ultimately responsible for environmental compliance of the Bridge Program. OTIA III specifies that ODOT use consultants for delivery of the Bridge Program including a Bridge Program Management Firm (BPM Firm) to operate the program. The BPM Firm will serve as an extension of ODOT staff and will have all the technical abilities that ODOT uses during the standard project delivery process. The BPM Firm will act under close supervision of ODOT's Bridge Delivery Unit, and will be responsible for managing the Bridge Program. The contract requirements of the BPM Firm will include ensuring environmental compliance. ODOT will retain a third-party audit firm to ensure compliance by the BPM Firm with all terms of the contract including meeting environmental requirements.

The BPM Firm will be responsible for developing a Program Management Plan (PMP) during the summer of 2004 and implementing that plan throughout the life of the Bridge Program. PMP will, to ensure environmental compliance of the Bridge Program, include pre-design education of designers and construction contractors regarding implementation of the Bridge Program and EPS, specify clear roles and responsibilities for internal and external staff regarding environmental compliance, and include an environmental compliance monitoring and reporting program to ensure and confirm that the program is meeting the objectives of minimizing and avoiding take. The compliance monitoring program will consist of five elements: (1) Pre-construction analysis; (2) construction monitoring; (3) post-construction monitoring; (4) annual reporting; and (5) annual coordination between ODOT, the FHWA, the Corps, and the Services. Every bridge project will be reviewed for environmental compliance. Reinitiation of consultaion will be triggered unless a final draft of the relevant portions of the PMP relative to this Opinion is approved in writing by the Services prior to start of any project construction or reintiation of consultation of this Opinion will be triggered. This conceptual or active PMP may be amended periodically during the life of the program to address needed changes and maintain the spirit of adaptive management with written approval by the Services. A summary of each of these program elements is provided below.

The PMP includes a Program Execution Plan (PEP) for all aspects of the Environmental Management Program. The PMP will outline the strategy for contractor selection, training, and supervision. It will include the process of evaluating contractors for selection of future work, accounting for previous performance. The Services and other resource and regulatory agencies will participate in the development of the PMP and those potions of the PMP that relate to this Opinion will be provided to the Services for approval prior to initiation of project activities.

FHWA understands the need to ensure the contracting community understands the intent of the Environmental Performance Standards (Section 2.5). Each contractor will be required to undergo training which will outline the environmental performance standards and the overall permitting program. An online training program and User Manual will be available to all stakeholders. The contractor will need to certify that they have viewed the training program and understand the permit requirements.

Each contractor will be held accountable for following the EPS. The BPM Firm will oversee a pre-construction meeting focused on environmental accountability and concerns. The meeting will include the construction inspector, project manager, and natural resource specialists. The participants will review the appropriate environmental project specifications and address site-specific environmental concerns. The BPM Firm will maintain a general quality assurance email address to address individual contractor questions, and share the findings with the contracting community.

Pre-construction monitoring will include development of a Pre-Construction Assessment (PCA) for each bridge project that will identify which EPS are applicable and demonstrate how the project meets the applicable EPS. The PCA will include relevant plans (e.g., pollution control plan, fish capture and release plan, site restoration plan, and fluvial analysis). The PCA will also identify any variances from the EPS. The construction element will consist of monitoring and documenting compliance with EPS during construction and identification of significant breaches of EPS. Post-construction monitoring will document the progress of site restoration activities for each bridge project.

ODOT, on behalf of the FHWA and Corps, will ensure annual monitoring reports are compiled for each bridge project undergoing construction or post-construction monitoring, as appropriate. Annual reporting will also include summary reporting of the actions of the Bridge Program and overall compliance with EPS during the previous year. Annual reporting will support annual coordination efforts in which ODOT and the services will conduct annual meetings to evaluate the adequacy of the program and the monitoring efforts and make changes to the program as necessary. Pre-Construction notifications, construction, and post-construction monitoring documentation will be available for review and audit by the Services on a project web page.

2.5 Bridge Repair/Replacement Environmental Performance Standards

The specific design and construction details and techniques for each bridge replacement or repair project will not be known until after consultation for ODOT's OTIA III Statewide Bridge Delivery Program is complete. Therefore, the EPS were developed in cooperation with the Services to guide specific project design and construction. The EPS were developed to avoid potential long-term adverse effects, avoid and minimize short-term adverse effects, and offset any residual unavoidable long-term adverse effects. Unavoidable adverse effects will be minimized and/or constrained to only those likely to be minor, repetitive, and predictable in nature. The EPS require unavoidable long-term adverse effects be offset with restorative or mitigative actions that result in no net long-term adverse effect to listed species and their habitats. In addition, the EPS were developed to maximize the potential for short and long-term beneficial effects to listed species, non-listed species, and their habitats. If any bridge project cannot meet these constraints, it will not be covered by this Opinion and must be the subject of an individual consultation.

Variances. The Services recognize the need for flexibility in implementation of this program. The OTIA III Statewide Bridge Delivery Program is a long-term endeavor that encompasses numerous projects in a variety of regions in Oregon. This flexibility will help to minimize the need for reinitiation of formal consultation for certain bridge design or construction elements and activities for which the Services have recognized the potential for alternate methodologies which may comply with the intent of a specific EPS but not the description in this Opinion. The Services, working with FHWA and the Corps, have identified these opportunities for variance requests when and where appropriate as describe below in the specific EPS.

The intent is for the BPM Firm to fully screen variance requests for accuracy, completeness, and appropriateness relative to the intent of the EPS to limit the magnitude and range of potential adverse effects to those analyzed in this Opinion and to ensure incidental take estimates are not exceeded. Only after project specific variance requests have been screened, will they be sent on to the Services for evaluation as part of a Pre-Construction Assessment (PCA) notification or other correspondence. The following scenarios are anticipated prior to or during implementation of specific projects:

1) Those bridge repair or replacement project elements or activities that have negligible or discountable potential to affect a listed species or designated critical habitat. The location of these projects relative to species ranges and habitats afford limited opportunities for effects.

2) Those bridge repair or replacement project elements or activities that have the potential to affect a listed species or designated critical habitat, but which comply

with the EPS. These projects would be covered by this Opinion and will be noted as such in the PCA notice.

3) Those bridge repair or replacement project elements or activities that have the potential to affect a listed species or designated critical habitat, but which demonstrate through an appropriate variance to the EPS, the effects are within the magnitude and range of those analyzed in this Opinion, and for which take estimates will not be exceeded. This category of variance was identified at specific locations through out the EPS where the opportunity for variances was anticipated in the development of the BA.

4) Those bridge repair or replacement project elements or activities that have the potential to affect a listed species or designated critical habitat, but which demonstrate compliance with the intent of EPS, the effects are within the magnitude and range as those analyzed in this Opinion, and for which take estimates will not be exceeded. These opportunities are not necessarily EPS specific but are located throughout the EPS and identified by the phrase, "unless authorized in writing by the Services and appropriate regulatory agencies". This category of variance is general in nature and was not fully anticipatable in the development of the BA without project specific information.

5) Those bridge repair or replacement project elements or activities that have greater potential to affect listed species or designated critical habitat, but which through additional conservation activities proposed in an appropriate variance to the EPS, the effects are adequately offset, resulting in only those within the magnitude and range as those analyzed in this Opinion, and for which incidental take estimates will not be exceeded.

Other Project Changes. The Services have also recognized the potential for other project changes such as changes in design or construction methodologies which will result in no potential to affect listed species or designated critical habitat and for which no variance request will be submitted to the Services. Any project change other than those discussed above as variances with the potential to affect listed species or designated critical habitat that exceed the magnitude or scope of those analyzed in this Opinion or that are likely to exceed the estimated take, will not be covered by this Opinion and must be the subject of an individual consultation.

The following EPS have been incorporated into the proposed action by the FHWA, Corps, and ODOT:

Program Administration

1. Ensure compliance with all performance standards developed for this program.

    a. Monitoring & Reporting. Develop and carry out a monitoring and reporting program to confirm that the performance standards are being properly followed and that the performance standards are achieving the goals of habitat improvement and avoidance or minimization of adverse effects to the ecosystem.

i. Program Elements:

(1) Program Management Plan (PMP). Develop and maintain a PMP which includes a Program Execution Plan (PEP) and Program Procedures Plan (PPP) for all aspects of the Environmental Management Program. The PMP will outline the strategy for contractor selection, training, and supervision. Include the process of evaluating contractors for selection of future work, accounting for previous performance. Provide the relevant portions of the PMP to the Services prior to initiation of project activities.

(2) Pre-Construction Assessment (PCA). Review each individual bridge project to ensure that all effects are within the range considered in the biological opinion, quantify project level take estimates or extent of take per established metrics, verify program level exempted take is not likely to be exceeded, and that all appropriate environmental performance standards are being properly followed. Submit the PCA to the Services and the appropriate Regulatory Authorities at least 30 days prior to starting construction activities.

(3) Construction Monitoring. Monitor active projects during environmentally sensitive work activities and at a frequency adequate to detect compliance with the appropriate environmental performance standards. Provide environmental monitor with appropriate authority and professional experience to ensure compliance with relevant environmental performance standards and other applicable environmental rules and regulations.

(4) Post-Construction Monitoring. Monitor relevant project features to ensure compliance with long-term beneficial effects goals outlined in the biological assessment. Report on success, failures, and remedial actions for site restoration and compensatory mitigation sites. Evaluate achievement of each relevant conservation measure outlined in the environmental performance standards.

(5) Annual Program Reporting. Submit an annual monitoring report by February 28 of each year that describes the efforts and actions of the preceding year and the anticipated efforts and actions of the following year. Summarize relevant project reports, such as pre-construction assessment reports, construction and post-construction monitoring reports, fish capture and release effort reports. Include summaries of

observed and estimated take and established effects metrics accumulated over the year, including area of riparian disturbance, length of linear streambank disturbance, net fill volumes in jurisdictional wetlands, net fill removed from the functional floodplain, and net area of impervious surfaces treated for detention and contamination.

(6) Annual Program Coordination. Discuss the annual monitoring report with the Services and the appropriate Regulatory Authorities by March 31 of each year. Pursue means of refining and improving program clarity and effectiveness.

ii. Report Contents. Include relevant project information in all reports prepared for this program.

(1) General Report Contents. Include the following, and other data as appropriate:

(a) Bridge identification (e.g., number, highway, crossing);

(b) Bridge location (e.g., county, legal description, ecoregion, species range, drainage);

(c) Project schedule (e.g., construction start and end dates, timing of environmentally sensitive work activities);

(d) Project team contact information (e.g., ODOT, BPM Firm, and contractor contacts);

(e) Photo documentation of habitat conditions within the project area. Label each photo with date, time, project name, photographer's name, and subject comment.

(2) PCA Report Contents. Include the following, and other data as appropriate:

(a) List of project actions.

(b) List of applicable environmental performance standards and how they will be followed.

(c) List of plans prepared.

(d) List of variances requested with supporting documentation.

(e) Date, time, and location of pre-construction meeting.

(f) Estimate of exempted take and established effects metrics required for the project

(3) Monitoring Report Contents. Monitoring reports shall be available within 30 days of the monitoring visit and shall include the following, and other data as appropriate:

(a) Site conditions at time of monitoring visit.

(b) Evaluation of compliance for each relevant environmental performance standard.

(c) Remedial actions suggested and required.

(4) Annual Program Monitoring Report Contents. Include the following, and other data as appropriate:

(a) Summary of work completed.

(b) Summary of variances requested, denied, and approved.

(c) Summary of monitoring dates and efforts.

(d) Summary of relevant reports.

(e) Comparison of annual observed take and effects metrics to remaining exempted take and effects metrics.

(f) Summary of fills/removals within waters of the U.S..

(g) Number and location of program bridges in design, construction, or restoration stage.

(h) Summary of mitigation/conservation credits/debits created and used that year.

(i) Summary of non-compliance situations and actions taken to remediate.

(j) Identification of anticipated variances for following year.

(k) Recommendations for program improvements.

iii. Program Oversight. Retain a third party oversight firm to ensure the Bridge Program Management firm is maintaining compliance with all terms of the contract, including meeting environmental requirements.

b. Variance Protocol.

i. Request a variance for actions not clearly addressed in the environmental performance standards. Requests may be included in the PCA report or other appropriate means and should include the following:

(1) Justification for the proposed variance.

(2) Description of additional actions necessary to offset potential effects, as appropriate.

(3) Demonstration of how the resulting effects are within the range considered in the biological opinion.

(4) Reevaluation of take and established effects metrics if different than identified in the PCA.

ii. Services will respond with an approval, approval with additional conservation measures, or disapproval within 30 calendar days of receipt of the variance request.

iii. Variances of the environmental performance standards that result in greater effects or greater take than provided in the biological opinion will not be granted and will require separate consultation.

c. Communication Protocol.

i. Communication Plan. Develop and carry out a communication plan to ensure appropriate, efficient, and timely coordination between Action Agency, the Services, the appropriate Regulatory Authorities, and other parties. The communication plan will define lines of communication to address concerns that arise during project design and construction.

ii. Electronic Format. Store all reports in an electronic format easily accessible by the Services and the appropriate Regulatory Authorities.

iii. Project Changes. Notify the Services and the appropriate Regulatory Authorities of any project changes[4] as soon as possible.

d. Conservation and Mitigation for Species under USFWS Jurisdiction. Ensure the proposed mitigation or conservation action meets the goal of net conservation benefit by providing on-ground benefits to species and habitats that are greater than necessary to simply compensate for cumulative project-level impacts. The increment of "surplus" benefit, at the program scale, is anticipated to be sufficient to advance recovery and conservation goals by providing a meaningful improvement in the size, distribution, and productivity of species populations, or in amount, distribution, and quality of habitats relative to that which existed prior to implementation of the Bridge Program.

i. Implement habitat protection, restoration, or enhancement actions to address the permanent and temporary habitat losses listed in the amount and extent of take subsection of this Opinion, as described in section 2.3.1.

[4] See discussion of variances and project changes above in Section 2.5 of this Opinion for clarification of project changes and procedures.

ii. Ensure that all mitigation and conservation actions for these species are consistent with all applicable standards contained in the *Compensatory Mitigation* (Section 2.5).

Species Avoidance and Adverse Effect Minimization

1. Fish Avoidance. Minimize incidental take of listed fish and adverse effects to fish species from in-water work activities.

   a. Timing of In-water Work. Complete work below the Ordinary High Water (OHW) elevation[5] during the preferred in-water work period included in Appendix B of this Opinion, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities[6].

   b. Cessation of Work. Cease project operations under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.

   c. Fish Screens. Have a fish screen installed, operated, and maintained according to NOAA Fisheries' fish screen criteria[7] on each water intake used for project construction, including pumps used to isolate an in-water work area. Screens for water diversions or intakes that will be used for irrigation, municipal or industrial purposes, or any use besides project construction are not authorized.

   d. Fish Passage. Provide passage for any adult or juvenile fish species present in the project area during and after construction and for the life of the project, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities[8].

2. Hydro-Acoustic. Prepare and implement a Noise Attenuation Plan (NAP) for steel piles driven with an impact pile driving hammer through water when listed fish may be present.

   i. The NAP will illustrate how hydro-acoustic sound pressure levels will be maintained below 150 decibels (dB) rms (re: 1 micro Pascal) for a minimum of 50 percent of the impacts and peak

[5] For the purposes of this project, "OHW elevation" means the bank height inundated by a 2.6 to 2-year average recurrence interval and may be estimated by morphological features such as average bank height, scour lines, and vegetation limits. Bankfull elevation may be interchanged with OHW elevation. OHW elevation will be field surveyed and marked by a qualified professional.

[6] For purposes of this Project, "Regulatory Authorities" include the ODEQ, ODSL, ODFW, Oregon Department of Agriculture, Corps, and other agencies with project-specific or activity-specific jurisdiction.

[7] National Marine Fisheries Service, Juvenile Fish Screen Criteria (revised February 16, 1995) and Addendum: Juvenile Fish Screen Criteria for Pump Intakes (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/ 1hydrop/hydroweb/ ferc.htm).

[8] Ensure compliance with Oregon Revised Statutes (ORS) 509.585 regarding fish passage.

sound pressure levels will be maintained below 180 dB (re: 1 micro Pascal) for all impacts in areas of potential fish presence.

ii. ODOT/FHWA will review and approve the NAP prior to steel pile driving activities in the water column.

iii. During hydro-acoustic measurement monitoring, the hydrophone(s) shall be positioned at mid-depths, 30-feet from the pile being driven or following the most recent NOAA Fisheries guidance, as directed by contract with ODOT.

iv. Acoustic measurements (monitoring) are not necessary assuming at least one of the following conditions are met:

(1) The pile is driven with a vibratory pile driving hammer.

(2) The pile is acoustically isolated from the water using measures including, but not limited to; dewatering, flow diversion, confined bubble curtains[9] (unconfined bubble curtains may be used if contractor demonstrates that currents are less than 1.7 miles per hour), and other means, as approved by ODOT/FHWA.

(3) The best available science shows that sound pressure levels will not reach the impact thresholds identified above under the stream conditions at the time of pile driving (e.g., channel substrate, water velocity and depth).

b. Isolation of In-water Work Area. If adult or juvenile fish are reasonably certain to be present, or if the work area is within 300 feet upstream of reasonably likely spawning habitats, completely isolate the work area from the active flowing stream using inflatable bags, sandbags, sheet pilings, or similar materials, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities. Prepare a Work Area Isolation Plan for all work below the bankfull elevation requiring flow diversion or isolation. Include the sequencing and schedule of dewatering and re-watering activities, plan view of all isolation elements, as well as a list of materials to adequately provide appropriate redundancy of key plan functions (e.g., an operational, properly sized backup generator). Pile driving may occur without isolation during the in-water work period, providing compliance has been achieved with all other relevant performance standards.

c. Capture and Release. Before, intermittently during, and immediately after isolation and dewatering to isolate an in-water work area, attempt to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.

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[9] See, Longmuir C. and T. Lively. 2001. Bubble curtain systems for use during marine pile driving. Fraser River Pile & Dredge Ltd., New Westminster, British Columbia, Canada. 9 pp.

i. The entire capture and release operation must be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

ii. Do not use electrofishing if water temperatures exceed 64°F, unless no other fish capture method is feasible or successful.

iii. If electrofishing equipment is used to capture fish, comply with NOAA Fisheries' electrofishing guidelines.[10]

iv. Handle all fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.

v. Ensure water quality conditions, including dissolved oxygen levels, within fish transport systems (e.g., buckets) are sufficient to promote fish recovery. Brief holding times; clean, cold, and circulated water; and aerators may be used to maintain water quality conditions.

vi. Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.

vii. In the event of mortalities, do not transfer Federally listed fish to anyone except the Services, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

viii. Obtain all other Federal, State, and local permits necessary to conduct the capture and release activity, such as an ODFW Incidental Take Permits and/or a Scientific Taking Permits.

ix. Allow the Services and the appropriate Regulatory Authorities to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.

x. Report salvage effort results, as called for in relevant permits, including the name and address of the supervisory fish biologist, methods used to isolate the work area and minimize disturbances to fish, stream conditions before and following placement and removal of barriers, the means of fish removal, the number and species of fish removed, the condition of all fish released, and any incidence of observed injury or death.

3. Wildlife Avoidance/Harassment (High Noise). Minimize incidental take of listed wildlife species and adverse effects to wildlife species from high-noise producing activities[11].

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[10] National Marine Fisheries Service, Backpack Electrofishing Guidelines (December 1998) (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf).

[11] For purposes of this project, "high noise" is defined as sound pressure levels greater than 10 dBA above the ambient as measured by the L_{AFmax} and L_{AFeq} at sensitive receptors (e.g., nests, roosting, nesting, foraging habitat).

a. Marbled Murrelet. For high-noise producing activities within one mile of suitable nesting habitat and non-blasting high-noise producing activities within 300-feet of suitable nesting habitat:

i. Inventory. Identify areas of suitable nesting habitat within one mile of the construction site.

ii. Avoidance. All blasting activities within one mile of suitable nesting habitat will be conducted from September 15 to March 30. All non-blasting high-noise producing construction activities will be conducted outside the critical nesting period of April 1 to August 5. Non-blasting high noise producing construction activities conducted from August 6 to September 15 shall implement a daily limited operating period (LOP) of daytime work being conducted from two hours after sunrise[12] to two hours before sunset[4]. If night construction is needed, then activity will be conducted one hour after sunset to one hour before sunrise.

iii. Minimization. High-noise producing construction activities may be conducted between April 1 and August 5, following the LOP with a variance from the USFWS.

b. Bald Eagle. For blasting activities within one mile of known nest sites[13] or communal roosts[14] and non-blasting construction activities within 0.25 mile or 0.5 mile visually (i.e., line-of-site), of a known nest or communal roost:

i. Inventory. Review the most recent Isaacs and Anthony bald eagle nesting survey database for nest locations.

ii. Avoidance. High-noise producing activities, including blasting, will be confined to between September 1 and October 30.

iii. Minimization. Construction activity, other than blasting, within the harassment threshold distances (0.25 mile for noise, 0.5 mile for visual, and 1 mile for blasting) or during October 31 to December 31 shall follow the daily LOP and will require a variance from the USFWS.

iv. Minimization. Staging areas and detour routes will be kept as far from a nest as practicable. If closer than 0.5 mile, then a variance from the USFWS is needed.

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[12] Official sunrise and sunset will be determined using the U.S. Naval Observatory which may be obtained at the following website URL: http://aa.usno .navy. mil / data/ docs/RS_OneYear.html.

[13] Nest sites identified by the most recent Bald Eagle Nest Locations and History of Use in Oregon and the Washington Portion of the Columbia River Recovery Zone database (Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis Oregon, Isaacs and Anthony) shall be assumed active unless surveyed following approved protocol.

[14] Communal roost sites are defined in the Biological Assessment.

c. Northern Spotted Owl. For blasting activities within one mile of suitable nesting and roosting habitat and non-blasting construction activity within 195-feet of nesting and roosting habitat:

i. Inventory. Inventory the area of potential harassment for nesting and roosting (NR) habitat[15].

ii. Avoidance. If NR habitat is present, then prohibit blasting and high-noise producing activities during the following critical nesting periods:

(1) March 1 to July 7 for the North Coast Province.[16]

(2) March 1 to June 30 for the Rogue/Siskiyou National Forest (NF) and Medford District of U.S. Bureau of Land Management (BLM) in the Southwest Province.

(3) March 1 to July 15 for the Umpqua NF in the Southwest Province.

(4) March 1 to July 15 for the Willamette Province.

(5) March 1 to September 30 for the Deschutes NF, Fremont, and Winema NF and unlisted areas.

iii. Minimization. High-noise producing activity within the provincial critical nesting periods may be conducted with a variance from the USFWS.

d. Peregrine Falcon. Obtain an Individual Take Permit from ODFW, as appropriate, for projects that may affect peregrine falcons. Refer to the Biological Assessment to identify those project areas that may affect peregrine falcons.

4. Marine Mammals Avoidance. Avoid disturbance to marine mammals.

a. Noise Disturbance. Avoid disturbance to marine mammals from high-noise producing activities that are within 1,640-feet of areas capable of

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[15] Nesting and roosting habitat are defined in the Biological Assessment.

[16] Province boundaries are shown on page E-19 of the 1994 Record of Decision for the Northwest Forest Plan.

supporting marine mammals[17] or known seal or sea lion haulouts[18] or rookeries[19,20].

i. Air. Maintain sound pressure levels below 85 dB at occupied marine mammal habitats. Monitoring of marine mammals is required when sound pressure levels are expected to exceed 85 dB at occupied marine mammal habitats.

ii. Water. Follow the hydro-acoustic environmental performance standard for fish species avoidance for waters occupied by marine mammals.

b. Visual Disturbance. Avoid visual disturbance to Steller sea lions from construction activities that are within 3,000-feet of Steller sea lion haulouts or rookeries.

i. Prevent aircraft or boats associated with the project from coming into line-of-sight within 3,000-feet of an occupied Steller sea lion haulout or rookery.

ii. If an aircraft or boat associated with the Bridge Program will be in line-of-sight within 3,000-feet of Steller sea lion haulout, then monitor, as directed, to ensure the haulout is not occupied.

iii. Aircraft or boats associated with the Bridge Program will not be allowed to be in line-of-sight within 3,000-feet of a Steller sea lion rookery during the breeding season.

c. Monitoring.

i. Conditions. Monitor during daylight hours[21] during weather conditions that allow the observer a constant line-of-sight to marine mammal habitats.

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[17] Marine Mammal habitat includes identified Coastal Dune and Beaches, Coastal Headlands and Islets, Bays and Estuaries, Marine Nearshore, Marine Shelf, and Oceanic habitat types (Kiilsgaard and Charley 1999), heads of tide for coastal stream and rivers (ODSL 1989), and bridges within 1,640 feet of the Columbia and Willamette Rivers in the Grays/Elokoman, Lower Columbia/Clatskanie, Lower Willamette, and Lower Columbia/Sandy 4th field HUCs (REO 2003).

[18] A haulout will be considered occupied if at least one individual is observed at the time of monitoring.

[19] Seal and sea lion rookeries and haulouts are areas that are known to be regularly occupied by two or more individuals for two consecutive days, identified as an existing haulout (ODFW 2003), or identified by local biologists.

[20] For purposes of this project, areas capable of supporting marine mammals, haulouts, and rookeries will be defined as marine mammal habitat, unless stated otherwise.

[21] Daylight hours will be 1 hour before official sunrise and 1 hour after official sunset. Official sunrise and sunset time will be determined using U.S. Naval Observatory which may be obtained at the following website URL: http://aa.usno.navy.mil/data/docs/RS_OneYear.html

ii. Effort. The number of observers[22] required to monitor an area will be sufficient to observe all marine mammal habitat within 1,640 feet of the construction activity and all haulouts and rookeries within 3,000 feet line-of-site of the construction activity.

iii. Duration. Monitor at least 30 minutes prior to the disturbance-causing activity, during the activity, and least 15 minutes after the completion of the activity.

iv. Haulouts. Monitor identified haulouts within 1,640 feet of a noise disturbance activity or 3,000 feet line-of-site to a visual disturbance for occupancy[23]. If the haulout is occupied, then the disturbance causing activity will be suspended until no marine mammals have been observed for at least 15 minutes at the haulout site.

v. Species. Monitor for marine mammals within 1,640 feet of the construction activity and within 3,000 feet line-of-site of the construction activity. If a marine mammal is observed, then the disturbing activity will be suspended until no marine mammals have been observed for at least 15 minutes.

vi. Reporting. Each monitor will record:

(1) General Data. Date of monitoring, location, proximity to activity, time of arrival and departure, weather[24] at time of arrival and departure.

(2) Species Data. Species, age class, sex, numbers, behavior, time of observation, location, proximity to activity, and reaction to disturbance for each marine mammal observation.

5. Wildlife Avoidance (Bridge Demolition). Minimize injury and death to wildlife species from bridge demolition activities.

a. Migratory Birds. Avoid destruction of occupied nests (i.e., containing eggs or young) an adult birds protected by the Migratory Bird Treaty Act (MBTA).

i. Prevent nesting by native birds[25] on structures to be removed.

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[22] Observers will be biologists capable of identifying marine mammal species, size class, and sex; and be able to interpret and describe marine mammal behavior and responses to disturbance activity.

[23] A haulout will be considered occupied if at least one individual is observed at the time of monitoring.

[24] Weather should include temperature, precipitation, wind, visibility, and cloud cover

[25] Exotic migratory birds, such as European starling, rock pigeons, and house sparrows are not protected by the MBTA.

(1) Inspect bridge for signs of nesting.

(2) Apply exclusionary methods prior to nest building (approximately March 15). Exclusionary methods may include noise cannons, power-washing (i.e., physical removal), netting (ensure proper mesh size and maintain the netting).

ii. Remove existing nests only if no eggs or young are found.

iii. If eggs have been laid and nest cannot be avoided, then consult with USFWS for compliance with the Migratory Bird Treaty Act.

b. Bats. Avoid destruction of bat maternity colonies.

i. Inspect bridge for signs of a maternity colony.

ii. Apply exclusionary methods, prior to maternity roost activity, that prohibit access to colony space.

c. Wildlife Passage and Migration. Maintain existing and re-establish connectivity between aquatic habitats that were severed during the previous or current placement of roadway prism fills.

i. For aquatic habitat (e.g., wetlands as defined by Cowardin 1979) within the construction project footprint, install an adequately sized crossing (36-inch pipe or larger) in the roadfill embedded 1/3 below the soil surface.

ii. Design bridges and approach fills to provide wildlife passage.[26]

iii. Replace existing fencing with "wildlife friendly" livestock fencing in areas where native ungulate crossing is likely.[27]

iv. Refer to the "Critter Crossing" guidance provided by the Federal Highway Administration to identify potential problem situations and solutions.[28]

6. Plant Avoidance. Avoid disturbance to State and Federally-listed plants and their occupied habitat[29].

a. Survey project areas during appropriate flowering period within the range of listed plants. Refer to the BA and the relevant Environmental Baseline

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[26] Refer to ODFW-ODOT liaison biologists for appropriate passage designs.

[27] Project design criteria are available from the U.S. Fish and Wildlife Service, Oregon State Office, 2600 SE 98th Ave., Suite 100, Portland, OR 97266.

[28] Federal Administration (FHWA). (2000). Critter Crossings: Linking Habitats and Reducing Roadkill. Available URL: http://www.FHWA.dot.gov/environment/ wildlifecrossings.

[29] Occupied habitat will be delineated by a qualified professional.

Reports for plant ranges. A survey is not required if the area has had a documented survey[30] within the last 10 years.

b. Flag and map occupied habitat necessary to sustain the identified population within the area of potential disturbance, prior to construction.

c. Ensure construction personnel, equipment, and associated pollutants (e.g., sediments, chemical contaminants, discharge water, non-native grass or weed seed) do not enter the occupied habitat. Delineate as a no work zone or fence the occupied habitat.

d. Maintain the hydrologic and microclimatic conditions necessary for the continued existence of the identified population within the project area.

e. If plants are found, then a management buffer will be developed to protect plants from indirect effects such as herbicide drift.

7. Vernal Pool Fairy Shrimp (VPFS) Avoidance. Avoid areas the potentially support vernal pool fairy shrimp.

a. For project within the range of VPFS, follow protocol surveys for individuals or habitat, as appropriate. Refer to the BA and the relevant Environmental Baseline Report to identify areas likely to support VPFS habitat.

b. Flag and map occupied/or suitable habitat within the area of potential disturbance, prior to construction.

c. Ensure construction personnel, equipment, and associated pollutants (e.g., sediments, chemical contaminants[31], discharge water, non-native grass or weed seed) do not enter the identified habitats. Delineate as a no work zone or fence the occupied or critical habitat.

d. Maintain the hydrologic and microclimatic conditions necessary for the continued existence of the identified habitats.

e. If occupied and/or suitable habitats are found, then a management buffer will be developed to protect vernal pools from indirect effects such as sedimentation or herbicide drift.

Habitat Avoidance and Removal Minimization

1. Streambank Protection. Avoid and minimize adverse effects to natural stream and floodplain function by limiting streambank protection actions to those that are not expected to have long-term adverse effects on aquatic habitats. Whether these actions will also be adequate to meet other streambank protection objectives

[30] Documented site evaluations by a qualified botanist may be considered a documented survey.

[31] For purposes of this performance standard, chemical contaminants include, but are not limited to aerial drift of abrasives, grindings, paint, and other similar materials.

depends on the mechanisms of streambank failure operating at site- and reach-scale.[32]

a. Choice of Techniques. The following bank protection techniques are approved for use individually or in combination:

   i. Woody plantings and variations (e.g., live stakes, brush layering, facines, brush mattresses).

   ii. Herbaceous cover, where analysis of available records (e.g., historical accounts and photographs) shows that trees or shrubs did not exist on the site within historic times, primarily for use on small streams or adjacent wetlands.

   iii. Deformable soil reinforcement, consisting of soil layers or lifts strengthened with fabric and vegetation that are mobile ('deformable') at approximately two- to five-year recurrence flows.

   iv. Coir logs (long bundles of coconut fiber), straw bales, and straw logs used individually or in stacks to trap sediment and provide growth medium for riparian plants.

   v. Bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, increase roughness and cross-section, and provide more favorable planting surfaces.

   vi. Floodplain roughness (e.g., floodplain tree and large woody debris rows, live siltation fences, brush traverses, brush rows, and live brush sills) used to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed.

   vii. Floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain.

   viii. Flow-redirection structures known as barbs, vanes, or bendway weirs, when designed as follows, and as otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

      (1) No part of the flow-redirection structure may exceed bank full elevation, including all rock buried in the bank key.

[32] For guidance on how to evaluate streambank failure mechanisms, streambank protection measures presented here, and use of an ecological approach to management of eroding streambanks, see, e.g., Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, Integrated Streambank Protection Guidelines, various pagination (April 2003) (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm), and Federal Interagency Stream Restoration Working Group, Stream Corridor Restoration: Principles, Processes, and Practices, various pagination (October, 1998) (http://www.usda.gov/stream_restoration/).

(2) Build the flow-redirection structure primarily of wood or otherwise incorporate large wood at a suitable elevation in an exposed portion of the structure or the bank key. Placing the large woody debris near streambanks in the depositional area between flow direction structures to satisfy this requirement is not approved, unless those areas are likely to be greater than 3 feet in depth, sufficient for target-species rearing habitats.

(3) Fill the trench excavated for the bank key above bankfull elevation with soil and topped with native vegetation.

(4) The maximum flow-redirection structure length will not exceed 1/4 of the bankfull channel width.

(5) Place rock individually without end dumping, unless approved in writing by the Services and the appropriate Regulatory Authorities.

(6) If two or more flow-redirection structures are built in a series, place the flow-redirection structure farthest upstream within 150 feet or 2.5 bankfull channel widths, from the flow-redirection structure farthest downstream.

(7) Include woody riparian planting as a project component.

b. Use of Large Wood and Rock. Use large wood as an integral component of streambank protection treatments.[33] Avoid or minimize the use of rock, stone, and similar materials.

i. Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable.

ii. Rock may be used instead of wood for the following purposes and structures. The rock may not impair natural stream flows into or out of secondary channels or riparian wetlands. Whenever feasible, place topsoil over the rock and plant with woody vegetation.

(1) As ballast to anchor or stabilize large woody debris components of an approved bank treatment.

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[33] See, e.g., Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, Integrated Streambank Protection Guidelines, Appendix I: Anchoring and placement of large woody debris (April 2003) (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm); Oregon Department of Forestry and Oregon Department of Fish and Wildlife, A Guide to Placing Large Wood in Streams, May 1995 (http://www.odf.state.or.us/FP/RefLibrary/RefsList.htm). For the purposes of this Opinion, Engineered Log Jams are considered to meet the definition of Large wood and rock

(2) To fill scour holes, as necessary to protect the integrity of the project, if the rock is limited to the depth of the scour hole and does not extend above the channel bed.

(3) To construct a footing, facing, head wall, or other protection necessary to prevent scouring or downcutting of, or fill slope erosion or failure at, an existing structure (e.g., culvert, utility line, or bridge support) to be repaired. New and replacement structures shall comply with the *Fluvial* Performance Standard.

(4) To construct a flow-redirection structure as described above.

2. Habitat Removal. Avoid or minimize habitat modification that will impair the ability of threatened, endangered, proposed, or selected sensitive species to complete essential biological behaviors, such as breeding, spawning, rearing, migrating, feeding, and sheltering.

a. Designated Critical Habitat. Maintain designated critical habitat within the project footprint.

i. Review appropriate sources (e.g., BA, Federal Registers) to determine if designated critical habitat is present or likely present within the project area.

ii. Flag and survey the boundary of designated critical habitat, as appropriate.

iii. Do not permanently degrade any primary constituent elements within the boundary of designated critical habitat.

b. Listed Species Nest Trees. Do not remove documented nest trees for bald eagle, marbled murrelet, or northern spotted owl.

c. Non-listed Species Nest Trees. Whenever feasible, do not remove documented nest trees of great blue herons and other non-listed bird species (see Migratory Bird subsection under *Species Avoida*nce Standard).

d. Breeding Habitat. Do not remove potential nesting, breeding, or alter reasonably likely spawning habitat during the breeding season[34] of listed species, unless protocol surveys show the area is not occupied.

e. Functional Habitat. Whenever possible, do not modify or degrade functional[35] habitats for listed species in the project area. If functional habitats for listed species cannot be avoided, then provide the justification(s), such as:

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[34] Breeding season restrictions are identified in the Biological Assessment.

[35] Functional habitat is synonymous with suitable habitat such that it is capable of supporting a protected species either presently or within the future.

i. Social: public safety, right-of-way;

ii. Physical: geomorphologic, built environment;

iii. Ecological: conflicting resources;

(1) Conserve habitat with the highest value relative to the listed species that will be affected, given the likelihood and timing of mitigation success.

(2) Use ecological value (uniqueness, rarity, resource utilization) and ease of replacement (probability of success, recovery time lags) to evaluate and justify the decision.

f. Replacement. Mitigation must be functionally equivalent to the habitat modified or degraded.

Water Quality

1. Pollution & Erosion Control. Prevent delivery of contaminants to soils and waters of the U.S. caused by surveying and construction operations. Prepare and carry out a Pollution and Erosion Control Plan that contains the elements outlined in Sections 280.00 and 290.30 of ODOT's *Standard Specifications for* Construction (2002), meets requirements of all applicable laws and regulations, and includes the following:

a. The name and address of the party(s) responsible for accomplishment of the pollution and erosion control plan.

b. Practices to prevent erosion and sedimentation associated with access roads, stream crossings, drilling sites, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations, staging areas, and roads being decommissioned.

c. Practices to confine, remove, and dispose of excess concrete, cement, grout, and other mortars or bonding agents, including measures for washout facilities.

d. A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.

e. A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.

f. Practices to prevent construction debris from dropping into any waters of the U.S., and to remove any material that does drop with a minimum disturbance to the aquatic habitat and water quality. Include complete and detailed plans for removing any structure and constructing new structures. Outline specific containment measures necessary to keep bridge removal and construction debris out of waters of the U.S..

g. Inspection of erosion and sediment controls. During construction, monitor in-stream turbidity and inspect all erosion controls daily during the rainy season and weekly during the dry season, or more often as necessary, to ensure the erosion controls are working adequately.[36]

   i. If monitoring or inspection shows that the erosion and sediment controls are ineffective, mobilize work crews immediately to make repairs, install replacements, or install additional controls as necessary.

   ii. Remove sediment from erosion and sediment controls once it has reached 1/3 of the exposed height of the control.

2. Staging Activities. Fuel, operate, maintain, and store vehicles and construction materials in areas that minimize disturbance to habitat and prevent adverse effects from potential fuel spills.

   a. Limit staging areas to the minimum size necessary to complete the project. To reduce the staging area and potential for contamination, ensure that only enough supplies and equipment to complete a specific task will be stored on-site.

   b. Complete vehicle staging, cleaning, maintenance, refueling, and fuel storage in a vehicle staging area placed 150 feet or more from any waters of the U.S., unless this distance is not appropriate because of the following site conditions:

      i. Physical constraints that make this distance not feasible (e.g., steep slopes, rock outcroppings).

      ii. Natural resource features would be degraded as a result of this setback.

      iii. Equal or greater spill containment and effect avoidance if staging area is less than 150 feet of any waters of the U.S..

   c. If staging areas are within 150 feet of any waters of the U.S., full containment of potential contaminants shall be provided to prevent soil and water contamination, as appropriate.

   d. Inspect all vehicles operated within 150 feet of any waters of the U.S. daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by the Services and the appropriate Regulatory Authorities.

   e. Before operations begin and as often as necessary during operation, steam clean (or an approved equal) all equipment that will be used below

[36] For purposes of this performance standard, "working adequately" means that project activities do not increase ambient stream turbidity by more than 10 percent above background 100 feet below the discharge, when measured relative to a control point immediately upstream of the turbidity-causing activity.

bankfull elevation until all visible external oil, grease, mud, and other visible contaminates are removed.

f. Diaper all stationary power equipment (e.g., generators, cranes, stationary drilling equipment) operated within 150 feet of any waters of the U.S. to prevent leaks, unless other suitable containment is provided to prevent potential spills from entering any waters of the U.S..

3. Construction Discharge Water. Avoid adverse affects to water quality from construction discharge water (e.g., concrete washout, hydromilling, pumping for work area isolation, vehicle wash water, drilling fluids).

   a. Discharge Containment. Design, build, and maintain facilities to collect and treat all construction discharge water, including any contaminated water produced by drilling, using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals, and other pollutants likely to be present. An alternate to treatment is collection and proper disposal offsite.

   b. Discharge Velocity. If construction discharge water is released using an outfall or diffuser port, velocities may not exceed 4 feet per second.

   c. Pollutant Containment. Do not allow pollutants including petroleum products, contaminated water, silt, welding slag, sandblasting abrasive, green concrete, or grout cured less than 24 hours to contact any area within 150 feet of waters of the U.S., unless approved by the Services and the appropriate Regulatory Authorities.

   d. Drilling Discharge. All drilling equipment, drill recovery and recycling pits, and any waste or spoil produced, will be completely isolated, recovered, then recycled or disposed of to prevent entry into waters of the U.S..

      i. Drilling fluids will be recycled using a tank instead of drill recovery/recycling pits, whenever feasible.

      ii. When drilling is completed, attempts will be made to remove the remaining drilling fluid from the sleeve (e.g., by pumping) to reduce turbidity when the sleeve is removed.

      iii. Follow the necessary terms and conditions of ODOT’s most recent drilling programmatic biological opinion.

4. Piling Removal. Avoid adverse affects to aquatic habitats during removal of temporary or permanent piling.

   a. Immediately place removed piling onto the appropriate dry storage site.

   b. Attempt to remove the entire temporary or permanent piling unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

c. Ensure remaining treated wood piling is broken, cut, or pushed at least 3 feet below the sediment surface and covered with a cap of clean, native substrates that match surrounding streambed materials.

d. Fill the holes left by each treated timber piling with clean, native substrates that match surrounding streambed materials, whenever feasible.

5. Treated Wood. Avoid adverse affects to aquatic habitats during handling of treated wood.

a. Ensure that no treated wood debris falls into waters of the U.S.. If treated wood debris does fall into waters of the U.S., remove it immediately.

b. Dispose of all treated wood debris removed during a project, including treated wood pilings, at an upland facility approved for hazardous materials of this classification. Do not leave a treated wood piling in the water or stacked on the streambank.

c. Projects using treated wood that may contact flowing water or that will be placed over water where it will be exposed to mechanical abrasion are not authorized, except for pilings installed following NOAA Fisheries' guidelines[37].

6. Site Stabilization. Stabilize all disturbed areas following any break in work unless construction will resume within four days.

7. Stormwater Management. Avoid or minimize adverse effects resulting from changes to the quality and quantity of stormwater runoff for the life of the project by improving or maintaining natural runoff conditions within project watersheds.

a. Plan. Prepare and carry out a Stormwater Management Plan for any project that will produce a new impervious surface or a land cover conversion that slows the entry of water into the soil. Include the following:

i. Logic and science (e.g., engineering equations and models or scientific literature and findings) supporting the selected stormwater management option. For projects that require engineered facilities to meet stormwater requirements, use a continuous rainfall/runoff model, if available for the project area, to calculate stormwater facility water quality and flow control rates.

ii. Schedule to inspect and clean each facility as necessary to ensure that the design capacity is not exceeded and whether improvements in operation and maintenance are needed. Make improvements as needed.

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[37] Letter from Steve Morris, National Marine Fisheries Service, to W.B. Paynter, Portland District, U.S. Army Corps of Engineers (December 9, 1998) (transmitting a document titled *Position Document for the Use of Treated Wood in Areas within Oregon Occupied by Endangered Species Act Proposed and Listed Anadromous Fish Species, National Marine Fisheries Service, December, 1998*).

b. Water Quality. Improve long-term water quality conditions associated with pollutant loading from the road network within the project watershed[38].

i. Drains. Eliminate direct discharge from the bridge deck to waters of the U.S.[39].

ii. Treatment Level. Increase treatment of stormwater runoff discharged to waters of the U.S.. Reduce the annual pollutant loading[40] to waters of the U.S., relative to pre-project conditions by providing treatment for the water quality event[41].

iii. Groundwater. Protect groundwater from pollutant loading.

(1) Pretreat the water quality event stormwater runoff from pollution generating surfaces before infiltration to groundwater or discharge into waters of the U.S., as necessary to minimize any pollutant load likely to be present.

(2) Pretreatment may include, but is not limited to, biofiltration (filtration, adsorption, and biological decomposition from soils that have sufficient organic content and sorption capacity to remove pollutants), filtration (engineered filtration systems), settling/sediment ponds (engineered stormwater facilities), or any combination treatment train there of.

iv. Placement. Avoid sensitive natural resource areas (e.g. riparian and wetland areas, unstable hill slopes, ESA-listed species habitat) during placement of stormwater treatment facilities.

v. Erosion. Prevent erosion caused by the conveyance of stormwater runoff. Consider the following:

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[38] For purposes of this project, "project watershed" refers to the 6th Field Hydrologic Unit Code.

[39] For purposes of this project, "waters" includes any natural waterway, including all bays, intermittent streams, constantly flowing streams, lakes, wetlands, and other bodies of water, any part of which are located within the State of Oregon.

[40] For purposes of this project, "pollutant loading" includes, but is not limited to debris, sediment, nutrients, petroleum hydrocarbons, and metals.

[41] For purposes of this project, "water quality event" refers to the volume of runoff predicted from a 6-month, 24-hour storm, which may be assumed to be 72 percent of the 2-year, 24-hour amount (See, Washington State Department of Ecology (2001), Appendix I-B-1), unless another storm size is more appropriate for the local climate and hydrology and provides equivalent conservation benefit (less than or equal adverse effects provided by the defined storm size) and is approved in writing by the Services and the appropriate Regulatory Authorities.

(1) Maintain natural drainage patterns and, whenever possible, ensure that discharges from the project site occur at the natural location.

(2) Use a conveyance system comprised entirely of manufactured elements (e.g., pipes, ditches, outfall protection) that extends to the ordinary high water line of the receiving water, where risk of erosion precludes conveyance through sheet flow.

(3) Stabilize any erodible elements of the conveyance system as necessary to prevent erosion.

(4) Do not divert surface water from, or increase discharge to, an existing wetland if that will cause a significant adverse effect to wetland hydrology, soils, or vegetation.

(5) The velocity of discharge water released from an outfall or diffuser port may not exceed 4 feet per second (attraction flow for fish).

c. Water Quantity. Increase the annual site infiltration potential of the project watershed, with emphasis on the project area.

i. Urbanized. For urbanized watersheds[42], reduce the post-project frequency, magnitude, and duration of the flow from ½ of the 2-year storm event up to the 50-year storm event as measured against pre-project frequency, magnitude and duration of flow from the same range of storm events.

ii. Wildland. For wildland (forest, rangeland) watersheds, reduce the post-project or maintain the pre-project frequency, magnitude, and duration of the flow from ½ of the 2-year storm event up to the 50-year storm event as measured against pre-project frequency, magnitude and duration of flow from the same range of storm events.

iii. Infiltration. Provide infiltration opportunities for stormwater runoff derived from the project area.

(1) Infiltration opportunities may include, but are not limited to; adequate soils, non-concentrated overland flow, vegetation management, land cover conversions, permeable bedded detention basins, and infiltration swales.

[42] For purposes of this project, "urbanized watersheds" are determined by a low percentage of natural vegetation and a high percentage (equal to or greater than 10 percent total impervious area) of impervious surface within the project watershed (6th Field HUC). Other methods may include Federal Emergency Management Agency mapping, land management, land cover types, or land ownership. The hydrology of these watersheds has been significantly altered by land development.

(2) Minimize, disperse, and infiltrate stormwater runoff onsite using sheet flow across permeable vegetated areas to the maximum extent possible without causing flooding, erosion impacts, or long-term adverse effects to groundwater.

iv. Discharge. Ensure that the post-project discharge is less than the pre-project discharge rates from 50 percent of the 2-year flow up to the 50-year flow.

Site Restoration

1. Renew habitat access, water quality, production of habitat elements, channel conditions, flows, watershed conditions, and other ecosystem processes that form and maintain productive habitats. Prepare and carry out a site restoration plan as necessary to ensure that all habitats and accesses (e.g., streambanks, soils, large woody material, and vegetation) disturbed by the project are cleaned up and restored as follows:

a. General Considerations:

i. Streambank shaping. Restore damaged streambanks to a natural slope, pattern and profile suitable for establishment of permanent woody vegetation, unless precluded by pre-project conditions (e.g., a natural rock wall).

ii. Revegetation. Replant or reseed each area requiring revegetation before the end of the first planting season following construction. Use a diverse assemblage of species native to the project area or region, unless approved in writing by the Services and the appropriate Regulatory Authorities.

iii. Pesticides. No pesticides, including herbicides, will be allowed within 150 feet of waters of the U.S.. Mechanical, hand, or other methods may be used to control weeds and unwanted vegetation.

iv. Fertilizer. Do not apply surface fertilizer within 50 feet of any stream channel, unless approved in writing by the Services and the appropriate Regulatory Authorities.

v. Fencing. Install wildlife-friendly fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

vi. Source of Materials. Obtain boulders, rock, woody materials and other natural construction materials used for the project outside the OHW elevation and at least 150 feet from any waters of the U.S., except for native materials obtained from within the project footprint to be stockpiled and reused on site.

(1) If possible, leave native materials where they are found.

(2) If native materials (e.g., downed wood) are damaged or destroyed, replace them with a functional equivalent during site restoration.

(3) Stockpile all large wood[43], native vegetation, weed-free topsoil, and native channel material displaced by construction for use during site restoration in-channel, in the riparian area, or in adjacent uplands, as appropriate.

b. Plan Contents. Include each of the following elements:

i. Responsible Party. The name and address of the party(s) responsible for meeting each component of the site restoration requirements, including providing and managing any financial assurances and monitoring necessary to ensure restoration success.

ii. Baseline Information. Include the location and extent of resources surrounding the restoration site (i.e., historic and existing conditions). This information may be obtained from existing sources (e.g., land use plans, watershed analyses, subbasin plans, and ODOT's Environmental Baseline Reports), where available.

iii. Goals and Objectives. Restoration goals and objectives that describe the extent of site restoration necessary to restore lost function, by resource type.

iv. Design Criteria. Use these criteria to help design the plan and to assess whether the restoration goal is met. While no single criterion is sufficient to measure success, the intent is that these features should be present within reasonable limits of natural and management variation:

(1) Bare soil spaces that approximate the size and dispersal pattern of pre-existing conditions;

(2) Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local;

(3) If areas with past erosion are present, they are completely stabilized and healed;

(4) Plant litter is well distributed and effective in protecting the soil with few or no litter dams present;

(5) Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site;

(6) Vegetation structure is resulting in rooting throughout the pre-existing, available soil profile;

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[43] For purposes of this project, "large wood" means a tree, log, rootwad, or engineered logjam big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in or near which the wood occurs. See, Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 (www.odf.state.or.us/FP/RefLibrary/LargeWoodPlacemntGuide5-95.doc).

(7) Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation;

(8) High impact conditions are confined to small areas that are necessary for access or other special management situations;

(9) Streambanks have less than 5 percent exposed soils with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris.

v. Work Plan. Develop a work plan with sufficient detail to include a description of the following elements, as applicable:

(1) Boundaries for the restoration area;

(2) Restoration methods, timing, and sequence;

(3) Irrigation plan, including water supply source, if necessary;

(4) Woody native vegetation appropriate to the restoration site. This must be a diverse assemblage of species that are native to the project area or region, including grasses;

(5) List forbs, shrubs and trees to be planted. This may include allowances for natural regeneration from an existing seed bank or planting;

(6) A plan to control exotic invasive vegetation;

(7) Elevation(s) and slope(s) of the restoration area to ensure they conform with required elevation and hydrologic requirements of target plant species;

(8) Geomorphology and habitat features of stream or other open waters;

(9) Site management and maintenance requirements.

vi. Five-year monitoring and maintenance plan:

(1) A schedule to visit the restoration site annually for five years or longer as necessary to confirm that the design standards are achieved. Revise the restoration plan if design standards are not achieved after initial 5-year period. Continue annual monitoring until restoration performance criteria are met;

(2) During each visit, inspect for and make plans to correct any factors that may prevent attainment of design criteria (e.g., low plant survival, invasive species, wildlife damage, and drought);

(3) Keep a written record to document the date of each visit, site conditions and any corrective actions taken.

Compensatory Mitigation

1. Ensure the proposed action meets the goal of no net loss of habitat function by offsetting unavoidable permanent and temporary adverse effects to habitats. Offsetting actions will be such that they are commensurate with the amount, type, timing, and significance of adverse effects to resources as much as possible. Activities that reduce or remove habitat function or that delay or prevent development of desired function or condition of habitat will require a Compensatory Mitigation Plan that describes how this will be achieved. General considerations for these plans include:

    a. Make mitigation plans compatible with adjacent land uses or, if necessary, use an appropriate buffer to separate mitigation areas from developed or agricultural lands so that desired functions and value will not be significantly reduced by the direct or indirect impacts of adjacent land uses. Adjacemt/proximal land use and land management will be accounted for in the assessment of the functional site value.

    b. Base the level of required mitigation on a functional assessment of adverse effects of the proposed project, and functional replacement (i.e., 'no net loss of function'), whenever feasible, or a minimum one-to-one linear foot or acreage replacement ratio shall be applied. As necessary, the replacement ratio shall be adjusted to accommodate the risk of failure associated with some habitat projects and in recognition of the long periods of time sometimes necessary for successful habitat projects to provide desired function and conditions.

    c. Acceptable mitigation must be consistent with all program-specific EPS and may include:

        i. Re-establishment or rehabilitation of natural or historic habitat functions when self-sustaining, natural processes are used to provide the functions.

        ii. Participation in ODOT's conservation banks, as approved in writing by the Services and the appropriate Regulatory Authorities.

    d. Actions that require construction of permanent structures, active maintenance, creation of habitat functions where they did not historically exist, or that simply preserve existing functions are not authorized, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

    e. Whenever feasible, complete mitigation before, or concurrent with, project construction to reduce temporal loss of ecosystem functions and simplify compliance.

    f. When project construction begins before mitigation is completed, show the Services that a mitigation project site has been secured and appropriate financial assurances are in place.

i. Complete all work necessary to carry out the mitigation plan no later than the first full growing season following the start of project construction, whenever feasible.

ii. If beginning the initial mitigation actions within that time is infeasible, then include other measures that mitigate for the consequences of temporal losses in the mitigation plan.

g. Include all pertinent elements of a site restoration plan, outlined above, and the following elements.

i. Consideration of the following factors during mitigation site selection and plan development.

(1) Watershed considerations related to specific resource needs of the affected area.

(2) Existing technology and logistical concerns.

ii. A description of the legal means for protecting mitigation areas, and a copy of any legal instrument relied on to secure that protection. Mitigation areas will be secured and protected on a permanent basis, utilizing the legal and procedural tools best suited to doing so.

h. Information related to unavoidable impacts to bull trout, short-nose and Lost River suckers, Oregon chub, marbled murrelet, bald eagle, northern spotted owl, and Fender's blue butterfly will be included so that ODOT can implement appropriate program-level mitigation planning and actions for these species.

i. All mitigation actions associated with the Bridge Program will comply with the USFWS' Conservation Banking for Threatened and Endangered Species (68 FR 24753), and the Corps' Regulatory Guidance Letter on Compensatory Mitigation (USACE 2002), as appropriate.

Fluvial

2. Fluvial. Allow normative physical processes[44] within the stream-floodplain corridor.

a. Channel Processes. Design water crossings other than overflow crossings[45] that: (1) promote natural sediment transport patterns for the reach, (2) provide unaltered fluvial debris movement, and (3) allow for longitudinal continuity and connectivity of the stream-floodplain system. If one of the three objectives cannot be restored at the project

[44]If existing conditions, exclusive of highway structures (e.g., built environment, hydrologic control), will likely preclude normative physical processes during the life of the proposed crossing (e.g., 100 years), then design crossing to existing conditions.

[45]Overflow crossings will be designed to pass the 50-year flood event or ODOT's most up-to-date design standards.

site, then locate an alternate, non-Bridge Program project within the same project watershed that will achieve an equal or greater function. Temporary fill below the bankfull elevation that results in embedded streambed material is not allowed, unless approved in writing by the Services and the appropriate Regulatory Authorities.

i. Ensure the functional floodplain is absent of roadway, embankment, or approach fills.

(1) For purposes of this project, the functional floodplain will be determined using the following process, unless another process (e.g., channel migration zone) is more appropriate for site conditions and is approved in writing by the Services and the appropriate Regulatory Authorities :

(a) Step 1: Determine the bankfull width, depth, and elevation.

(b) Step 2: Determine the floodprone elevation and width.[46]

(c) Step 3: Determine the Entrenchment Ratio (E).[47]

(i) If E < 2.2, then the floodprone area is considered the functional floodplain.

(ii) If E > 2.2, then 2.2 times the bankfull width is considered the functional floodplain.

(d) <u>Process Considerations</u>:

(i) The bankfull discharge level (elevation)[48] can be located using field indicators as defined by Dunne and Leopold (1978). Bankfull indicators include: (1) topographic break from vertical bank to flat floodplain, (2) topographic break from steep slope to gentle slope, (3) change in vegetation from bare to grass, moss to grass, grass

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[46] Floodprone Width (FPW) is defined as the width at the elevation of twice the maximum bankfull depth or three times the average bankfull depth.

[47] Entrenchment (E) is defined as the ratio between the floodprone width and bankfull width (E = FPW/BFW). Values of less than 1.4 indicate a stream with a relatively small floodplain, while values over 2.2 indicate a system with high floodplain connectivity.

[48] As general consideration, in western Oregon, bankfull discharge is approximately a 1.1 to 1.2-year flow event, while in eastern Oregon it more closely corresponds to a 2.6-year event (Janine Castro, Pers. Comm. 2003).

to sage, grass to trees, or from no trees to trees, (4) textural change of depositional sediment, (5) elevation below which no fine debris (needles, leaves, cones, seeds) occurs, and (6) textural change of matrix material between cobbles or rocks (Dunne and Leopold 1978).

(ii) Surveys of the bankfull discharge elevation should be conducted upstream and/or downstream of the bridge, outside of the area influenced by the bridge. Five to seven channel widths (one average meander wavelength; 10 widths is preferred) is often used as a minimum distance to survey upstream and downstream, however, site conditions will dictate the appropriate distance for surveying.

(iii) Bankfull width (BFW) is the active channel width at the bankfull discharge elevation as defined above. Averaging several width measurements (taken at riffle sections, if available) are preferable to a single measurement. Comparing upstream and downstream measurements is valuable for determining various physical processes in operation at specific sites. Avoid measuring widths where bank stabilization structures are located. Vast disparities in upstream and downstream bankfull widths may indicate stream instability and should be further investigated.

(iv) Average bankfull depth can be determined by either averaging the measured depths across the stream channel at the bankfull width level, or by dividing the cross-sectional area by the bankfull width.

(v) The floodprone width (FPW) is determined by finding the elevation at twice the maximum bankfull depth at a riffle or three times the average bankfull depth. The width of the floodplain, or floodprone area, is then measured at this elevation. Using three times the average depth is a more robust approach because it is not as sensitive to the exact location of the cross-section.

(2) As a means of evaluating bridge placement, appropriate span length, and overall program goals, perform scour analysis to:

(a) Evaluate the bridge length so that there is equivalent contraction scour at the bridge crossing as in the area upstream of the bridge crossing or would be expected under natural conditions up to the 10-year flood event.

(b) Ensure that the discharge at which incipient motion[49] begins under the bridge is similar to the discharge at which incipient motion begins upstream of the bridge.

(c) Ensure scour through the bridge opening is equivalent to reach conditions outside of the influence of the bridge structure and road prism.

ii. Remove man-made constrictions within the functional floodplain of the project area.

(1) Reduce existing fill volumes in the functional floodplain: Possible measures to reduce fill volumes could include removing existing approach fills, installing relief conduits through existing fill, or removing other floodplain fill volumes located within the project area.

(2) Avoid increases and decrease, as feasible, net fill volumes[50] within the floodprone area.

(3) Remove vacant[51] bridge support structures in the functional floodplain: Possible measures may include removing structures to below the modeled scour depth[52]

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[49] Incipient motion is defined as the velocity at which bed material becomes mobile.

[50] Fill volumes will be calculated from the existing soil surface to the floodprone elevation.

[51] For purposes of this project, "vacant structures" include unused, unnecessary, or abandoned structures that are no longer fulfilling their intended purpose, except for those structures that are potentially eligible for, eligible for, or listed on the National Register of Historical Places.

[52] For purposes of this performance standard, the scour analysis shall be performed according to methodology developed by the Federal Administration: Hydraulic Circular No. 18, Evaluating Scour at Bridges, Third Edition (FHWA-IP-90-017, November 1995) or equivalent. The focus of this fluvial scour

or removing structures located within debris transportation corridors.

iii. Design and locate bridge support structures with the following considerations:

(1) Avoid inducing localized scour of streambanks and reasonably likely spawning areas.

(2) Bridge supports will avoid supplemental[53] scour prevention (e.g., riprap) and incorporate scour protection (e.g., drilled shafts, piles driven below critical scour depth).

(3) Bridge supports will allow the fluvial transport of large wood through the project area.

(a) Avoid the need for removal or modification (e.g., cutting, limbing) of large wood resting against bridge support structures.

(b) Design span length to facilitate potential large wood movement through the project area with the following considerations:

(i) The site-potential tree height[54] and the large wood transport capacity[55] of the project watershed upstream of the bridge.

(ii) The orientation of the bridge crossing and bent locations relative to stream flow in order to capitalize on the orientation of drift material relative to the bridge structure.

b. Floodway Processes. Design crossings that allow lateral connectivity between the stream and floodplain.

i. Bridge the functional floodplain.

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review is to ensure that the new bridge will have a sufficient span over the waterway and functional floodplain area to prevent scour from occurring differentially at the bridge site than would occur in natural stream reference sections up to the 10-year flood event.

[53] For purposes of this project, "supplemental scour protection" can also be referred to as "active scour protection"

[54] For purposes of this project, the site potential tree height can be obtained in the county-specific Natural Resource Conservation Service (NRCS) soil surveys.

[55] For purposes of this project, the "large wood transport capacity" is the maximum capability of the stream to move large wood under historic, current, and future land use activities and is a product of the channel morphology, stream power, and site potential tree height.

ii. Accommodate potential flow pathways at multiple flood stages by:

  (1) Locating bridge opening to maximize floodplain function;

  (2) Providing flood-relief conduits (bottomless arch and embedded culvert design only) within existing road fill at potential flood flow pathways based on analysis of flow patterns (or floodplain topography) at multiple flood stages, as necessary;

  (3) Locating bridge abutments with consideration of channel migration patterns over the designed lifetime of the bridge

2.6 Interrelated & Interdependent Activities

Interrelated actions are defined as actions that are part of a larger action and depend on the larger action for justification (50 CFR section 402.2). Interdependent actions are defined as actions having no independent utility apart from the proposed action (50 CFR section 402.2). The bridge program described above does not represent a new level of service, or require new roads. Actions that could be considered either interrelated or interdependent to the proposed action include aggregate extraction and utility relocation. Induced development is not anticipated to be an interrelated or interdependent action resulting from the OTIA III Bridge Delivery Program because highways associated with the bridges are not being expanded to accommodate additional traffic lanes.

ODOT has changed the manner in which it addresses aggregate sources for this program. The exemption (Section 00160.60(c) of ODOT's Standard Specifications (ODOT 2002a)) for commercial, continuously-operated sources is no longer available. This exemption allowed commercial operators to obtain aggregate material from these sources. These sources were not required to provide documentation that the collection of the aggregate was legally permitted. Additionally, the batched nature of this program allows a greater amount of recycling. All aggregate sources will now be required to show proof of environmental compliance and all appropriate permits. Transportation of aggregate to landfills will be minimized; thus decreasing inputs to landfills and reducing fossil fuel use.

New aggregate sources may need to be identified as a result of the Bridge Program. In addition, existing operations may need to be expanded to address the increased demand for quality aggregate materials. ODOT, on behalf of FHWA/Corps has attempted to minimize and avoid potential adverse effects as a result of this increased aggregate extraction through three distinct approaches: 1) Minimizing the ultimate Program aggregate demand; 2) evaluating quarry management practices at ODOT/FHWA/Corps-controlled sources (an ongoing activity); and 3) expanding the ODOT Standard Specifications language to require proof, in writing, of permits obtained or, if certain permits have not been obtained, a written statement explaining why those permits are not necessary for the operation of the source (Corps Rivers and Harbors Act Section 10 and/or Section 404 Clean Water Act, Oregon Department of Geology and Mineral Industries, and, Oregon Department of State Lands (ODSL), local government authorities) to all commercial sources. The first approach involves the development and implementation of the following Recycling Goal Performance Standard which will help avoid the interrelated and interdependent effects of material disposal:

For each bridge demolished, the Contractor must meet the following Minimum Recycling Standards and should make every attempt to reach the Recycling Goals:

MATERIAL	MINIMUM REYCLING STANDARD	RECYCLING GOAL
Concrete	70%	95%
Asphalt	70%	95%
Treated Wood	10%	25%
Untreated Wood	70%	95%
Metal	50%	95%
Other	5%	10%

The second approach involves an internal agency review of existing practices and consultation, if necessary, with the appropriate regulatory and resource agencies to ensure that Agency actions do not adversely affect listed and proposed species. The final approach involves adding a special provision, applicable to the Bridge Program, to Section 00160.60(c) of ODOT's Standard Specifications (ODOT 2002a). The special provision will add Corps Rivers and Harbors Act Section 10 and Section 404 Clean water Act permits to the list of required permits and remove the statement "except for continuously-operated commercial sources" from Section 00160.60(c) of ODOT's Standard Specifications (ODOT 2002a); thereby requiring proof of permits or that permits are not required from all commercial sources.

Road and bridge work commonly require the temporary relocation of utilities located with ODOT right-of-way. The elements of activities involved in utility relocation actions are similar to those described above in Section 2.2.1of this Opinion. Utility relocation requires right-of-entry permits from ODOT. These permits commonly carry terms and conditions that limit the actions of the utility company. In addition to the regular permitting process that these utility companies may need to follow, ODOT/FHWA/Corps has the ability to apply the EPS presented in Section 2.5 of this Opinion to the right-of-entry permit.

Induced development is not an anticipated result of the Bridge Program because no new bridges, travel lanes, interchanges, or off-ramps will be added; thus the capacity will not increase as a result of the proposed action. The program bridges are repair and replacement projects of existing structures. No new bridges will be built and no new travel lanes will be added to the existing bridges. Some bridges will be expanded for projected growth; however, these additional lanes will not be striped for expansion at this time. Future expansion of travel lanes and additional structures will undergo a separate ESA section 7 consultation and possibly a NEPA consultation.

3.0 ENDANGERED SPECIES ACT INFORMAL CONCURRENCE

The Services concur with the FHWA/Corps' determination of "may affect, not likely to adversely affect" for the Columbian white-tailed deer, Canada lynx, Steller sea lion, brown pelican, Snake River sockeye salmon, Upper Columbia River steelhead, Upper Columbia River Chinook salmon, Snake River Fall-run Chinook salmon, vernal pool fairy shrimp, Willamette daisy, Gentner's fritillary, water howellia, large-flowered meadowfoam, Bradshaw's lomatium, Cook's lomatium, Kincaid's lupine, rough popcornflower, and Nelson's checker-mallow (Table 1-2). The Services were able to concur with "may affect, not likely to adversely affect" determinations for these species based on the following summarized information available to the Services and presented in the BA:

Columbian white-tailed deer

Initial Geographic Information System (GIS) screening for the proposed action identified one proposed bridge (ODOT Bridge #07417) to be potentially within the range of the Columbian white-tailed deer. In addition, a personal communication with Mr. Al Clark (Wildlife Biologist, Julia Butler Hanson Columbian White-Tailed Deer Refuge, January 26, 2004) indicated that there had been no known records of Columbian white-tailed deer within a few miles of the bridge site. The *Site Restoration* and *Fluvial* EPS were developed, in part, to restore native riparian vegetation and improve floodplain connectivity and wildlife passage at project sites.

The USFWS concurs with FHWA/Corps' determination of "may affect, not likely to adversely affect" based on the EPS's long-term improvement of the site for wildlife passage through greater floodplain connectivity and restoring habitat, and the insignificant chance of occurrence of Columbian white-tailed deer within a distance likely to result in harassment from construction activity. No critical habitat has been designated for the Columbian white-tailed deer, therefore none will be affected.

Canada lynx

Screening for the proposed action identified 38 bridges within the USFWS' area of concern for Canada lynx in the Blue Mountain ecoregion of northeast Oregon. This included 37 bridges outside of potential Canada lynx habitat (below 4,500-foot elevation) but within areas containing riparian corridors important for connectivity between larger blocks of National Forest Service lands. Canada lynx in the Pacific Northwest are associated with high elevation boreal forests above 4,500 feet in elevation (Lee et al. 1998). Territories are typically made up of a mosaic of age classes with a majority of younger age stands which support the lynx's primary food source, snowshoe hare (*Lepus americanus*). Territories also have a component of late seral stage forest with downed log structure for denning, thermal and hiding cover. Canada lynx have been recorded widely across Oregon with the majority of records from the northeastern portion of the state. Currently, there is debate over the existence of a breeding population of lynx in Oregon, however, the USFWS' position is that breeding lynx may occur in low numbers in northeastern Oregon and dispersing lynx from northern forests, particularly during years of low snowshoe hare abundance, are likely to occur in northeastern Oregon. Based on the likelihood of Canada lynx dispersing into or through northeastern Oregon, and possibly occurring in low numbers, corridors of habitat linking areas of suitable boreal forest habitat are important to the overall conservation of Canada lynx. Riparian areas are known to act as wildlife corridors, particularly in arid environments, thus are likely important to maintain habitat connectivity in this portion of the Canada lynx range.

The *Site Restoration* EPS was developed, in part, to replace native vegetation at bridge sites after construction is complete. The *Fluvial* EPS is, in part, intended to provide floodplain connectivity which will provide improved wildlife passage within stream corridors. In addition, the *Habitat Avoidance* EPS directs contractors to minimize habitat removal and to prioritize habitats so that younger more easily replaceable habitats are removed rather than older vegetation.

The USFWS concurs with the FHWA/Corps' determination of "may affect, not likely to adversely affect" the Canada lynx based on the likelihood that harassment to a denning lynx at the one bridge site (ODOT bridge #03596) within potential habitat is discountable due to their scarcity in Oregon, the high baseline levels of noise occurring at existing bridges, and wildlife passage and habitat connectivity will be maintained or improved at the 37 bridges not in suitable habitat over the long-term based on the EPS in the proposed action. No critical habitat has been designated for the Canada lynx, therefore none will be affected.

Steller sea lion

On December 4, 1990, the Steller sea lion was designated as threatened throughout its range under the Federal ESA (55 FR 49204). Primary threats to the Steller sea lion include disease, incidental take in fishing gear, shooting, and natural or anthropogenic changes in the abundance and species composition of its prey (58 FR 45269). The Steller sea lion population was determined to have two genetically and reproductively isolated populations. As a result, in 1997 NOAA Fisheries re-classified the Steller sea lion as two Distinct Population Segments (DPS) (62 FR 24345). The western DPS, which consists of breeding colonies located west of 144° West Longitude (line near Cape Suckling, Alaska) is listed as endangered, and the eastern DPS east of 114° West Longitude is listed as threatened.

The eastern DPS of the Steller sea lion ranges from southeast Alaska south to central California. Oregon is near the southern extent of their eastern range, where species abundance and distribution are reduced (55 FR 49204). However, numbers in the eastern DPS and specifically at rookery sites in Oregon are increasing. Between 1975 and 1990, non-pup (adults and juveniles) aerial counts at the Rogue Reef have increased 53 percent (from 802 to 1,229 non-pups), and counts at the Orford Reef rookery have increased seven percent (from 716 to 766 non-pups) (NMFS 1992).

Steller sea lions spend most of their time at sea feeding on a variety of fish species. The Steller sea lion is not known to migrate, but they disperse widely outside the breeding season (NMFS 1992). Primary terrestrial habitats include remote islands, rocks, reefs, and beaches, often in areas exposed to wind and waves, where access by terrestrial predators is limited (NMFS 1992). Females appear to select birthing areas (known as rookeries) that are gently sloping and protected from waves; they will frequently return to the same pupping site in successive years. In Oregon, pupping generally occurs from late April to early July[56]. Pups normally stay on land for about two weeks (NOAA Fisheries 1992), then spend an increasing amount of time in waters adjacent to rookeries, as will post-parturient females whose foraging range (usually in shallow waters within 20 nautical miles of the rookery) is restricted by the need to return to the rookery to nurse pups (58 FR 45269).

In addition to rookeries, haulouts are essential habitat for Steller sea lions. In Oregon, Steller sea lions may be found hauled out at Astoria East Mooring Basin and at the end of the South Jetty of the Columbia River, and also at Tillamook Rock, Three Arch Rocks, Cascade Head, Seal Rock, Sea Lion Caves, Cape Arago, Rogue Reef, Blacklock Point, Blanco Reef, Orford Reef, and Mack Reef[57]. These haulouts can be used any time of the year. In addition, Steller sea lions have been observed foraging up to 8 miles upriver on the Rogue River during the spring and fall Chinook salmon runs. Small numbers of Steller sea lions may be found in the lower Rogue River at any time of the year since the largest rookery in the State is located just two miles northwest of the river mouth. Steller sea lions have also been observed foraging up the Columbia River as far as Longview, Washington, primarily during fall and spring salmon migration periods and during the winter smelt run[58]. In Oregon, Steller sea lions may be found at any of the above-listed rookeries, haulout areas, or river mouths at any time of year; however, most occurrences in Oregon are during June and July, which corresponds with the Steller sea lion's reproduction period.

Critical habitat for the Steller sea lion was designated on September 27, 1993 and includes (in Oregon) an air and aquatic zone that extends 3,000 feet from any historically occupied sea lion rookery (58 FR 45269). In Oregon, the major rookeries designated as critical habitat are the Rogue Reef Pyramid Rock Site, the Orford Reef Long Brown Rock Site, and the Seal Rock Site (58 FR 45269). Not all known Steller sea lion locations in Oregon have been designated as critical habitat. The Three Arch National Wildlife Refuge in Tillamook County has a smaller, less successful rookery and is not designated, but is protected by a 500-foot buffer enforced by the Oregon Marine Board. Haulouts in Oregon are not included in critical habitat designation (58 FR 45269). For regulatory purposes, rookeries and haulout boundaries are defined as the mean lower-water mark (58 FR 45269).

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[56] November 11, 2003, telephone conversation from Robin Brown at Oregon Department of Fish and Wildlife to Kendal Emmerson at Mason Bruce and Girard Inc... Conversation discussing Oregon specific Steller sea lion information. (From BA page 5-111 through 5-113)
[57] ibid
[58] ibid

During the pre-consultation technical assistance phase of this consultation, the FHWA/Corps and the Services cooperatively developed a GIS effects screening layer overlaying known or likely Oregon Steller sea lion range with that of the proposed action. The GIS effects screening resulted in the seven bridge locations with a project API (2-mile radius) within or adjacent to the Oregon Steller sea lion range (Table 3-1).

In addition, the *Species Avoidance, Habitat Avoidance,* and *Water Quality* EPS were cooperatively developed, in part, to avoid potential adverse effects to Steller sea lions and their designated critical habitats. The FHWA/Corps has proposed to implement these EPS at these seven bridge locations in order to avoid the potential for bridge repair/replacement elements or activities to adversely affect Steller sea lions or their designated critical habitats. Project-level elements and activities including any temporary traffic detour routes or structures will be adequately designed, constructed and administered to avoid any disturbance to Steller sea lions or their designated critical habitats capable of reaching the threshold of harassment or other forms of take.

NOAA Fisheries concurs with FHWA/Corps' determination of "may affect, not likely to adversely affect" for Steller sea lions and their designated critical habitat based on the scarcity of program bridges within 2-miles of the species range and the implementation of pertinent EPS to avoid adverse effects to the species and designated critical habitat. Therefore, the proposed action has less than a negligible likelihood of causing incidental take of or causing adverse effects to Steller sea lions or their designated critical habitats.

Table 3-1. Program bridge locations with potential to affect Steller sea lions

Bridge Number[1]	Highway Type[2]	MP[3]	County[4]	Crossing[5]
09591	IS084	48.36	Columbia	Lewis and Clark Bridge
08281	OR042	0.07	Coos	US 101
01950	US101	234.76	Coos	Central Oregon Railroad (North Bend)
00922A	US101	114.88	Lincoln	Devils Lake Outlet (D River)
00925A	US101	119.27	Lincoln	Drift Creek
13491	OR018	0.04	Lincoln	US 101
00924A	US101	118.17	Lincoln	Schooner Creek

1 ODOT bridge identification number
2 Interstate Route (IS), U.S. route (US), or Oregon Route (OR)
3 Milepost where bridge is located
4 County where bridge is located
5 Description of feature that the bridge is crossing and ODOT highway designation

Brown pelican

Brown pelicans are not known to breed in Oregon even though numbers have increased dramatically in recent years during the summer. Brown pelicans found along the Oregon coast are primarily post breeding or non-breeding birds which are following abundant forage species north. There are no known colonial roosts on proposed bridges, and pelicans roosting on, or foraging adjacent to, project bridges would be doing so despite high levels of vehicle traffic and often, bicycle and pedestrian activity. Because detour routes are likely to be adjacent to existing bridges or along existing routes, high levels of auditory and visual disturbance will continue at these sites. Under baseline conditions, brown pelicans that might roost on a bridge are likely flushed to a new location, if they are intolerant of disturbance, within a relatively short time due to high activity levels.

The USFWS concurs with the FHWA/Corps' determination of "may affect, not likely to adversely affect" for the brown pelican because it is unlikely that the activities under the proposed action will significantly disrupt normal behavior patterns including breeding, feeding or sheltering. No critical habitat has been designated for the brown pelican, therefore none will be affected.

Marbled murrelet and northern spotted owl designated critical habitat

In the BA, the FHWA/Corps also made a determination of "may affect, not likely to adversely affect" designated critical habitat for the marbled murrelet (61 FR 26256) and northern spotted owl (57 FR 1796).

Within Oregon, 1,515,300 acres were designated as critical habitat for murrelets (61 FR 26256). The vast majority (88%) is on Federal lands managed by the National Forest Service and Bureau of Land Management with the remaining 12 percent primarily on State lands. Primary constituent elements of murrelet habitat include: (1) individual trees with potential nesting platforms, and (2) forested areas within 0.5 miles of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height.

Approximately 3,257,000 acres were designated as northern spotted owl critical habitat within Oregon (61 FR 26256). All of this is on Federal lands managed by the National Forest Service and Bureau of Land Management. The USFWS did not define the primary constituent elements as precisely as that for marbled murrelet but stated that they consisted of four components: (1) nesting, (2) roosting, (3) foraging, and (4) dispersal habitat. Of primary importance to nesting, roosting and foraging is old growth/mature forest stand structure. The USFWS treats actions such as the removal of mature trees, diverse canopy layers, and large woody debris to constitute actions that may adversely affect the constituent elements of critical habitat.

The *Habitat Avoidance* EPS in the BA states that FHWA/Corps will not permanently degrade the constituent elements of designated critical habitat for the murrelet and the owl. This was based on initial GIS screening indicating that relatively few of the bridges are within designated critical habitat units, the likelihood of suitable nesting, roosting habitat (i.e. mature large trees) being near the bridges being low and the position that with so few bridges having a potential to adversely affect designated critical habitat, they could find ways to avoid it or address it through an individual consultation, thus providing contractors with an additional incentive to avoid suitable mature forest habitat.

Therefore, based on the proposed action, as specifically identified in the *Designated Critical Habitat* subsection of the *Habitat Avoidance* EPS, the Service concurs with the determination that the Bridge Program "may affect, is not likely to adversely affect" designated critical habitat for the marbled murrelet or northern spotted owl. Potential effects to marbled murrelet or northern spotted owl designated critical habitat will not be discussed further in this Opinion.

<u>Anadromous Salmonids</u>

As a functional group, the anadromous fish species addressed in this Opinion include Chinook, coho, sockeye, and chum salmon, as well as steelhead and coastal cutthroat trout. These species have similar life histories and habitat requirements, and all depend on the same basic habitat elements necessary to carry out the various life history stages (spawning, rearing, and migration). Anadromous species are unique in that they migrate to sea to feed and mature after an early freshwater cycle. Upon maturation, they generally return to natal streams to spawn. It is during the early freshwater phase (including incubation and rearing) and the spawning phase that they are most dependent on habitat features that are subject to degradation by human activities. Anadromous salmonid habitat features include substrate composition; water quality; water quantity, depth, and velocity; water temperature; channel gradient and stability; food availability; cover and habitat complexity; habitat area, access, and passage; and floodplain and habitat connectivity (Roni et al. 1999). Degradation of any of these elements will reduce the viability of anadromous fish populations and species.

During the pre-consultation technical assistance phase of this consultation, the FHWA/Corps and the Services cooperatively developed GIS effects screening layers overlaying known SR sockeye, UCR steelhead, UCR Chinook salmon, and SR Fall-run Chinook salmon range with that of the proposed action. The GIS effects screening resulted in the 43 bridge locations with a project API (2-mile radius) within or adjacent to the Columbia River migration corridor.

SR sockeye salmon. No OTIA III Statewide Bridge Delivery Program bridges are within the SR sockeye salmon ESU boundary. SR sockeye salmon use the Columbia River primarily as a migration corridor to reach their natal waters in eastern Idaho. Therefore, SR sockeye salmon may be present near Columbia or Snake River tributary program bridges. There are 43 bridges located on Columbia or Snake River tributaries within two miles of the Columbia or Snake Rivers, and their repair or replacement could affect migrating Snake River sockeye salmon (Table 3-2). Of these, six bridges occur in the Coast Range ecoregion, 10 occur in the Willamette Valley ecoregion, 13 occur in the West Cascades ecoregion, eight occur in the East Cascades ecoregion, and six occur in the Columbia Basin ecoregion.

Bridges where repair and replacement activities may affect migrating SR sockeye salmon occur in 14 5th Field HUCs. The greatest concentration of these bridges occurs in the Middle Columbia/Eagle Creek watershed, which accounts for 15 percent the total API outside the ESU and along the migratory corridor.

Table 3-2. Program bridge locations with potential to affect SR sockeye salmon, UCR steelhead, UCR Chinook salmon, and SR Fall-run Chinook salmon

Bridge Number[1]	Highway Type[2]	MP[3]	County[4]	Crossing[5]
07417	US030	82.52	Clatsop	Big Creek
00921	ÚS030	77.25	Clatsop	Gnat Creek
07519	IS084	61.21	Columbia	Clatskanie River
07715	IS084	60.82	Columbia	Swedetown County Road
09591	IS084	48.36	Columbia	Lewis and Clark Bridge (Columbia River)
07722	IS084	55.29	Columbia	Lost Creek
00338A	IS084	36.47	Columbia	Tide Creek
07403A	IS084	46.10	Hood River	Herman Creek
08605	IS084	45.05	Hood River	Historic Highway 30
07496A	IS084	63.02	Hood River	Jaymar Rd (Westcliff Dr)
08610	IS084	43.93	Hood River	Moody St (Cascade Locks)
08662	IS084	63.41	Hood River	OWR & NRR
07458	IS084	63.98	Hood River	Frontage Rd (2nd St) and OWR & NRR (UPRR)
08604	IS084	50.99	Hood River	Connector (Wyeth Interchange)
07398	IS084	64.44	Hood River	Connector 2
08534	IS084	56.04	Hood River	Connector Viento Interchange
08623	IS084	47.31	Hood River	Herman Creek Connector
08605W	IS084	45.05	Hood River	Connector to Historic Highway 30
08610W	IS084	43.93	Hood River	Moody St (Cascade Locks)
08931E	IS084	167.95	Morrow	Irrigon Junction Interchange Connector
07333	IS005	308.38	Multnomah	Columbia River and North Hayden Island Drive
04516A	IS005	307.70	Multnomah	Jantzen Pedestrian Tunnel
06945	IS084	17.82	Multnomah	Connector #2 to (Jordan Rd)
02176A	IS084	35.12	Multnomah	Historic Highway 30 & Union Pacific Railroad
08588B	IS084	0.52	Multnomah	Connector to I-5 (Banfield Interchange)
06945A	IS084	17.82	Multnomah	Connector #2 (Jordan Rd)
02194B	IS084	38.98	Multnomah	Moffet Creek
02194A	IS084	38.98	Multnomah	Moffet Creek
13514E	IS084	7.65	Multnomah	North East 102nd Avenue and Highway 64 Connectors
02163A	IS084	6.73	Multnomah	North East 102nd Ave Overpass
06875	IS084	17.68	Multnomah	Sandy River
06875A	IS084	17.68	Multnomah	Sandy River
02062B	IS084	40.14	Multnomah	Tanner Creek
02062A	IS084	40.14	Multnomah	Tanner Creek
08893	US097	2.37	Sherman	Spanish Hollow Creek
08894	US097	2.48	Sherman	Spanish Hollow Creek
00308A	IS084	88.04	Wasco	Fifteen Mile Creek
08276	IS084	82.62	Wasco	Hostetler Way Connector
07771	IS084	88.83	Wasco	The Dalles Dam Access Connector
07397	IS084	69.85	Wasco	Mosier Connector over Union Pacific Railroad
07393	IS084	70.10	Wasco	Mosier Creek
07626A	IS084	69.65	Wasco	Mosier Connector Overpass

07392	IS084	69.62	Wasco	Rock Creek

1 ODOT bridge identification number
2 Interstate Route (IS), U.S. route (US), or Oregon Route (OR)
3 Milepost where bridge is located
4 County where bridge is located
5 Description of feature that the bridge is crossing and ODOT highway designation

UCR steelhead. No OTIA III Statewide Bridge Deliver Program bridges are within the UCR steelhead ESU boundary. UCR steelhead use Oregon waters (the Columbia River) primarily as a migration corridor to reach their natal waters in eastern Washington. Therefore, steelhead of the UCR ESU may be present near Columbia or Snake River tributary program bridges. There are 43 bridges located on Columbia River tributaries within two miles of the Columbia River and their replacement could affect migrating UCR steelhead (Table 3-2). Of these, six bridges occur in the Coast Range ecoregion, 10 occur in the Willamette Valley ecoregion, 13 occur in the West Cascades ecoregion, eight occur in the East Cascades ecoregion, and six occur in the Columbia Basin ecoregion.

Bridges where repair and replacement activities may affect migrating UCR Steelhead occur in 14 5th Field HUCs. The greatest concentration of these bridges occurs in the Middle Columbia/Eagle Creek watershed, which accounts for 15 percent of the total API outside the ESU and along the migratory corridor.

UCR Chinook salmon. No OTIA III Statewide Bridge Delivery Program bridges are located within the UCR Chinook salmon ESU boundary. UCR Chinook salmon use Oregon waters (the Columbia River) primarily as a migration corridor to reach their natal waters in eastern Washington. There are 43 bridges located on Columbia River tributaries within two miles of the Columbia River, and their replacement could affect UCR Chinook salmon (Table 3-2). Of these, six bridges occur in the Coast Range ecoregion, 10 occur in the Willamette Valley ecoregion, 13 occur in the West Cascades ecoregion, eight occur in the East Cascades ecoregion, and six occur in the Columbia Basin ecoregion.

Bridges where repair and replacement activities may affect the UCR Chinook Salmon ESU occur in 14 5th Field HUCs. The greatest concentration of these bridges occur in the Columbia Slough/Willamette River, Columbia Gorge Tributaries, Middle Columbia/Eagle Creek, Mosier Creek, Lower Sandy River, and Middle Columbia/Grays Creek watersheds; these account for 80 percent the total API outside the ESU and along the migratory corridor.

SR Fall-run Chinook salmon. No OTIA III Statewide Bridge Delivery Program bridges occur within the SR Fall-run Chinook salmon ESU boundary were SR Fall. Specifically, there are no bridges located within the ESU and no bridges are within 2 miles of the ESU boundary (and drain to the ESU). However, SR Fall-run Chinook salmon use the Columbia River as a migratory corridor to reach their natal waters in northeast Oregon, Washington, and Idaho. Migrating SR Fall-run Chinook salmon could be affected by the repair or replacement of 43 Columbia River tributary bridges occurring within two miles of the Columbia River (Table 3-2). Of the bridges where the proposed action may affect migrating SR Fall-run ESU Chinook salmon, six occur in the Coast Range ecoregion, 10 occur in the Willamette Valley ecoregion, 13 occur in the West Cascades ecoregion, eight occur in the East Cascades ecoregion, and six occur in the Columbia Basin ecoregion.

Of the bridges located along the migration corridor of the SR Fall-run Chinook salmon, the greatest concentration of bridges occurs in the Columbia Slough/Willamette River, Columbia Gorge Tributaries, Middle Columbia/Eagle Creek, Mosier Creek, Lower Sandy River, and Middle Columbia/Grays Creek watersheds; these account for 79 percent of the total API outside the ESU and along the migratory corridor.

In addition to the GIS effects screening for potential to affect SR sockeye salmon, UCR steelhead, UCR Chinook salmon, and SR Fall-run Chinook salmon discussed above (relative to bridge repair/replacement project locations), the *Program Administration, Species Avoidance, Habitat Avoidance, Water Quality, Site Restoration, Compensatory Mitigation,* and *Fluvial* EPS (Section 2.5) were cooperatively developed, in part, to avoid potential adverse effects to anadromous salmonids and their designated critical habitats. The FHWA/Corps has proposed to implement these EPS at these 43 bridge locations in order to avoid the potential for bridge repair/replacement elements or activities to adversely affect SR sockeye salmon, UCR steelhead, UCR Chinook salmon, SR Fall-run Chinook salmon, or their designated critical habitats. Project-level elements and activities including any temporary traffic detour routes or structures will be adequately designed, constructed and administered to avoid any disturbance to these four ESUs of listed salmonids or their designated critical habitats capable of reaching the threshold of harassment or other forms of take.

NOAA Fisheries concurs with FHWA/Corps' determination of "may affect, not likely to adversely affect" for SR sockeye salmon, UCR steelhead, UCR Chinook salmon, SR Fall-run Chinook salmon, or their designated critical habitat based on the lack of program bridges in, or within 2-miles of, the ESU boundaries, the discountable likelihood of take from a program bridge adjacent to the Columbia River migratory corridor, and the implementation of pertinent EPS at those bridges to avoid adverse effects to the species and designated critical habitat. Therefore, the proposed action has less than a negligible likelihood of causing incidental take of, or causing adverse effects to, SR sockeye salmon, UCR steelhead, UCR Chinook salmon, SR Fall-run Chinook salmon or their designated critical habitats.

<u>Vernal pool fairy shrimp and the nine plant species</u>

The USFWS worked with FHWA/Corps representatives on a *Species Avoidance* EPS with sections that address listed plants and vernal pool fairy shrimp. Following these EPS, a bridge site is first evaluated for the potential occurrence of a species based on the presence of suitable habitat or soil types which are known to support listed plants. All bridge locations were screened using known habitat or soil types and using the USFWS' XID plant database to determine whether a listed plant or vernal pool habitat was possible at a bridge site. If suitable habitat or soil types are indicated to be present, the EPS requires surveys be conducted during the appropriate time of year to locate the vernal pools, habitat, or plants. If individual plants or vernal pool habitat are present they will be flagged to delineate the site and will be avoided during pre-construction and construction activity. Pre-construction and construction activities will be monitored to ensure personnel do not alter the hydrology of the site. If vernal pool habitat or plants can not be avoided, FHWA/Corps will conduct an individual site specific formal consultation for that particular bridge.

Based on the Plant and Vernal Pool fairy Shrimp Avoidance EPS in the proposed action, the USFWS concurs with the FHWA/Corps determination that the OTIA III Statewide Bridge Delivery Program "may affect, is not likely to adversely affect" the vernal pool fairy shrimp, Willamette daisy, Gentner's fritillary, water howellia, large-flowered meadowfoam, Bradshaw's lomatium, Cook's lomatium, Kincaid's lupine, rough popcornflower, and Nelson's checker-mallow. All bridges were outside of habitat designated as vernal pool fairy shrimp critical habitat, therefore no critical habitat will be affected. In addition, critical habitat has not been designated for the plants listed above; therefore no critical habitat will be affected.

4.0 ENDANGERED SPECIES ACT FORMAL CONSULTATION

4.1 Biological Opinion

4.1.1 Biological Information and Critical Habitat (Status of the Species)

Marbled Murrelet (*Brachramphus marmoratus*)

Background. An account of the taxonomy, ecology, and reproductive characteristics of the murrelet is found in the 1988 Status Review (Marshall 1988), the final rule designating the species as threatened (57 FR 45328), the final rule designating critical habitat for the species (61 FR 26256), the Service's Biological Opinion for Alternative 9 (USFWS 1994a) of the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Spotted Owl (USDA and USDI 1994a), the Ecology and Conservation of the Marbled Murrelet (Ralph et al. 1995), and the Recovery Plan for the Threatened Marbled Murrelet (USFWS 1997) and are incorporated by reference.

Habitat Relationships

Nest Tree Characteristics. Lank *et al.* 2003 states that marbled murrelets "occur during the breeding season in near-shore waters along the north Pacific coastline from Bristol Bay in Alaska to central California," using single platform trees generally within 20 miles and older forest stands generally within 50 miles of the coast for nesting. Unlike most auks, marbled murrelets nest solitarily on mossy platforms of large branches in old-forest trees (Lank *et al.* 2003). Suitable habitat for murrelets may include contiguous forested areas with conditions that contain potential nesting structure. These forests are generally characterized by large trees greater than 18 inches dbh, multistoried canopies with moderate closure, sufficient limb size and substrate (moss, duff, etc.) to support nest cups, flight accessibility, and protective cover from ambient conditions and potential avian predators (Manley 1999, Burger 2002 and Nelson and Wilson 2002). Over 95 percent of measured nest limbs were ≥15 cm diameter, with limb diameter ranges from 7-74 cm diameter (Burger 2002).

Nelson and Wilson (2002) found that all 37 nest cups identified were in trees containing at least seven platforms. All trees were climbed, however, and ground-based estimates of platforms per tree in the study were not analyzed. Lank *et al.* (2003) emphasizes that marbled murrelets do not select tree species for nesting, but select individual trees containing suitable nest platforms. Nest cups have been found in deciduous trees, albeit rarely. Nest trees may be scattered or clumped throughout a forest stand.

Adjacent forest can contribute to the conservation of the murrelet by reducing potential for wind throw during storms by providing area buffers and creating a landscape with a higher probability of occupancy by murrelets (Burger 2001, Meyer *et al.* 2002, Raphael *et al.* 2002, and Zharikov *et al.* submitted). Trees surrounding and within the vicinity of the potential nest tree(s) may provide protection to the nest platform and potentially reduce gradations in microclimate (Chen *et al.* 1993).

Nest Stand Characteristics. Nest stands are typically composed of low elevation conifer species. In California, nest sites have been located in stands containing old-growth redwood and Douglas-fir, while nests in Oregon and Washington have been located in stands dominated by Douglas-fir, western hemlock, and Sitka spruce. Murrelets appear to select forest stands greater than 50 ha (Burger 2002), but are found nesting in stands as small as one acre (Nelson and Wilson 2002). In surveys of mature or younger second-growth forests in California, murrelets were only found in these forests when there was nearby old-growth stands or where residual older trees remained (USFWS 1992, and Singer *et al.* 1995).

At the stand level, vertical complexity was correlated with nest sites (Meekins and Hamer 1998, Manley 1999, Waterhouse *et al.* 2002, and Nelson and Wilson 2002), and flight accessibility has been postulated as a necessary component for suitable habitat (Burger 2002). Some studies have shown higher murrelet activity near stands of old-forest blocks over fragmented or unsuitable forest areas (Paton *et al.* 1992, Rodway *et al.* 1993, Burger 1995, Deschesne and Smith 1997, and Rodway and Regehr 2002), but this correlation may be confounded by ocean conditions, distance inland, elevation, survey bias and disproportionate available habitat. Nelson and Wilson (2002) found that potential nest platforms per acre was a strong correlate for nest stand selection by marbled murrelets in Oregon.

Landscape Characteristics. Zharikov *et al.* (submitted) documents that murrelet nests were more often found within 98-feet of stand edges (hard and soft), closer to streams and farther from glaciers than would be expected if nests were placed randomly across the landscape. Murrelets preferred lower elevation habitat (below 1,969-2,297-foot elevation) than was available in the study areas (Huettmann *et al.* manuscript, and Zharikov *et al.* submitted). Lank *et al.* (2003) states, “Huettmann *et al.* (manuscript) found no relationship between breeding success and large-scale landscape features…". "In contrast, for Desolation Sound, Zharikov *et al.* (submitted) reported that, compared to failed nests, nests successful to the mid-chick stage were initiated earlier in the season, were located closer to the edge of an area of subalpine vegetation, in a location with higher hard-edge clear-cut density, and at a higher elevation." It is hypothesized that murrelets selected edges for flight access, that higher nest success was from lower corvid densities at higher elevations (away from supplemental feeding by human development and agriculture), that subalpine sites were on north-facing aspects which contain better moss production on limbs, and that earlier nesting murrelets were older and more seasoned breeders able to take advantage of these factors from learned experience, rather than some genetic-induced fixed action pattern.

Although large blocks of nesting habitat may attract increased murrelet activity due to the inherent increase in carrying capacity of nest platforms, fragmentation and patch size per se are very poor covariates when attempting to correlate habitat quality with landscape characteristics. Based on a sample of 16 nests, Nelson and Hamer (1995) found that nesting success of murrelets was lower if within 164-feet of a stand edge. Huettmann *et al.* (manuscript) found a bimodal distribution where murrelets preferentially selected for landscape patches that were <10 ha and >200 ha in size with no differences in nest success. Also, Zharikov *et al.* (submitted) found higher nest success closer (<30 m) to edges. Combined, all Canadian nest sample sizes were n = 200. Artificial nest depredation rates were found to be highest in western conifer forests where stand edges were close to human development (De Santo and Willson 2001 and Luginbuhl *et al.* 2001), and Bradley (2002) found increased corvid densities within 3 miles of urban interface due to supplemental feeding opportunities from anthropogenic activities. Artificially high corvid densities from adjacent urbanization and park campgrounds appear to be a direct cause of the high nesting failure rates for murrelets in the redwoods parks.

These relationships measured with murrelets are consistent with studies of nest success of hundreds of other passerines. If the surrounding landscape has been permanently modified to change the predators' densities or carrying capacities (i.e. agriculture, urbanization or recreation), and the predators affected impact the species under study, the reproductive success of the prey species being studied is reduced. Because corvids account for the majority of depredations on murrelet nests and corvid density increases with human development, landscape effects of potential corvid predation on murrelet habitat is a primary impact consideration.

Threats. The Marbled Murrelet Recovery Plan (USFWS 1997) identified the primary threats to the species: (1) predation; (2) loss of nesting habitat; (3) by-catch in gill-nets, and; (4) oil pollution both chronic and from major spills. Predation and the amount and distribution of nest habitat are considered to be the most important determinants for species recovery.

Population Dynamics. The present population estimate for the murrelet in Oregon is 9,500 (± 3,000) and approximately 23,000 (± 9,000) within the conterminous United

States (Strong 2003). Spiech and Wahl (1995) concluded that murrelet populations in Puget Sound are lower now than they were at the beginning of this century, and total estimates for Washington are still about 5,500 murrelets (Strong 2003). Ralph and Miller (1995) estimated the California population to be approximately 6,500 birds, and this estimate remains within the statistical confidence interval (Strong 2003).

Beissinger (1995) constructed a demographic model of the murrelet and concluded that the population may be declining at rates of 4-6 percent per year, but this estimate is hampered by the possibility that the age-ratio data used in the model are reflective of a relatively temporary decline due to unusual ocean conditions (Ralph et al. 1995). Boulanger et al. (1996) found that change in adult survivorship is the single most important factor when projecting demographic trends for murrelets. Similarly, Strong and Carten (2000) suggest that there may have been a 50 percent decline from 1992 to 1996 in the Oregon population, but appears to have stabilized since (Strong 2003). Ralph et al. (1995) summarized some of the reasons for variability in population estimates among researchers, including differences in methodology, assumptions, spatial coverage, and survey and model errors. Lank *et al.* (2003) states, "Regardless of the approaches taken to estimate [(sic) vital rate] parameter values, the output from the Leslie matrix models representing survivorship and fecundity values for all populations in Washington, Oregon and California (Beissinger and Nur 1997) suggest negative population growth rates." Present at-sea surveys for effectiveness monitoring have a 95 percent chance of detecting annual population changes of ±20 percent or greater.

Available Nesting Habitat. The precise number of acres of suitable habitat in WA, OR and CA is unknown. However, suitable habitat for the murrelet on Federal lands is estimated at 2,492,000 acres of which 153,000 acres (6%) is classified as remnant habitat within the listed range of this species (USFWS 2003a). Occupied murrelet habitat is protected on Federal land under the Northwest Forest Plan (NWFP) in several ways. All occupied murrelet stands automatically become Late-Successional Reserve (LSR), regardless of the original designated land allocation. In addition, all "contiguous existing and recruitment habitat for marbled murrelets...within a 0.5-mile radius" becomes LSR (USDA and USDI 1994ab; C-10). Timber harvest within LSRs is designed to benefit the development of late-successional conditions, which should improve future conditions of murrelet nesting habitat. Designated LSRs not only protect habitat currently suitable to murrelets (whether occupied or not), but will also develop future suitable habitat in large blocks.

<u>Bald eagle (*Haliaeetus leucocephalus*)</u>

Background. A detailed account of the taxonomy, ecology, and reproductive characteristics of the bald eagle is found in the Pacific States Bald Eagle Recovery Plan (USFWS 1986), the final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states (60 FR 36000), the proposed rule to remove the bald eagle from the Endangered Species List in the lower 48 states (64 FR 36454), and Stalmaster (1987).

Habitat Relationships

Nesting Tree Characteristics. In the Pacific Northwest, bald eagles typically nest in multi-layered, uneven-aged, coniferous stands with old-growth trees that are located within one mile of large bodies of water (Anthony et al. 1982). Suitable habitat for bald eagles is characterized by the presence of large, mature trees, generally greater than 32 inches dbh. Live, mature trees with deformed tops or large limbs and an open structure are required for eagle access and nest support. Tree species is variable; however, on the Deschutes National Forest, ponderosa pine and Douglas-fir trees with large open limb structures are preferred for nesting. Factors such as tree height, diameter, tree species, position on the landscape, distance from water, availability of prey and distance from disturbance also appear to influence nest selection. Nest trees usually provide an unobstructed view of the associated water body. Availability of suitable trees for nesting and perching is critical for maintaining bald eagle populations. Bald eagles often construct several nests within a territory and alternate between them from year to year. Snags, trees with exposed lateral branches, or trees with dead tops are often present in nesting territories and are used for perching or as points of access to and from the nest. Such trees also provide vantage points from which territories can be defended.

Roosting Habitat. Communal roosts (night roosts occupied by three or more bald eagles) tend to be located near a rich food resource (i.e. runs of anadromous fish, high concentrations of waterfowl) and in forest stands that are uneven-aged and have at least a remnant of the old-growth forest component (USFWS 1986). Roosts tend to have more favorable microclimates and protection from inclement weather than surrounding areas and thereby facilitate energy conservation. Isolation is also an important feature of bald eagle wintering habitat (USFWS 1986).

Bald eagles are territorial when breeding but gregarious when not (Stalmaster 1987). In Oregon, the bald eagle breeding season extends from January 1 through August 31 (Isaacs and Anthony 1983). Courtship may begin as early as January. Nest building and repair occurs any time of year, but is most often observed February to June (Isaacs and Anthony unpubl. data). Egg laying takes place mid-February to late April with incubation lasting approximately 35 days. Hatching may occur from late March to late May. Chicks are not able to thermoregulate for at least two weeks after hatching (Stahlmaster 1987). Fledging occurs in late June to mid-August. Fledging typically occurs 11 to 13 weeks after eggs are laid.

The roosting period of the northern bald eagle typically extends from November 15 to March 15. However, depending upon weather conditions, the roosting period in Oregon may extend from October 31 to April 30.

Threats. Bald eagle numbers have been influenced by several well documented threats. The primary threat leading to the listing of the bald eagle was chemical contamination due to persistent pesticides which resulted in thin eggshells and nest failure. Despite the banning of DDT in 1972, its break down products such as DDE still persist in areas. Other threats include shooting, poisoning, electrocution, vehicle collisions, and habitat loss (USFWS 1986).

Trends. The bald eagle was listed on February 14, 1978, as a threatened species in Oregon and Washington under the Act. A Recovery Plan for the bald eagle in the Pacific states was issued in 1986 in accordance with section 4(f)(1) of the ESA. The Pacific States Bald Eagle Recovery Plan established recovery population goals, habitat management goals, and management zones (e.g. Recovery Zones) for a seven-state Pacific Recovery Region (Recovery Region). It outlined the following criteria for delisting the bald eagle in the Recovery Region (USFWS 1986):

- There should be a minimum of 800 pairs nesting in the Recovery Region.
- These pairs should be producing an annual average of at least 1.0 fledged young per pair, with an average success rate per occupied territory of not less than 65 percent over a five-year period.
- To ensure an acceptable distribution of nesting pairs, population recovery goals must be met in at least 80 of the management zones (e.g., 38 out of 47 Recovery Zones) identified in the Recovery Plan.
- Wintering populations should be stable or increasing.

Currently available information indicates increasing bald eagle populations range-wide. In the Pacific States Recovery Region, the number of occupied territories has consistently increased since 1986 to 1482 pairs in 1998, thereby exceeding the 800 pair goal for 5 years beginning in 1990 when 861 territories were reported. The species' status recovered sufficiently to warrant reclassification to threatened throughout the lower 48 states on July 12, 1995 (60 FR 36000). However, this action did not change the status of the species for Oregon and Washington. Distribution goals and nesting targets in several Recovery Zones have not been met. Productivity objectives have been met and have averaged about 1.03 young per occupied territory since 1990. Currently, a proposal to delist the species in the lower 48 states has been under consideration by the Service since July 6, 1999 (64 FR 36454)

In Oregon, 444 breeding territories were occupied in 2003. Productivity in 2003 resulted in a 5-year average of 1.03 young per occupied territory. Several Recovery Zones have productivity averages below 1.00 young per occupied territory indicating localized regions of poorer reproduction still persist within Oregon. Nesting success resulted in a 5-year average of 64 percent (Isaacs and Anthony 2003)

Conservation Needs. The listed status of the bald eagle is a result of past and present destruction of habitat, harassment, disturbance, shooting, electrocution, poisoning, a declining food base, and environmental contaminants. Currently, the primary threats to bald eagles are habitat degradation and, in some areas, environmental contaminants.

It is well established that many human activities negatively affect raptors, such as bald eagles. Studies show that noises associated with human activities can affect bird behavior in a number of ways, including nest abandonment, increased nest predation, or avoidance of otherwise suitable habitat. Bald eagles may be particularly sensitive to disturbances close to active nest sites during the January 1 through August 31 breeding period. Disturbances during the early courtship, nest building and incubation phases of their breeding cycle can be particularly critical due to the higher risk for nest abandonment and loss of eggs or chicks. Disturbance at active bald eagle nest sites may be avoided with the use of seasonal restrictions or increased buffer distances. In Oregon, disturbances at communal roost sites should also be avoided during the period of eagle use, or between October 31 and April 30 if the period of winter use is unknown.

The Recovery Plan/Team and Bald Eagle Working Team for Oregon and Washington (BEWTOW) recommend site-specific planning for managing bald eagle habitat (USFWS 1986; BEWTOW 1990). Site planning requires that each eagle nesting or roosting site be studied and managed according to the unique set of circumstances (e.g., landform land use, landowner, eagle use) at that site. Most site plans assist the recovery process by maintaining habitat conditions to

Table 4-1. Bald eagle recovery population goals and habitat management goals from the Pacific Bald Eagle Recovery Plan (USFWS 1986; Isaacs and Anthony 2003)

Recovery Zone	Zone Name	Habitat Management Goal	Recovery Population Goal	2003 Recovery Population
9	Blue Mountains	12	7	8
10	Columbia River (Oregon only)	29	19	54
10	Columbia River (Oregon and Washington)	47	31	96
11	High Cascades	47	33	61
12	Willamette Basin	35	21	59
13	Oregon Coast	68	45	80
14	Snake River Canyon	5	2	1
21	Harney Basin/Warner Mountains	2	1	2
22	Klamath Basin	89	66	128
23	California/Oregon Coast	15	8	22
37	Great Basin	7	4	Not Available
	Oregon Total (Oregon only)	309	206	416
	Oregon and Columbia River Total	327	218	458

Recovery Population Goals and Habitat Management Goals may be found in Isaacs and Anthony 's Bald Eagle Productivity Surveys conducted in 1999 and prior years. Recovery Population Goals and Habitat Management Goals are not available in Productivity Survey reports produced subsequent to 1999, so they are noted here for your convenience. The last column notes the current population figures taken from the latest Isaacs and Anthony, Bald Eagle Productivity Survey.

support nesting, roosting, and foraging, and implementing conservation measures designed to alleviate ongoing threats and to avoid conflicts with identified use activities which are identified to occur within the foreseeable future. Some site plans assist recovery by also incorporating habitat enhancement or habitat management measures to maintain or increase bald eagle use and the long-term availability and viability of suitable nest and roosting habitat.

Northern Spotted owl (*Strix occidentalis caurina*)

Background. Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the spotted owl are found in the 1987 and 1990 USFWS Status Reviews (USFWS 1987, USFWS 1990a), the 1989 Status Review Supplement (USFWS 1989), the Interagency Scientific Committee (ISC) Report (Thomas et al. 1990), the Forest Ecosystem Management Assessment Team (FEMAT) Report (Thomas and Raphael 1993), and the final rule designating the spotted owl as a threatened species (55 FR 26114) and final rule designating critical habitat (57 FR 1796). The spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union is typically associated with old-growth forested habitats throughout the Pacific Northwest. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutierrez 1990), morphological (Gutierrez et al. 1995) and biogeographic information (Barrowclough and Gutierrez 1990).

Current and Historical Range. The current range and distribution of the spotted owls extends from southern British Columbia through western Washington, Oregon, and California, as far south as Marin County (USFWS 1990a). The southeastern boundary of its range is the Pit River area of Shasta County, California. The range of the spotted owl is partitioned into 12 physiographic provinces (provinces), based upon recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993). These provinces are distributed across the range as follows: 4 provinces in Washington (Washington Cascades East, Olympic Peninsula, Washington Cascades West, Western Lowlands), 5 provinces in Oregon (Oregon Coast Range, Willamette Valley, Oregon Cascades West, Oregon Cascades East, Klamath Mountains), and 3 provinces in California (California Coast, California Klamath, California Cascades). Although the current range of the spotted owl is similar to its historical range where forested habitat still exists (the distribution is relatively contiguous, but influenced by the natural insularity of habitat patches within geographic province, and by natural and man-caused fragmentation of vegetation), the owl is extirpated or uncommon in certain areas (e.g., southwestern Washington).

Habitat Relationships

Home Range. Spotted owl home range size varies by province. Home range generally increases from south to north, which is likely in response to decreasing habitat quality (USFWS 1990a). Home range size was linked to type, availability, and abundance of prey (Zabel et al. 1995).

Based on available radio-telemetry data (Thomas et al. 1990), the Service estimated median annual home range size for the spotted owl by province throughout the range of the owl. Because the actual configuration of the home range is rarely known, the estimated home range of an owl pair is represented by a circle centered upon an owl activity center, with an area approximating the provincial median annual home range. For example, estimated home range area varies from 3,340 acres (i.e., 1.3-mile radius area) in California to 9,731 acres (i.e., 2.2-mile radius circle) in Washington. The Service uses a 0.7 mile radius circle (i.e., 984 acres) to delineate the area most heavily used (i.e., core area) by spotted owls during the nesting season. Spotted owls in northern California focused their activities in core areas that ranged from about 167 to 454 acres, with a mean of about 409 acres; approximately half the area of the 0.7-mile radius circle (Bingham and Noon 1997). Spotted owls maintain smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984).

Although differences exist in natural stand characteristics that influence provincial home range size, habitat loss and forest fragmentation caused by timber harvest effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, Bart 1995).

Habitat Use. Forsman et al. (1984) report that spotted owls have been observed in the following forest types (Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*A. concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*A. magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane) and redwood (*Sequoia sempervirens*). Use by these types coincide with appropriate forest structure (see below). In parts of the Oregon Coast Range, owls have been recorded in pure hardwood stands. In California spotted owls are found from near sea level in coastal forests to approximately 2130 m in the Cascades (Gutierrez et al.1995). The upper elevational limits at which spotted owls occur decrease gradually with increasing latitude in Oregon and Washington. In all areas, the upper elevation limit at which owls occur correspond to the transition to subalpine forest, which is characterized by relatively simple structure and sever winter weather (Gutierrez et al.1995).

Roost sites selected by spotted owls have more complex vegetation structure than forest generally available to them (Barrows and Barrows 1978, Forsman et al. 1984, Solis and Gutierrez 1990). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, Hershey1995). Even in forests that have been previously logged, owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, Buchanan et al. 1995, Hershey. 1995).

Foraging habitat is the most variable of all habitats used by territorial owls (Thomas et al. 1990). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutierrez 1990) to owls that will forage in forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutierrez 1996).

Habitat Selection. Spotted owls generally rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics of older forests include the following: a multi-layered, multi-species canopy dominated by large overstory trees; moderate to high canopy closure; a high incidence of trees with large cavities and other types of deformities; numerous large snags; an abundance of large, dead wood on the ground; and open space within and below the upper canopy for owls to fly (Thomas et al. 1990, USFWS 1990a). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001), as well as protection from predation. Recent landscape-level analyses suggest that a mosaic of late-successional habitat interspersed with other vegetation types may benefit spotted owls more than large, homogeneous expanses of older forests (Franklin et al. 2000, Meyer et al. 1998). In redwood forests along the coast range of California, spotted owls may be found in younger forest stands with structural characteristics of older forests (Thomas et al. 1990). However, spotted owls do not generally appear to select for stands of intermediate or younger ages (Solis and Gutierrez 1990).

Ward (1990) found the spotted owls foraged in areas that had lower variance in prey densities (prey were more predictable in occurrence) within older forest and near ecotones of old forest and younger in brush seral stages. Presumably owls foraging in edge areas might encounter prey that ventured into the older forest. Zabel et al. (1995) showed that spotted owl home ranges are larger where flying squirrels are the predominant prey and, conversely, are smaller where woodrats are the predominant prey.

Population Dynamics. The spotted owl is a relatively long-lived bird, produces fewer and larger young, invests significantly in parental care, experiences later or delayed maturity, and exhibits high adult survivorship. The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000). In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), another closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 1999), a relationship that may be a function of increased prey availability. Across their range, spotted owls show a pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999). Annual variation in breeding may be related to weather conditions and fluctuation in prey abundance (Zabel et al. 1995).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on variation in rate of population growth, which tends to increase variation in the rate of growth (Franklin et al. 2000). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated and decline to extinction (Franklin et al. 2000).

Lambda (λ) describes the rate of population growth in spotted owl populations. A rate of 1.0 indicates a stable population, neither increasing or decreasing; a rate less than 1.0 indicates a decrease in population growth; and a rate greater than 1.0 indicates a growing population. On a range-wide basis, the rate of growth for individual spotted owl populations vary within consistent bounds around a mean value of $\lambda = 1$ (Franklin et al. 2000).

Threats. The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USFWS 1990a). More specifically, significant threats to the spotted owl included the following: low populations; declining populations; limited habitat; declining habitat; distribution of habitat or populations; isolation of provinces; predation and competition; lack of coordinated conservation measures; and vulnerability to natural disturbance (USFWS 1992b). These threats were characterized for each province as severe, moderate, low, or unknown. Declining habitat was recognized as a severe or moderate threat to the spotted owl in all 12 provinces, isolation of provinces within 11 provinces, and declining populations in 10 provinces. Consequently, these three factors represented the greatest concern range-wide to conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations a severe or moderate concern in eight provinces, suggesting that these factors are a concern throughout the majority of the range.

Vulnerability to natural disturbances was rated as low in five provinces, indicating that habitat loss due to fire, wind throw, insects, or diseases was less of a concern from a range-wide perspective. However, the occurrence of recent, relatively large fires suggests that habitat loss due to natural disturbance may pose a more significant threat than previously thought. Past fire suppression efforts and other land management actions have resulted in vast forested areas that are susceptible to large-scale, stand-replacing fires. These events could reduce and possibly eliminate owl habitat from extensive areas.

The degree to which predation and competition might pose a threat the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Since listing of the spotted owl, changing conditions and new information suggest that competition may now be a greater threat than previously anticipated. The recent range expansion of barred owls into the Pacific Northwest (Taylor and Forsman 1976, Dunbar et al. 1991, Dark et al. 1998) may compete with spotted owls through a variety of mechanisms: prey overlap (Hamer et al. 2001); habitat use (Hamer et al 1989, Dunbar et al 1991, Herter and Hicks 2000, Pearson and Livezey, in press); and/or agonistic encounters (Leskiw and Gutiérrez 1998, Kelly et al 2003). Kelly et al. (2003) found that spotted owls were displaced from their territories by barred owls.

Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls. However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forest, openings, and clearcuts (Craighead and Craighead 1956, Johnson 1992, Laidig and Dobkin 1995). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

Conservation Needs. The conservation needs of the spotted owl address three primary threats: declining populations; declining habitat; and isolation of provinces. These needs are centered on the following biological principles: 1) presence of large blocks of habitat to support clusters or local population centers of owls (e.g., 15 to 20 breeding pairs); 2) habitat conditions and spacing between local populations of owls to facilitate survival and movement; and 3) managing habitat across a variety of ecological conditions within the owl's range to reduce risk of local or widespread extirpation (USDI Fish and Wildlife Service 1992b).

Conservation Strategy. Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. These efforts began with the ISC's Conservation Strategy (Thomas et al. 1990); they continued with the designation of Critical Habitat (57 FR 1796), the Draft Recovery Plan (USFWS 1992b), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA and USDI 1994a). Each conservation strategy was based upon the reserve design principles first articulated in the ISC's report, which are summarized as follows.

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.

- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.

- Blocks of habitat that are close together are better than blocks far apart.

- Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.

- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Federal Contribution to Recovery

The NWFP is the current conservation strategy for the spotted owl on Federal lands. It is designed around the conservation needs of the owl and based upon the designation of a variety of land-use allocations whose objectives are either to provide for population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting population clusters: LSRs; Managed Late Successional Areas (MSLAs); Congressionally Reserved Areas; and Managed Pair Areas and Reserve Pair Areas. The remaining land-use allocations [Matrix, Adaptive Management Areas, Riparian Reserves, Connectivity Blocks, and Administratively Withdrawn Areas (AWAs)] provide connectivity between habitat blocks intended for demographic support.

The range-wide system of LSRs set up under the NWFP captures the variety of ecological conditions within the 12 different provinces to which spotted owls are adapted. This design reduces the potential for extinction due to large catastrophic events in a single province. Multiple, large LSRs in each province reduce the potential that spotted owls will be extirpated in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a LSR. In addition, LSRs are generally arranged and spaced so that spotted owls may disperse to two or more adjacent LSRs. This network of reserves reduces the likelihood that catastrophic events will impact habitat connectivity and population dynamics within and between provinces.

Although FEMAT scientists predicted that spotted owl populations would decline in the Matrix over time, populations were expected to stabilize and eventually increase within LSRs, as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, USDA and USDI 1994a and 1994b). The NWFP included standards and guidelines for managing all agency actions, and it provided for

Conservation Efforts on Non-Federal Lands. FEMAT noted that limited Federal ownership in some areas constrained the ability to form an extensive reserve network to meet conservation needs of the spotted owl. Thus, non-Federal lands were an important contribution to the range-wide goal of achieving conservation and recovery of the spotted owl. The Service proposed a special rule for non-Federal lands in 1995, it was never finalized. The Service's primary expectation for private lands are for their contributions to demographic support (pair or cluster protection) to and/or connectivity with NWFP lands. In addition, timber harvest within each state is governed by rules that may provide protection of spotted owls and/or their habitat to varying degrees.

The Oregon Forest Practices Act provides for protection of 70-acre core areas around known spotted owl nest sites, but it does not provide for protection of owl habitat beyond these areas (ODF 2000). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The four owl-related habitat conservation plans currently in effect address relatively few acres of land; however, they will provide some nesting habitat and connectivity over the next few decades.

Habitat Trends. The current condition of the species incorporates the effects of all past human and natural activities or events that have led to the present-day status of the species (USFWS and NMFS 1998). Baseline conditions for the owl were evaluated to some degree during formulation of the NWFP through qualitative and quantitative analyses of measures such as habitat availability, distribution, and condition. The following section reports on changes in those baseline conditions since 1994, relying particularly on information in documents the Service produced pursuant to section 7 (e.g., consultation, technical assistance) of the ESA.

Since 1994, the Service has consulted on many actions associated with implementation of the NWFP and other Federal and non-Federal activities that may affect the spotted owl or its Critical Habitat. The geographic scale of these consultations varied from individual actions (e.g., timber sales or habitat conservation plans) on one administrative unit to multiple actions covering multiple administrative units. In general, the analytical framework of these consultations was assessed in light of the reserve or connectivity goals established by the NWFP land-use allocations (USDA and USDI 1994a), and expressed in terms of changes in suitable spotted owl habitat within those land-use allocations.

The Service updated the environmental baseline for spotted owl habitat on several occasions since the owl was listed in 1990. Based on these assessments, habitat continues to decline on a range-wide basis. For example and perspective, about 7,397,098 acres of suitable habitat were estimated to exist on Federal lands in 1994 (Table 4-2). As of April 16, 2003, the Service has consulted on the removal of 594,914 acres of spotted owl habitat of which 189,604 occurred on Federal lands managed under the NWFP (Table 4-3). This habitat loss was distributed throughout most provinces in the NWFP area, except the Western Lowland and Willamette Valley provinces.

Table 4-2. Changes to NRF[1] habitat (acres) from activities subject to Section 7 consultations and other causes; range-wide aggregate from 1994 to current range-wide update (*April 16, 2003*)

Ownership[1]		**Consulted-on Habitat Changes[2]**		**Other Habitat Changes[3]**	
		Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Federal - NWFP	Bureau of Land Management	70,653	7,318	0	0
	Forest Service	96,888	418,846	0	3,642
	National Park Service	908	2,861	0	0
	Multi-agency	15,151	23,337	0	0
	NWFP Subtotal	183,600	453,362	0	3,642
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs	97,200	20,850	0	0
	Habitat Conservation Plans	295,889	14,430	0	0
	OMCP Subtotal	393,089	35,280	0	0

Other Federal Agencies and Lands4	154	1	0	0
Other Public and Private Lands5	10,315	878	5,480	0
Totals	587,158	488,521	5,480	3,642

1 Nesting, roosting, foraging habitat. Note that in California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington,. Effects to NRF habitat compiled in this and all subsequent tables include effects that occurred primarily to NR habitat in California.
2 Includes both effects reported in USFWS 2001 and subsequent effects compiled in the Spotted owl Consultation Effects Tracker (web application and database).
3Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.
4Includes lands that are owned or managed by other federal agencies not included in the NWFP.
5Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across Forest Service and BLM lands are included here.

Table 4-3. Changes in NRF habitat (acres) documented via section 7 consultation for all physiographic provinces throughout Northwest Forest Plan Lands; aggregate changes from 1994 to the current range-wide update (*April 16, 2003*)

Physiographic Provinces		**Habitat removed/ downgraded** [4]			**Evaluation Baseline** [3]	**% of Provincial Baseline Affected**	
		Reserves [1]	**Non-Reserves** [2]	**Total**			
WA	Olympic Peninsula	55	24	79	560,217	0.0	0.0
	Western Lowlands	0	0	0	0	0	0
	W. Cascades	246	10,862	11,108	1,112,480	1.0	6.1
	E. Cascades	1,525	3,340	4,865	706,849	0.7	2.6
OR	Coast Range	279	3,954	4,233	516,577	0.8	2.3
	Willamette Valley	0	0	0	5,658	0	0
	Cascades W.	2,807	49,628	52,435	2,045,763	2.6	28.6
	Cascades E.	1,462	10,758	12,220	443,659	2.8	6.7
	Klamath Mountains	1,358	66,605	67,962	786,298	8.6	37.0
CA	Coast	181	64	245	51,494	0.5	0.1
	Klamath	1,470	23,775	25,245	1,079,866	2.3	13.8
	Cascades	0	5,200	5,200	88,237	5.9	2.8
TOTAL		9,390	174,210	183,600	7,397,108		

1 Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs.

2 Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.
3 1994 FSEIS baseline (USDA and USDI 1994b).
4 Includes both effects reported in USFWS 2001 and subsequent effects compiled in the Spotted owl Consultation Effects Tracker (web application and database

The loss of suitable habitat since 1994 did not exceed 4 percent in most provinces (Table 2). However, habitat loss within the Oregon Klamath Mountain province was relatively high (about 8.5%), compared to other provinces, making up 37 percent of habitat loss range-wide. Most (98%) of this habitat loss was concentrated outside of reserves (i.e., LSRs, managed late successional reserves, and Congressionally Reserved Areas). Consequently, the Service concludes the following: loss of suitable habitat within LSRs was not significant; and loss of suitable habitat outside of LSRs did not preclude connectivity between LSRs, nor adjacent provinces (USFWS 2001a). Reasons for the comparatively large number of acres of habitat consulted-on for removal in the Oregon Klamath Mountain province include a higher percentage of Matrix acres and a shift to density management harvest, which can impact up to three times as many acres as a regeneration harvest for an equal amount of timber volume removed.

In 2002, the Biscuit Fire in southwest Oregon (Rogue River basin) and northern California burned over 500,000 acres, primarily on the Siskiyou National Forest. The fire and the associated fire suppression efforts resulted in a loss of approximately 112,000 acres of spotted owl habitat, including habitat within five LSRs. In the Service's 2003 programmatic BO (USFWS 2003b), the Service analyzed the amount and distribution of spotted owl dispersal habitat (based on agency habitat data) in the Rogue basin and found they were adequate in most areas, except in the location of this fire. This analysis also highlighted that the smaller LSRs in this area contained very little suitable or dispersal habitat and were unlikely to support large clusters of reproducing spotted owls. Although the Biscuit fire heavily affected one large LSR (Fishook), the distribution of areas affected by loss of suitable habitat would not likely preclude movement of spotted owls between the Coast and Cascade provinces.

Range-wide, consulted-on effects of timber harvest on NWFP lands from 1994 to March 12, 2004 are consistent with timber harvest rates assumptions for the first decade of the NWFP as discussed in the Service's 1994 BO (USFWS 1994). The amount of suitable habitat removed due to timber harvest in the first decade did not exceed the level (196,000 acres) expected under the NWFP. April 14, 2004, will mark the beginning of the second decade under the NWFP and will reset the calculation of expected habitat loss to timber harvest. Most harvest was concentrated outside Reserves intended to provide for population clusters of owls.

Population Dynamics. Spotted owls were located at approximately 4,600 sites (Federal and non-Federal lands) between 1987-1991. The status of these sites included 3,602 confirmed pairs and 957 territorial single spotted owls. Although a majority of owl sites occurred on Federal lands, a significant number also occurred on non-Federal lands, particularly in northwestern California. The actual population of owls across the range is undoubtedly larger than the number of individuals confirmed at that time because a significant portion of the range of the spotted owl remains unsurveyed (USFWS 1992, Thomas et al. 1993).

In California, surveys conducted through 1992, detected 1,039 confirmed pairs, 347 resident singles, and 242 sites with owls of unconfirmed status; about 40 percent of these sites were on non-Federal lands (USFWS 1992). A March 2003 query of the 2002 California Department of Fish and Game's spotted owl database shows 2,145 activity centers (pairs and territorial singles) occur in California. This estimate is rough and likely represents an over-estimate of currently active activity centers because surveys are not completed to determine if owls are still resident at many of these sites. Nevertheless, the number of known activity centers has increased since 1992, most likely due to increased survey effort.

To date, survey coverage of all suitable habitat is incomplete. Survey effort has been sporadic, not systematic. Survey coverage and effort are insufficient to produce reliable population estimates. Consequently, the Service now uses other indices, such as demographic data, to evaluate the current condition of the spotted owl population. Analysis of demographic data can provide an estimate of the rate and direction of population growth [i.e., lambda (λ)]

Demographic data from 1985 through 1998 from 16 independent study areas located throughout the owl's range (4 in Washington, 9 in Oregon, and 3 in California) were recently analyzed. Study areas encompassed 20,500 square miles, representing about 23 percent of the owl's range. They consisted primarily of Federal lands, but included some private, Tribal, and Oregon State lands. Overall, results indicated the owl population is still declining, but at a slower rate than previously reported (Franklin et al. 1999). Thomas and Raphael (1993) predicted a population decline, but did not present a specific rate of decline. Therefore, conformance of observed declines with those they anticipated cannot be determined.

On a range-wide basis, lambda (λ), adjusted for juvenile emigration, for territorial females is 0.961, indicating the population of territorial females declined 3.9 percent annually from 1985 to 1998 (Franklin et al. 1999). Although less than the 4.5 percent rate of decline estimated for the years from 1986 through 1993 (Burnham et al. 1996), the rate of decline is still significantly different from a stable population (Franklin et al. 1999). After accounting for juvenile emigration, 4 of 16 individual owl populations appear stable (λ =1.0), at least 8 have evidence to support a decline (λ<1.0), and the remainder are either stable or declining (Franklin et al. 1999).

Mean estimates of apparent survival across all study areas increased with age of individuals. Survival rates of adult females across all study areas varied among years, but no longer exhibited the negative range-wide trend apparent in the 1993 analysis (Forsman and Anthony 1999). However, survival rates of female spotted owls in the three California studies continue to show a downward trend. Fecundity varied by year and province. Across its range, the spotted owl continues to show alternating good and bad reproductive years. Owls found east of the crest of the Cascade Mountains exhibited higher fecundity and lower survival rates, compared to those found west of the crest.

<u>Lost River Sucker (*Deltistes luxatus*) and Shortnose sucker (*Chasmistes brevirostris*)</u>

Background. Detailed accounts of the taxonomy, life history and behavior of the Lost River and shortnose suckers can be found in the final rule designating the species as endangered (53 FR 61744), and the proposed

Threats. At the time of listing, perceived threats to the species included: 1) loss of historical populations and range; 2) habitat loss, degradation and fragmentation; 3) drastically reduced adult populations; 4) overharvesting by sport and commercial fishing; 5) large summer fish die-offs caused by declines in water quality; 6) lack of significant recruitment; 7) hybridization with the other two sucker species native to the Klamath Basin; 8) potential competition with introduced exotic fishes; and 9) the inadequacy of existing regulatory mechanisms to provide for the conservation of these species (53 FR 61744).

Current and Historic Range. Currently, there are three major populations of shortnose sucker (SNS) in the Upper Klamath Basin found in Upper Klamath Lake (UKL), Clear Lake, and Gerber. There are two major populations of Lost River sucker (LRS) in the Upper Klamath Basin found in UKL and Clear Lake, along with a very small population in Tule Lake. Upper Klamath Lake contains the largest populations of SNS and LRS and these populations are crucial for the long-term survival of both species.

Population Status and Trends
Upper Klamath Lake. Accurate population estimates of the adult sucker populations in UKL do not exist. Early estimates of relative declines in abundance prior to listing came primarily from the sport fishery catch records (Andreasen 1975, Bienz and Ziller 1987, Markle and Cooperman 2002, Eugene Register-Guard 1967, Golden 1969, USFWS 1988). Subsequent estimates have been based primarily on tagging efforts in the Williamson River and recovery of tagged fish that died during catastrophic fish die-offs in 1995-1997 (Bienz and Ziller 1987, Perkins 1996, Perkins 1997, Shively 2002). The highly complex ecological and physical variability of the UKL system, the large size of the lake, sampling constraints, and substantive unmet statistical assumptions in the calculation of tag/recapture results make absolute population estimates unavailable from current information at this time and quantitative interannual comparisons of estimates inappropriate (Shively 2002).

Prior to listing, several spawning populations of suckers were apparently lost from Upper Klamath Lake, as evidenced by the absence of suckers at many historical spawning areas in the lake (Andreasen 1975, Markle and Cooperman 2002). In the late 1980's and early 1990's, at least six additional spawning areas, including the Wood River, have either ceased to show evidence of use or shown severe declines in use (Markle and Cooperman 2002, Markle and Simon 1993).

Given the above difficulties in estimating sucker population sizes, the available information suggests that LRS and SNS population numbers have fluctuated somewhere between a few thousand to a few hundred thousand adults of each species in UKL within the period since 1988 (Markle and Cooperman 2002). While these estimates are very broad, it is important to consider that recovery of the suckers depends not on absolute numbers, but rather, on the viability of the populations and their ability to sustain themselves into the future. This aspect of viability is dependent on the ability of the species to balance adult mortality with successful recruitment of new individuals into the adult spawning population.

In UKL, the major source of adult mortality is periodic catastrophic fish die-offs. Adult mortality must be compensated by the production of successful juvenile year classes (cohorts) and then by the survival and recruitment of those cohorts into the spawning population at a rate in excess of adult mortality.

Upper Klamath Lake - Fish Die-offs. Water quality in UKL consistently reaches levels known to be stressful to suckers and periodically reaches lethal levels in August - September, resulting in catastrophic die-off events (Bienz and Ziller 1987, Buettner 1997, Foott 1997, Gilbert 1898, Holt 1997, Loftus 2001, Perkins et al. 2000b, Scoppettone 1986, Scoppettone and Vinyard 1991, USBR 1996). Major fish die-offs have been recorded since the late 1800's but have increased in frequency in the last few decades (Figure 4-1). Small, localized fish die-offs have been observed annually on UKL since 1992, when extensive research and monitoring activities began.

The magnitude of fish kills in the 1990's have been estimated by scientific observers to be approximately tens of thousands of suckers for each event (Bienz and Ziller 1987; Buettner 1997; Gilbert 1898; Perkins et al. 2000b; Scoppettone 1986; Scoppettone and Vinyard 1991).

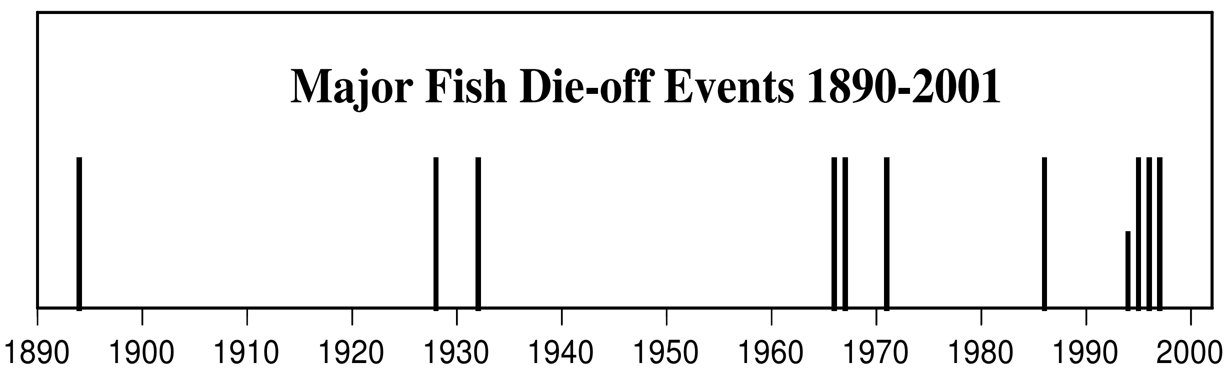

Figure 4-1. Major fish die-off events in Upper Klamath Lake from 1890 to 2001 (USFWS 2002)

Accurate estimates are not possible due to the difficulty of counting dead, floating fish in a lake the size of UKL and due to the undeterminable numbers of dead suckers that are out of sight on the bottom. Also, numerous fish-eating birds inhabit the lake, likely eat many of the smaller fish, since large numbers of birds are frequently noted as the first sign that fish are stressed or dying. A general estimate of the magnitude of the 1996 die-off, based on estimates of population numbers before the 1996 die-off and the 1997 estimate, suggests that the 1996 die-off killed about 50 percent of the adult populations. Although there are no absolute figures for the magnitude of the die-offs, it is clear that three major die-offs in 1995-1997 reduced the pre-1995 population by a substantial amount. This is further supported by substantial declines in the abundance index values of adults spawning in the Williamson River during the years following the die-offs (Cunningham et al. 2002).

Upper Klamath Lake - Production of Larvae and Juveniles. Oregon State University scientists (Markle et al. 2000, Simon 2002, Simon et al. 2000a, 2000b, Simon and Markle 2001) have monitored the relative abundance of larval suckers in UKL consistently since 1995. Larval catch rates were similar in 1995, 1996, 1997 and 1999, but were significantly lower in 1998 and 2000; data are not yet available for 2001 (Simon and Markle 2001). Juvenile abundance was low in 1995, 1997, 1998 and 2001, but relatively high in 1996, 1999 and 2000 (Simon 2002).

There was little correlation between adult spawning run indices and larval or juvenile indices from 1995-1999 (Cunningham et al. 2002, Markle et al. 2000b, Simon et al. 2000a). However, there was a relatively good correlation between larval and juvenile beach seine indices (Simon et al. 2000b, Simon and Markle 2001). This suggests that successful spawning and production of a strong juvenile year class may be more dependent on environmental conditions and larval/juvenile mortality than on adult spawning effort. In most years there is almost an order of magnitude decline in age 0 sucker abundance from late July to October. The exact cause of this decline is unknown but increased mortality, habitat shifts, dispersal, adverse water quality, and entrainment losses are potential factors (Gutermuth et al. 2000a, 2000b; Simon 2002, Simon and Markle 2001).

Spring catch rates of older juveniles in UKL are consistently low (Simon et al. 2000a,2000b; Simon and Markle 2001). This trend is disturbing and may suggest that late fall/winter juvenile mortality is high, resulting in little or no survival into the second year, even though larval and juvenile numbers appear substantial in summer and fall samples (Simon and Markle 2001). However, the absence of larger juveniles in catches may be caused by sampling difficulties. Therefore, survival and recruitment of juveniles into the spawning population is better assessed by examination of adult spawning populations.

Upper Klamath Lake - Recruitment to the Adult Spawning Population. Some information on relative abundance changes in the adult spawning population can be obtained from variation in the number of suckers migrating up the Williamson River each spring to spawn, which shows the drastic decline during the three fish die-offs (1995-97) and the hiatus in 1998-1999 before the population began to increase in 2000

(Cunningham et al. 2002). The increase in 2000-2001 spawning index probably represents the recruitment of a single dominant year class over a period of two years, rather than recruitment of two distinct year classes. For LRS that would be the 1991 year class, and for SNS it would probably be the 1993 year class that indicate the arrival of a new cohort of young adults in a given year, although assessment of the relative strength of the cohort is confounded by declines in the absolute numbers of older adults caused by mortality events, such as the 1995-97 fish kills. Records of annual adult length distributions are available from the Williamson River spawning run and from UKL east-side, shoreline springs (e.g., Sucker, Silver Building and Ouxy springs). The spawning run up the Williamson River represents the vast majority of tributary spawning suckers and a large percentage of the adult spawning population in Upper Klamath Lake (Bienz and Ziller 1987, Buettner and Scoppettone 1990, Cunningham et al. 2002, Perkins 1996, Perkins et al. 2000, Scoppetone and Vinyard 1991). Records are available for 1984-85, 1987-1991 and 1994-2001. The available data show evidence for relatively substantial recruitment of smaller fish into the Williamson spawning populations for LRS and SNS in only a few of the last eighteen years. Records of the lake-spawning populations at eastside springs are available for LRS in 1987-1990, 1993 and 1996-2001 (Hayes and Shively 2002, Perkins et al. 2000). SNS are rarely caught at the springs and records are too limited to draw conclusions on recruitment. Data again show that there is substantial recruitment into the shoreline spawning populations of LRS for only a few of the last fifteen years.

Age distribution data are available based on suckers recovered fish die-off events during 1995 (USBR 1996), 1996 (Perkins 1996) and 1997 (Shively 2002). These data showed that in 1995 95 percent of the suckers were age 7 years or younger, with most age 4 (1991 year-class) and 5 (1990 year-class). Examination of about 860 suckers from the 1996 fish kill documented LRS and SNS that were mostly 2-8 years old (USGS, unpub. data). Eighteen year-classes of LRS and 11 year-classes of SNS were identified. The most abundant year-class of both species was 1991; the 1988-1993 year classes were also fairly well represented. In 1997 die-off, older LRS and SNS were more prevalent than in other years. Preliminary data from adult suckers collected during 2001 indicated that the current total population of LRS in Upper Klamath Lake is dominated by fish 45-65 cm in length, which represent the 1988-1994 year classes exclusively (USGS 2002, unpub. data). The current population of SNS contains fish 36-55 cm, which represents the 1989-1996 year classes. The dominant year class for LRS is 1991, while the dominant class for SNS is now 1993.

Clear Lake. Sucker populations in Clear Lake exhibit a broad range of sizes, indicative of a relatively diverse age structure. However, LRS in particular are generally dominated by younger individuals, suggesting some recruitment but relatively low adult survivorship (CDFG 1993). Drought conditions severely reduced sucker habitat in the Clear Lake watershed in the early 1990s. The reservoir reached its lowest level since 1935 and only 5 percent of the water remained, and many tributaries went dry (USFWS 1994b). Populations of suckers in small reservoirs above Clear Lake were apparently eliminated, but may have reestablished themselves. Within Clear Lake itself, the sucker population showed signs of stress and reduced condition during the drought, due to adverse temperatures, turbidity and dissolved Oxygen (DO) conditions at low water levels, but had apparently recovered by the next year. Clear Lake contains large populations of introduced warm-water predatory fishes; their specific impacts on the sucker population are not known. No population estimates are available for the Clear Lake LRS and SNS populations.

The Clear Lake sucker populations are currently isolated from suckers in the rest of the Klamath Basin by Clear Lake Dam, which provides no fish passage. This isolation prevents genetic exchange with other populations and provides no opportunity for natural recolonization of the sub-basin in the event of local extirpation. While suckers are entrained at the dam, this will be reduced by screening in place by May 2002. Generally the populations of SNS and LRS in the Clear Lake sub-basin appear to be relatively stable, and the primary threat to their persistence would be prolonged drought conditions and perhaps adverse water quality during prolonged ice-cover. The relatively low percentage of older adults in the Clear Lake populations, the cause of which has not been resolved is a concern.

Gerber Reservoir. Monitoring since 1992 within the Gerber watershed has documented a SNS population exhibiting a wide range of size classes (USBR unpub. data). Suckers ranged from 2-14 years old, indicating a young population in the reservoir. The presence of smaller suckers indicates the population in Gerber Reservoir has successfully recruited recently. In dry years, tributaries dry up and fish in Gerber Reservoir are subjected to extremely low water levels, high turbidity, and low DO which may contribute to poor sucker condition in these years. Gerber Reservoir contains large populations of introduced warmwater predatory fishes; their specific impacts on the SNS population are unknown. No population estimates are available for the Gerber SNS population.

The Gerber SNS population is currently isolated from the rest of the Klamath Basin by Gerber Dam, which provides no fish passage. This isolation prevents genetic exchange with other populations and provides no opportunity for natural recolonization of the sub-basin in the event of local extirpation. While some suckers are entrained at the dam, this has been largely eliminated through placement of net screens at the outlet. Generally the population of SNS in Gerber Reservoir appears to be relatively healthy, and the primary threat to its persistence would be prolonged drought conditions and associated adverse water quality.

Lost River. The Lost River currently supports an apparently small population of SNS and LRS. Suckers, primarily SNS and Klamath largescale sucker (KLS, *Catostomus snyderi*) have been reported from throughout the drainage (Koch and Contreras 1973, Buettner and Scoppettone 1991). However, the majority of both adults and juveniles are caught in a very restricted reach of the river, above Harpold Dam and to a lesser extent from Wilson Reservoir (Shively et al. 2002). Movement of suckers within the river are severely restricted due to diversion dams, and available habitat is limited by adverse water quality in the impoundments and channelized sections of the river. The Lost River contains large populations of introduced warm-water predatory fishes and has become dominated by introduced fathead minnows; their specific impacts on the sucker population are not known. No population estimates are available for sucker populations in the Lost River.

Sucker spawning habitat in the Lost River is very limited. Sucker spawning has been documented below Anderson-Rose Dam, in Big Springs, and at the terminal end of the West Canal as it spills into the Lost River. According to residents, sucker spawning at Big Springs is now rare, but historically it was an important spawning site and was used by Native Americans as a major fishing site during the spawning migration (Klamath Echos). Suspected spawning areas that have suitable habitat (rocky riffle areas) include the spillway area below Malone Reservoir, just upstream of Keller Bridge, just below Big Springs, just below Harpold Dam, and adjacent to Station 48. Spawning has also been documented in Miller Creek, and is suspected in Buck Creek and Rocky Canyon Creeks (Shively et al. 2002). Based on length frequency distributions it appears that several year classes of SNS are represented within the Lost River.

Populations of both LRS and SNS in historical Tule Lake migrated up the Lost River to spawn at Big Springs (River Mile 42), near Bonanza, Oregon and probably at other shallow riffle areas with appropriate spawning substrate (Coots 1965). The construction of Lost River Diversion Dam in 1912 by Reclamation restricted sucker migrations out of Tule Lake to the lower 23 miles of the Lost River. In 1921, construction of the Anderson-Rose Diversion Dam further restricted migrations to the lower 7 miles of the river. Reclamation has monitored endangered sucker spawning runs from Tule Lake into the Lost River regularly since 1991 (USBR 1998). Although dozens of suckers were observed spawning during May, and some eggs were found, substantial numbers of larval suckers were only observed in 1995. In 1999, Reclamation changed operations in the Lost River below Anderson Rose Dam, and suckers began migrating to the dam as early as two days after releases were started.

Tule Lake. Historically Tule Lake had enormous sucker populations of both LRS and SNS which made significant spawning runs up the Lost River (Cope 1879; Coots 1965; Howe 1968). Sucker runs up the Lost River were once so large that several canneries were set up to can and process suckers into dried fish, oil, and other products (Howe 1968, Andreasen 1975). Perhaps the largest recorded osprey colony, which numbered about 500 nests, was located near Merrill, Oregon, and was probably dependent on suckers and other fishes from Tule Lake (Henny 1988). The vast sucker populations that migrated out of Tule Lake are severely reduced today. The lake was sampled for suckers in 1973, but none were collected (Koch and Contreras 1973). However, in 1991 both species were observed spawning below Anderson-Rose Dam, and in 1992-93 about 20 specimens of each species were captured in Tule Lake (USFWS 1993). Further sampling has confirmed a small population of both species in the Tule Lake sumps (Scoppettone et al. 1995). The negative surveys of Koch and Contreras are likely explained by limited collecting effort in areas where suckers aggregate and low sucker population levels. It seems unlikely that suckers have only recently re-invaded the sumps via entrainment of fish into irrigation canals. Suckers inhabiting Tule Lake, while low in number, were found to have a high condition factor (ratio of weight to length) relative to that of other Klamath Basin sucker populations.

Population estimates, based on limited capture and recapture data, estimate 159 adult SNS (95% CI: 48-289) and 105 LRS (95% CI: 25-175) in the Tule Lake populations, which contain few size classes (Scoppettone et al. 1995). Most SNS are about 46 cm fork length, and most LRS are 46-60 cm fork length. While an accurate estimate of the population size is not possible, the available information suggests that sucker population sizes in what remains of the lowest reach of the Lost River and Tule Lake are currently limited to a few hundred individuals of each species.

Sucker habitat in Tule Lake sumps for juveniles and adults is extremely limited due to shallow depths, and the sumps continue to fill with sediment. Approximately 8,000 and 5,000 acre-feet (ft) of storage were lost from sumps 1A and 1B, respectively, between 1958 and 1986 (USBR unpub. data). Wind- and water-borne silt is coming primarily from agriculture in the Lost River watershed. Since the Tule Lake sumps are shallow, with an average depth of less than 4 ft, this loss of habitat is significant. Reduction of water depth in Tule Lake is a threat to the suckers because it increases the risk of a winter freeze, reduces the amount of deepwater habitat for adult suckers, increases avian predation, and may contribute to poor water quality by allowing the water to heat more rapidly and allowing sediments and nutrients to be more readily mixed by wind shear. The Refuges are developing a plan of sump rotation that may help alleviate the problem of siltation in Tule Lake, however, sediment transported by the Lost River will continue to be a problem until erosion in the Lost River watershed is reduced.

Rearing habitat in the Lost River downstream of Anderson-Rose Dam is limited both by water quality and structural features of the channelized river. The lower Lost River is, at high lake levels, made up almost entirely of backed-up sump water, and water quality conditions reflect those in the sump. A few small irrigation return drains empty into the river in this reach and may contribute to water quality degradation.

The small sucker populations residing in what remains of Tule Lake are likely limited by a lack of recruitment, inadequate water depth, and seasonally poor water quality. Other than Clear Lake and UKL, Tule Lake (including a portion of the Lost River) contains the only additional population of LRS within its historical range. The small Tule Lake populations of both species appear to be healthy, relatively free of parasites and skin infections, and to have a higher condition factor than suckers found elsewhere in the Basin. However, present rates of sedimentation threaten the persistence of their remaining habitat.

Lower Klamath Lake. Prior to 1917, Lower Klamath Lake was seasonally connected to the Klamath River either when it flooded in spring or later in the summer when the river level was down and water flowed from the lake to the Klamath River (Weddell 2000). Steamboats were even able to navigate the Klamath Straits, a slough that connected the lake and river. The railroad completely severed that connection by 1917, and by 1924, the majority of the Lower Klamath wetlands had been drained (Weddell et al. 1998; Weddell 2000). Connectivity between Lower Klamath Lake and the rest of the Klamath Basin is now limited to water pumped through Sheepy Ridge from Tule Lake and various irrigation channels that connect into the Keno impoundment, primarily the Klamath Straits Drain and Ady Canal.

Prior to about 1924, suckers migrated up Sheepy Creek (a spring-fed tributary to Lower Klamath Lake) in sufficient numbers that they were taken for food or to feed hogs (Coots 1965). In 1960, small numbers of adult suckers were observed moving up Sheepy Creek in the springtime (Coots 1965). Since 1960, available survey information, though limited, indicates no suckers remain in Lower Klamath Lake sub-basin (Buettner and Scoppettone 1991, Koch and Contreras 1973). Occasional suckers may disperse into the Lower Klamath Lake sub-basin through irrigation canals, but there is apparently no suitable habitat for long-term survival, and at present there are no known resident populations in the Lower Klamath Lake sub-basin.

Link River. Prior to construction of the Link River Dam, there were apparently large spawning runs of suckers migrating up the Link River in March, which were described in the Klamath Republican in 1901 as "immense congregations" of fish weighing two to six pounds. The origin of these runs is not recorded; presumably, they came up out of Lower Klamath Lake or the Lake Ewauna/Keno reach, as no suitable lake habitat was available below Keno prior to construction of J.C. Boyle Dam. Suckers apparently occupied the Link River even in summer, as evidenced by accounts of stranded "mullet," when flow to the Link River was cutoff by southerly winds producing a seiche (a wind-drive oscillation of the water surface) in UKL that lowered the level at the outlet to below the sill and the river temporarily stopped flowing (Spindor 1996).

There has been no concerted effort to survey the Link River itself for fish distribution and seasonal use patterns. However, the limited information available demonstrates that adult suckers still make an attempt to migrate upstream in the Link River during the spring, and at least juveniles apparently reside in the river below the dam throughout most of the year. Primarily juvenile suckers are consistently caught during salvage operations conducted at the base of the Link River Dam during maintenance operations and spill termination, which occurs in most seasons except the January-March period (USBR 2000). Small numbers of adult suckers have also been found attempting to utilize the poorly designed fish ladder at the Link River Dam (Hemmingsen et al. 1992, PacificCorp 1997).

While suckers appear to still occupy habitat throughout the Link River in low numbers, the lower Link River is probably crucial to suckers and other fish, since it may be the best habitat now available in the reach upstream of Keno. The lower Link River can serve as a critical refuge for fish during periods of low DO. Water quality in Lake Ewauna is frequently very poor and the higher water quality in the Link River may allow fish from the lake to survive. Link River, because of its high gradient and numerous cascades, has a significant potential for oxygenation of water prior to entry into Lake Ewauna where there is a high biochemical oxygen demand. Furthermore, a number of small springs along and in the channel add fresh, high-quality water to the river. In summer, when most of the flow is diverted into the hydroproject, water quality in the Link River itself and the reach's potential to oxygenate water entering Lake Ewauna is greatly compromised by the reduced flow caused by the diversions.

At this time, suckers attempting to move up into UKL, including those that have been entrained from UKL and delivered downstream by diversion channels, are effectively prevented by the Link River Dam. Mature suckers trapped below the Link River Dam are prevented from reaching spawning grounds in UKL or its tributaries and are lost to the population.

Keno Impoundment (Lake Ewauna to Keno Dam). Historically, Lake Ewauna and the upper Klamath River were connected to both the Lost River, at least in years of high water, and to Lower Klamath Lake. In 1890, the paddle-wheeler "Mayflower" was able to navigate up the Lost River Slough and moved down the Lost River to near Merrill. The Lake Ewauna/ upper Klamath River reach may have formed a critical connectivity corridor for suckers moving between the Upper and Lower Klamath lakes and the Lost River. Currently, Lake Ewauna and the upper reach of the Klamath River above the Keno Dam form an impoundment 20 miles-long by 300 to 2600 ft-wide, with depths of 9 to 20 ft (the Keno Impoundment, see Environmental Baseline). Water quality in this reach of the Klamath River is seasonally poor and it is 303(d)-listed by Oregon Department of Environmental Quality for DO, pH, Chl-a, and ammonia (CH2M Hill 1995, ODEQ 1998).

Very little is known about the present use of the Keno to Link River reach by suckers or other fishes, and no systematic sampling has been done. There is evidence that some suckers still migrate upstream past the Keno Dam (Hemmingsen et al. 1992, PacifiCorp 1997). Their destination and success at reaching it are unknown. The occasional capture of adult suckers in the Keno Impoundment, the presence of suckers both in the Link River itself and at both the Link River and Keno fish ladders, and the apparent out-migration of tens of thousands of juveniles from UKL in the late summer and fall demonstrate that suckers utilize this reach and suggests that improvement of habitat quality, coupled with adequate fish passage at the Link River and Keno Dams, would be a key component to restoring exchange between UKL and downstream populations, as well as allowing the survival and return of the large number of suckers swept downstream of the Link River Dam from UKL.

Klamath River Reservoirs. Downstream of Keno Dam the Klamath River consists of three primary reservoirs (J.C. Boyle, Copco and Iron Gate) interconnected by three riverine reaches (Desjardins and Markle 2000, Fishpro 2000). Four species of suckers are known from the Klamath River and its reservoirs: LRS, SNS, KLS, and the Klamath smallscale sucker (KSS, *Catostomus rimiculus*). The KSS is principally a river- and stream-dwelling species which is rare in the upper Basin. Due to the high-energy character of the river reaches, the primarily lake-dwelling LRS and SNS are not expected to occupy them, except potentially for spawning and as migration corridors. Of the five dams below UKL, only Keno and J.C. Boyle have fish passage facilities (Hemmingsen et al. 1992, Ott Engineers 1990, PacificCorps 1997). While the Keno and J.C. Boyle ladders are apparently passable by suckers to some degree, neither is designed for optimum sucker passage.

The SNS is the only lake sucker that occurs in abundance in the Klamath drainage below Keno, and adult SNS have been consistently collected in all three reservoirs (J.C. Boyle, Copco, and Iron Gate). Copco Reservoir apparently contains the largest population of larger adults. However, the two lower reservoirs, Copco and Iron Gate Reservoirs contain few sub-adults, which are generally present only in J.C. Boyle Reservoir. Although larval suckers have been caught in all three reservoirs, their identity is uncertain. SNS spawning behavior has been recorded from Copco, but there is no evidence that SNS consistently survive past their first year in the reservoir (Beak Consultants Inc. 1987, Buettner and Scoppettone 1991, Desjardins and Markle 2000).

LRS are apparently rare in the two upper reservoirs and have not been recorded from Iron Gate. In 1956, Coots did catch three LRS in Copco, however it is unclear whether they were abundant at the time (Coots 1965); more recent surveys have caught only a few individuals (Desjardins and Markle 2000). ODFW and PacifiCorp caught only eight LRS passing the Keno Dam from 1988-1991 (PacifiCorp 1997).

Desjardins and Markle (2000) considered J.C. Boyle to be a possible sink for UKL larvae and juvenile suckers entrained into the Klamath River from UKL. J.C. Boyle was the only reservoir where juveniles were plentiful. No SNS or LRS have been recorded spawning in J.C. Boyle.

Threats and Conservation Needs. The threats to the LRS and SNS are discussed below along with the conservation needs that address each threat and the general status of the species relative to that threat. The specific status of each LRS/SNS population was discussed above by area (e.g., Status: Upper Klamath Lake). The term "conservation needs" is defined as those actions or conditions necessary to bring an endangered or threatened species to the point at which protection under the ESA is no longer necessary. In other words, those actions or conditions that adequately provide for the survival and recovery of the listed species. The discussion below addresses the primary threats recognized at the time of listing and two additional threats recognized since listing, lack of passage and entrainment.

Establish a sufficient number of viable, self-sustaining populations of the LRS and SNS in as much of their historical range as possible. Multiple populations provide resiliency in response to localized extirpations caused by adverse conditions such as prolonged drought, contaminant spills, disease and catastrophic water quality declines. Multiple populations also help ensure the genetic diversity of the species and improve its ability to adapt to changing environmental conditions.

The historical range of LRS and SNS has been severely reduced by drainage and management of Lower Klamath and Tule Lakes. Lower Klamath Lake no longer supports suckers, and the populations in Tule Lake are reduced to a few hundred adults. Both species were once very abundant and were critical food resources for Native

Americans and white settlers in the upper Klamath River Basin (Cope 1879, Gilbert 1898, Howe 1968). It was estimated that the aboriginal harvest at one site on the Lost River may have been 50 tons annually (Stern 1966). Settlers built a cannery on the Lost River and suckers were also processed into oil and salted for shipment. In 1900, the *Klamath Republican* newspaper reported that "mullet," as suckers were referred to, were so thick in the Lost River that a man with a pitch fork could throw out a wagon load in an hour. In 1959, suckers were made a game species under Oregon State law, and snagging suckers in the Williamson and Sprague River was popular with locals and out-of-town sportsmen. By 1985, Bienz and Ziller (1987) estimated the harvest had dropped by about 95 percent. Based on this information, the game fishery was terminated in 1987, just prior to federal listing of these species under the Endangered Species Act.

Historically, both LRS and SNS occurred throughout the Upper Klamath Basin, with the exception of the higher, cooler tributaries dominated by resident trout and the upper Williamson, which is isolated by the Williamson Canyon. At the time of listing, LRS and SNS were reported from UKL, its tributaries, Lost River, Clear Lake Reservoir, the Klamath River, and the three larger Klamath River reservoirs (Copco, Iron Gate, and J.C. Boyle). The general range of LRS and SNS had been substantially reduced from its historic extent by the total loss of major populations in Lower Klamath Lake, including Sheepy Lake, and Tule Lake (53 FR 61744). The Klamath River reservoir populations receive individuals carried downstream from upper reaches of the river, but they are isolated from the Upper Klamath Basin by dams and show no evidence of self-sustaining reproduction (Desjardins and Markle 2000). The current geographic ranges of LRS and SNS have not changed substantially since they were listed and only two additional SNS and one LRS populations have been recognized since 1988. They all occur in isolated sections of the Lost River drainage, within the historical ranges of the species, and include an isolated population of SNS in Gerber Reservoir and a small population (limited to several hundred adults) of each species in Tule Lake.

Currently, there are three major populations of SNS in the Upper Klamath Basin found in UKL, Clear Lake, and Gerber Reservoir. There are two major populations of LRS in the Upper Klamath Basin found in UKL and Clear Lake, along with a very small population in Tule Lake. UKL contains the largest populations of SNS and LRS and these populations are crucial for the long-term survival of both species. However, multiple populations provide resiliency in response to localized extirpations caused by adverse conditions such as prolonged drought, contaminant spills, disease and catastrophic water quality declines. Multiple populations also help ensure the genetic diversity of the species and improve its ability to adapt to changing environmental conditions. Therefore, in addition to sucker populations in UKL, the populations of LRS and SNS in Clear Lake, Gerber, and Tule Lake are essential to ensure the long-term survival of the species.

Habitat Loss, Degradation, and Fragmentation. Provide adequate quantity and quality of habitat to meet the needs of all life-history stages of the LRS and SNS. Adequate habitat is crucial to ensure recruitment and support viable populations.

Aquatic habitat has been substantially altered or destroyed in the Klamath Basin. Many previously occupied areas no longer support suckers, and crucial habitat for larvae and juveniles is often unavailable due to water management in critical rearing areas such as UKL. The Klamath Basin has lost extensive areas of emergent marshes and open lake environments that were previously used by the LRS and SNS. Lower Klamath Lake no longer supports suckers, and available habitat in Tule Lake is now limited to a few hundred acres or less. Conditions in the Lost River have limited suckers to a few primary reaches of the river. In UKL emergent vegetation that provides habitat to larval and juvenile suckers, is greatly reduced in extent and often fragmented into isolated patches along the shoreline or left dry as lake levels drop. Current habitat availability and conditions in the Klamath Basin are greatly dependent on water management. In UKL availability of larval and juvenile sucker habitat is constrained by lake level, with much of the available habitat lost by mid to late summer as water levels decline. Adult sucker habitat is also limited by low summer/fall lake levels.

Small or Isolated Adult Populations [Reproduction]. Increase and maintain population sizes of the LRS and SNS. Populations must be maintained at levels that ensure genetic viability and provide sufficient genetic variability to allow the species to respond to environmental and ecological variability.

Important portions of the suckers' historical range, including the Lost River, Tule Lake, Clear Lake and Gerber Reservoir, contain populations which are either relatively small or are isolated by dams. LRS and SNS populations in Tule Lake and the Lost River (LRS in particular) appear to have declined substantially below historic levels. The primary threat to these populations is limited habitat due to adverse water quality, sedimentation, impoundment, isolation from spawning areas and lack of significant recruitment. The Clear Lake and Gerber Reservoir populations of the LRS and SNS are isolated by dams from the rest of the Klamath Basin. Although these populations appear to be maintaining themselves, each is at risk by habitat reduction during prolonged drought with no ability to replenish the gene pool through immigration of individuals from neighboring areas.

Isolation of Existing Populations by Dams [Passage]. Provide for adequate passage for all life-stages of suckers past dams. Both sucker species are dependent on free-passage along river corridors to ensure genetic exchange between populations, to gain access to spawning areas, and to allow young fish entrained downstream to return to their parent populations.

There are nine primary dams within the natural range of the LRS and SNS, none of these dams provide suitable passage for suckers. The dams physically isolate sucker populations, prevent genetic exchange, block access to essential habitat, cut off escape from adverse conditions downstream, and prevent the return of entrained suckers to upstream habitat and spawning areas. The proposed fish ladder at the Link River Dam is intended to allow spawning adults to pass the dam, but the smaller juvenile and sub-adult suckers will remain isolated downstream. Completion of the Link River fish ladder is not expected until at least January 2006.

Poor Water Quality Leading to Large Fish Die-Offs and Reduced Fitness. Improve water quality to a level where adverse effects are not sufficient to threaten the continued persistence of the LRS and SNS. Lethal water quality conditions in UKL are the primary cause of mortality in adult suckers.

Water quality in UKL consistently reaches levels known to be stressful to suckers and periodically reaches lethal levels in August and September, resulting in catastrophic die-offs. Major fish die-offs have been recorded at UKL since the late 1800's but have increased in frequency in the last few decades. Small, localized fish die-offs have been observed annually on UKL since 1992 when extensive research and monitoring activities began. In 1995, 1996 and 1997 a series of major fish kills in UKL reduced adult sucker populations of LRS and SNS in UKL by an estimated 80-90 percent.

Adverse water quality conditions in Clear Lake and Gerber Reservoirs is primarily determined by shallow reservoir depths, which reduce available habitat and cause declines in DO, resulting in stress to the suckers and reducing their overall fitness. Available habitat in Tule Lake is severely limited by shallow depths and further limited by seasonal declines in water quality. All three water bodies are subject to potential winter fish-kills when poor water quality, especially low DO, is associated with prolonged ice-cover and shallow depths.

Lack of Sufficient Recruitment. Increase the frequency and magnitude of recruitment into the spawning populations of both LRS and SNS. For a population to survive, survival and recruitment of young fish into the spawning population must be sufficient to offset adult mortality and allow populations to increase to sustainable levels that provide adequate resiliency against fish kills, disease, infrequent recruitment, and other factors.

Since listing in 1988, the UKL sucker populations have not maintained recruitment levels sufficient to offset adult mortality caused by catastrophic fish die-offs. Successful recruitment of substantial new cohorts of the LRS and SNS into the UKL spawning populations has only occurred 2-3 times in the last seventeen years (1984-2001). During this time there have been four catastrophic, and many minor fish die-offs, caused by adverse water quality (see discussion below under the status of suckers in UKL). Size frequency of suckers in Clear Lake and Gerber Reservoirs indicates that these populations have had recent recruitment; however, the overall status of the populations is uncertain. There is no evidence of successful sucker recruitment in the small Tule Lake population or in the Klamath River reservoirs.

Entrainment into Irrigation and Hydropower Diversion Canal. Substantially reduce entrainment of larval, juvenile and adult LRS and SNS. Entrainment represents a major cause of mortality in young suckers and adults within the Upper Klamath Basin. For recovery of LRS and SNS it is crucial to increase survival of young life-stages so that they can recruit into the adult spawning population, and reduce mortality of adults; both are necessary for the establishment of viable, self-sustaining, natural populations.

Entrainment of suckers into Klamath Basin irrigation and hydro-power diversions is documented to account for the loss of millions of larvae, tens of thousands of juveniles, and hundreds to thousands of adult suckers each year (Gutermuth et al. 1997, 1998, 1999, 2000a, 2000; Harris and Markle 1991, Markle and Simon 1993, Simon and Markle 2001, USBR 2002). There are currently no fish screens at principal diversions that meet State or Federal screening criteria. Reclamation is currently in the final design phase for construction of a fish screen at the A-Canal, which is scheduled to be operational by July 22, 2003. However, the proposed facility will not prevent entrainment of larval fish under about 30 mm, and so larval entrainment of suckers will continue. Suckers prevented from entering A-Canal will still have to contend with entrainment just downstream at the Link River Dam and diversions. The fact that adequate screening has not been provided anywhere within the Project after nearly a century of operation is considered by the Service to be a major factor imperiling and retarding the recovery of the two endangered suckers.

Hybridization with Other Native Klamath Sucker Species. Maintain rates of hybridization appropriate to the evolutionary framework in which the suckers are evolving. Excessive hybridization can result in the loss of genetic diversity, fitness, and need to explain effect to lineage, evolutionarily unique lineages.

Hybridization was believed to be widely occurring in Klamath Basin suckers and was considered a threat by the Service at time the LRS and SNS were listed. From 1997-2001 several different laboratories (Oregon State University; University of California, Davis; and Arizona State University) have used independent strategies to identify morphological and genetic characters to address questions regarding reproductive isolation, classification, systematic relationships, and the extent of hybridization among Klamath Basin suckers. The preliminary evidence suggests that some hybridization may be natural within the Klamath Basin sucker fauna, and hybridization may not represent as great a threat as was thought at the time the LRS and SNS were listed. However, the biological and conservation implications of hybridization, as well as the degree to which recent man-made changes to the Klamath Basin have altered the natural rate of hybridization, are still not completely understood.

Potential Competition with and Predation by Non-Native Fishes. Ensure that LRS and SNS populations can withstand the adverse effects of competition and predation from introduced fishes.

At least eighteen species of non-native fishes have been introduced and have established populations in the Upper Klamath Basin. Little is known about the ecological and competitive interactions of the introduced fishes with the native suckers, and this limits our ability to assess their impact. Many of the introduced fishes, including the fathead minnow, yellow perch and brown bullheads, have successfully established themselves in the Upper Klamath basin and are predators that could prey on larval and juvenile suckers. One species of particular concern is the fathead minnow, *Pimephales promelas*. The fathead minnow, *Pimephales promelas* is a small minnow which first appeared in UKL in 1974, and has increased in abundance to an extent where it is frequently the most abundant fish captured there and in the Lost River. Fathead minnows and juvenile yellow perch generally occupy the same near-shore habitat as larval and juvenile suckers and may be significant predators on the larvae. It is not practical to remove non-native fishes once they have become established. However, habitat management to the benefit of native suckers, especially larvae and juveniles, and recovery of the adult population to a point where reproduction offsets the adverse effects of competition will allow the suckers to sustain viable populations in the face of increased competition and predation.

Overharvesting by Sport and Commercial Fishing. Reduce harvest to levels that allow for viable natural populations to maintain themselves.

LRS and SNS were once very abundant and were critical seasonal foods of Native Americans and white settlers in the upper Klamath River basin. In 1959, suckers were made a game species under Oregon State law, and snagging suckers was extremely popular with both locals and out-of-town sportsmen. By 1985, the estimated harvest had dropped by about 95 percent. Based on this information, the fishery was terminated in 1987, just prior to Federal listing. As a result of the regulatory termination of sport and commercial fishing, overharvest is no longer considered a threat to the species.

Status Summary. Currently, there are three major populations of SNS in the Upper Klamath Basin found in UKL, Clear Lake, and Gerber. There are two major populations of LRS in the Upper Klamath Basin found in UKL and Clear Lake, along with a very small population in Tule Lake. Upper Klamath Lake contains the largest populations of SNS and LRS and these populations are crucial for the long-term survival of both species. However, multiple populations provide resiliency in response to localized extirpations caused by adverse conditions such as prolonged drought, contaminant spills, disease and catastrophic water quality declines. Multiple populations also help ensure the genetic diversity of the species and improve its ability to adapt to changing environmental conditions. Therefore, in addition to sucker populations in UKL, the populations of LRS and SNS in Clear Lake, Gerber, and Tule Lake are essential to ensure the long-term survival of the species.

<u>Oregon Chub (*Oregonichthys crameri*)</u>

Background. Detailed accounts of the taxonomy, ecology, and life history of the Oregon chub can be found in the final rule designating the species as endangered (58 FR 53800), the annual progress reports for Oregon chub investigations (Scheere et al. 2000, 2002, 2003) and the Recovery Plan for the Oregon Chub (USFWS 1998).

Oregon chub are found in slack water off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes. These habitats usually have little or no water flow, silty and organic substrate, and considerable aquatic vegetation as cover for hiding and spawning (Pearsons 1989, Markle et al. 1991, Scheerer and McDonald 2000). The average depth of Oregon chub habitats is typically less than 6 feet and the summer temperatures typically exceed 16oC (61oF). Adult Oregon chub seek dense vegetation for cover and frequently travel in the mid-water column in beaver channels or along the margins of aquatic plant beds. Larval chub congregate in near shore areas in the upper layers of the water column in shallow areas (Pearsons 1989). Juvenile Oregon chub venture farther from shore into deeper areas of the water column (Pearsons 1989). In the winter months, Oregon chub can be found buried in the detritus or concealed in aquatic vegetation (Pearsons 1989). Fish of similar size classes school and feed together. In the early spring, Oregon chub are most active in the warmer, shallow areas of the ponds.

Current and Historical Range. The Oregon chub is a small minnow (Family: Cyprinidae) endemic to the Willamette River drainage of western Oregon (Markle et al. 1991). This species was formerly distributed throughout the Willamette River Valley in off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes (Snyder 1908). Historical records show Oregon chub were found as far downstream as Oregon City and as far upstream as Oakridge. Records of Oregon chub collections exist for the Clackamas River, Molalla River, Mill Creek, South Santiam River, North Santiam River, Luckiamute River, Long Tom River, McKenzie River, Calapooia River, Muddy Creek, Mary's River, Coast Fork Willamette River, Middle Fork Willamette River, and the mainstem Willamette River (Markle et al. 1991, Scheerer and McDonald 2000).

Based on a 1987 survey (Markle et al. 1989) and compilation of all known historical records, at the time of the petition for listing in 1991, viable populations of the Oregon chub occurred in the following locations: Dexter Reservoir, Shady Dell Pond, Buckhead Creek near Lookout Point Reservoir, Elijah Bristow State Park, William L. Finley National Wildlife Refuge, Greens Bridge, and East Fork Minnow Pond. These locations represented a small fraction - estimated as two percent based on stream miles - of the species' formerly extensive distribution within the Willamette River drainage.

Population Status and Trends. At present, Oregon chub occur at approximately 27 locations in the North and South Santiam River, McKenzie River, Middle Fork Willamette River, Coast Fork, and several tributaries to the mainstem Willamette River downstream of the Coast Fork Willamette/Middle Fork Willamette confluence (Scheerer et al. 2003). The Oregon Department of Fish and Wildlife has reintroduced Oregon chub at a number of sites within the Willamette Basin; seven currently sustain a population. In 2002, only nine populations of Oregon chub were larger than 1,000 fish, and eight populations numbered fewer than 100 individuals (Scheerer et al. 2003). Oregon chub appear to have been extirpated from at least nine locations at which they were detected in the 1990s (Scheerer et al. 2003).

Of the known Oregon chub populations, the sites with the highest diversity of native fish, amphibian, and reptile species have the largest populations of Oregon chub (Scheerer and McDonald 2000). Beavers (Castor canadensis) appear to be especially important in creating and maintaining habitats that support these diverse native species assemblages (Scheerer and Apke 1998).

McKenzie Subbasin. Historical records show that Oregon chub were collected in the McKenzie River subbasin, but until recently, no extant populations were known from the basin. In October 2001, Oregon chub were introduced into Russell Pond in the Mohawk drainage on private land under the terms of a Safe Harbor Agreement among the landowner, the Service and ODFW (Scheerer et al. 2002). The current estimated population in Russell Pond is 470 chub (Scheerer et al. 2003). A population of Oregon chub was discovered in April 2002 in Shetzline Pond, a small man-made pond near Marcola in the Mohawk drainage. The population estimate was 120 (Scheerer et al. 2003). ODFW is seeking funds to expand the wetland to create more habitat for the chub. Neither of these two populations in the Mohawk drainage is affected by flows in the mainstem McKenzie.

In 2002, a population of Oregon chub was found in side channels of the McKenzie River just east of Springfield in an area called Big Island, upstream of the confluence with Cedar Creek (Scheerer et al. 2003). The population was estimated at 940 chub. This site is connected to the mainstem McKenzie.

North Santiam Subbasin. Oregon chub are currently known to persist at about five sites in the North Santiam River subbasin: Geren Island, Santiam Conservation Easement, Green's Bridge Backwater, Pioneer Park Backwater, and at I-5 Backwater, which is downstream of the confluence of the North and South Santiam Rivers (Scheerer et al. 2003). Oregon chub populations in the North Santiam have been declining in recent years; no chub were detected at two sites (Stayton Public Works Pond and Gray Slough) in 2002, which had small populations of the fish in 2000 and 2001 (Scheerer et al. 2003). Only two populations in this subbasin have more than 100 fish (Geren Island and I-5 Backwater). Many of the sites in the North Santiam subbasin (e.g., Geren Island, Santiam Conservation Easement sloughs) have seen chub populations decline as non-native fishes invaded the habitats (Scheerer et al. 1998).

The largest Oregon chub population in the subbasin is at Geren Island, in the ponds and channels of the City of Salem's municipal water treatment facility. Oregon chub were first detected there in 1996. At the time, the population was the largest known, with over 8,000 Oregon chub. Since 1996, the population has declined precipitously to fewer than 800 chub in 2002; the cause of the decline is unknown, but may be associated with the proliferation of non-native fishes, which appear to have entered the ponds in the 1996 floods. The water treatment ponds at Geren Island are connected to the North Santiam by means of intake structures; the North Pond, which supports most of the Oregon chub at Geren Island, appears to have a hydrological connection to the North Santiam. River level is closely correlated to the water level in the North Pond; as river levels drop, pond level drops and the temperature rises (Scheerer and McDonald 2000). When releases from Big Cliff Dam fall below 2,000 cfs, water levels in the North Pond drop below optimum levels (Scheerer and McDonald 2000). The City of Salem is preparing a Habitat Conservation Plan for Oregon chub at the facility. A number of conservation measures to protect the chub are already in place, including screening and monitoring for chub in the sand filters.

All of the other known Oregon chub populations in this subbasin are in backwater sloughs connected to the river, and are potentially affected by changes in flow levels in the river. Non-native fish appear to have invaded the Santiam Conservation Easement sloughs and Green's Bridge Backwater in the 1996 floods (Scheerer and McDonald 2000).

South Santiam Subbasin. There are two introduced populations of Oregon chub in the South Santiam subbasin. In 1999, ODFW introduced Oregon chub into Foster Pullout Pond, on the north shore of Foster Reservoir. The spring-fed pond is perched above the full-pool reservoir level; it is free of any other fish species, and contains a diverse assemblage of native amphibians, western pond turtles (*Clemmys marmorata marmorata*), and bull frogs (*Rana catesbiana*) (Scheerer and McDonald 2000). The population was estimated at 320 fish in 2002 (Scheerer et al. 2003).

Fifteen Oregon chub were introduced into Menear's Bend Pond in 2000. The site is a small series of beaver ponds on Corps land upstream of Foster Reservoir on a small unnamed tributary to the South Santiam River; 29 chub were captured at the site in 2002 (Scheerer et al. 2003). Water levels were very low at this pond in 2001, which may have contributed to the low numbers.

Middle Fork Willamette Subbasin. The Middle Fork Willamette River Subbasin supports the largest number of Oregon chub populations, as well as the most abundant populations. Oregon chub are currently known to persist at 13 locations in the subbasin: Fall Creek Spillway Pond, East Fork Minnow Creek Pond, Elijah Bristow State Park (two sites), Hospital Pond, Buckhead Creek Enhancement Ponds, Shady Dell Pond, Dexter Reservoir Alcoves (two sites), Oakridge Slough, Wicopee Pond, Rattlesnake Creek, and Barnhard Slough. Reintroductions have been conducted at four sites (i.e., Fall Creek Spillway, Wicopee, East Ferrin and West Ferrin). Surveys by ODFW between 1992 and 2002 have found Oregon chub populations in the Middle Fork Willamette River to be generally stable or increasing in abundance (Scheerer et al. 2002).

The Buckhead Creek Enhancement Ponds consist of three shallow, off-channel ponds with surface areas of 300-500 m2 each. The ponds were created by the WNF in 1998 to increase the amount of off-channel habitat available to Oregon chub in the Middle Fork Willamette drainage. The ponds are connected to Buckhead Creek in high flow events, but are not affected by flows in the Middle Fork. In 2001, surveys detected 1,230 chub in the middle pond, 200 chub in the lower pond, and no chub in the upper pond (Scheerer et al. 2002).

Shady Dell Pond is on a small tributary to the Middle Fork between Hills Creek and Lookout Point. The population in 2002 was estimated at 2,420 Oregon chub (Scheerer et al. 2003). There is not likely to be any effect of flow regime in the Middle Fork on chub habitat in Shady Dell Pond.

The Oregon chub habitat at Oakridge Slough has connections to the Middle Fork Willamette River at both upstream and downstream ends. There may also be a subsurface connection to the river. Surveys in 2002 found just 9 Oregon chub at the site (Scheerer et al. 2003).

Barnhard Slough is downstream of Oakridge on the Middle Fork, between Hills Creek and Lookout Point Reservoirs. Only two chub were found at the site in 2002 (Scheerer et al. 2003). The slough is a backwater area with upstream and downstream connections to the Middle Fork, and may also be affected by the flow regime in the Middle Fork via subsurface connections.

Hospital Pond is a 1-acre pond created when Lookout Point reservoir fills and backs water into a depression above Forest Road 5821 (County Road 360) through a culvert. The pond elevation is maintained at the existing reservoir elevation. The pond also receives water from a spring that appears to be associated with nearby Hospital Creek; the inflow is reported to be perennial and was estimated to be a few cubic feet per second in March 2001. When full, the pond is approximately 16 ft deep, with shallower areas around the margins and a large bench at elevation 922 ft. Typically, the reservoir and pond fill in late May and water elevations begin to drop in early to mid-July, depending on downstream water needs and inflow.

In the winter, when Lookout Point is lowered to provide flood storage, the water in Hospital Pond is maintained at the top of the culvert (elevation 917 ft) by a small check dam below the culvert outflow. Surface acreage is much reduced, but the pond depth is maintained at approximately eight feet at it deepest point throughout the winter.

Since 2001, Corps has been attempting to protect the Oregon chub spawning habitat in Hospital Pond by decoupling the water level in Hospital Pond from the level in Lookout Point Reservoir. The goal is to allow Lookout Point to be drafted to meet downstream flow objectives without regard to chub spawning needs in the pond. So far, several projects have had some beneficial effect on the pond, but have not completely succeeded in making Hospital Pond's hydrology independent of the reservoir.

Since 1993, ODFW has conducted surveys for Oregon chub at Hospital Pond. The population has ranged from a low of 690 individuals in 1993 to a high of 3,160 individuals in 1996, and is thought to be stable at around 3,000 fish (Scheerer et al. 2002). The population was estimated at 2,130 individuals in the 2002 survey (Scheerer et al. 2003). Data from ODFW have shown that in years when the reservoir does not fill, Oregon chub reproduction in Hospital Pond fails because the benches which provide spawning habitat are not submerged. The reservoir did not fill in 1992 and 1994, which resulted in year class failures (Scheerer and McDonald 2000). A diversity of other native fishes have been collected in Hospital Pond [sculpins (*Cottus* sp.), dace (*Rhinichthys* sp.), redside shiner (*Richardsonius balteatus*), Northern pikeminnow (*Ptychocheilus oregonensis*) and largescale sucker (*Catostomus macrocheilus*)], but no non-native species have been found in the pond.

The Oregon chub at Hospital Pond are consistently larger in size than other populations in the vicinity, despite lower than average water temperatures (Scheerer and McDonald

2000), suggesting that this population may be genetically unique, or that the pond is unusually productive. Preservation of this population is a high priority for the resource agencies involved in chub recovery.

Oregon chub have been found in alcoves and ponds on the south side of Dexter Reservoir. These sites are connected to the reservoir by culverts; water levels in the coves fluctuate with the height of the reservoir, and may vary by as much as five feet in elevation in a day. As the reservoir is drawn down for flood control in winter, or only partially filled in the spring and summer, these coves become inhospitable to chub. The survival of chub in the main body of the reservoir is probably very low since food, vegetative cover and other refugia are practically non-existent. Introduced predators, and lack of cover and breeding habitat combine to create a hostile environment for chub in the reservoir.

The Oregon chub population in East Fork Minnow Creek Pond numbered 3,270 in 2002 (Scheerer et al. 2003). The site is a beaver pond near Lookout Point Reservoir; it is not affected by changing reservoir levels, as the pond is perched above the level of the full pool, and the culvert that connects Minnow Creek with the reservoir is impassable to the upstream movement of fish from the reservoir (Scheerer and McDonald 2000).

There is a very small population of Oregon chub in Rattlesnake Creek (only two chub were found in 2002)(Scheerer et al. 2003). Rattlesnake Creek is a tributary that enters the Middle Fork below Dexter Dam; flow regime in the Middle Fork has no effect on chub habitat in this population.

Oregon chub have been found in several ponds at Elijah Bristow State Park on the Middle Fork Willamette River below Dexter Dam. The populations in Berry Slough and the Northeast Backwater do not appear to be directly affected by flows in the Middle Fork, although there may be a subsurface connection. These populations have been stable or increasing; surveys in 2002 estimated 4,910 chub in Berry Slough, and 940 chub in the Northeast Backwater (Scheerer et al. 2003). A small number of chub were found in the gravel pits at the park about five years ago; these ponds appear to be very sensitive to the flow levels in the Middle Fork Willamette River. In 2001, releases from Dexter fell below 1100 cfs, which resulted in the water level in one of the chub ponds falling to less than 0.25 m. The Corps worked closely with ODFW and the Service to monitor the water levels in the chub ponds as flows from Dexter dropped, but these populations appear to have been extirpated (Scheerer et al. 2002).

Recent surveys of the introduced populations in the Middle Fork Subbasin found robust populations in Fall Creek Spillway Pond (6,370 chub) and Wicopee Pond (2,410 chub)(Scheerer et al. 2003). The Fall Creek Spillway Pond was formed by a beaver dam that blocks the spillway overflow channel, and has been in existence for over 10 years. The pond has high quality habitat (Scheerer and McDonald 2000).

Wicopee Pond was the site of a 1988 introduction of 50 Oregon chub. The pond is a former borrow pit adjacent to Salt Creek in the Middle Fork Willamette drainage. Few chub were found between 1992 and 1999, but in 2000, the population increased dramatically to over 4,000 individual (Scheerer et al. 2003).

Not all introductions have fared as well as Fall Creek Spillway Pond and Wicopee Pond. East Ferrin Pond and West Ferrin Ponds were treated with Rotenone to remove non-native fishes in 1993. In 1994, Oregon chub were introduced to the ponds. West Ferrin Pond did not succeed as a reintroduction site, and no chub have been found in the pond. East Ferrin Pond had a population of approximately 7,200 Oregon chub in 1997; surveys in 2000 and 2001 found no chub in the pond, and the population is presumed to be extirpated (Scheerer et al. 2002). The decline of chub in East Ferrin Pond occurred in concert with the increase of largemouth bass, a non-native predatory fish at the site, which illustrates the threat of non-native fishes to Oregon chub (Scheerer and McDonald 2000).

Coast Fork Willamette Subbasin. Oregon chub are known from two sites in the Coast Fork subbasin. Surveys in 1992 and 1993 found very low numbers of chub in poor quality habitat in Camas Swale; subsequent surveys have failed to detect any chub at all (Scheerer and McDonald 2000). In April 2002, surveys by the Oregon Department of Transportation and ODFW found a few Oregon chub in side channels of the mainstem Coast Fork at RM 16, upstream of Camas Swale. The habitat at the site is influenced by releases out of both Dorena and Cottage Grove Reservoirs. The site has abundant non-native fishes.

Upper Mainstem Willamette River Subbasin. Oregon chub occur at three sites in the Upper Mainstem Willamette subbasin: Gray Swamp and Display Pond in the Muddy Creek drainage at William L. Finley National Wildlife Refuge, and the Dunn Wetland Ponds in the Beaver Creek drainage. The population at Gray Creek Swamp has been declining for the last three years; in 2002, the population was estimated at 290 (Scheerer et al. 2003). The Display Pond population is the result of an introduction in 1998; numbers of chub there have decreased from 1,750 fish in 2000 to 500 in 2002 (Scheerer et al. 2003). In 1997, Oregon chub were introduced into the Dunn Wetland Ponds in the Beaver Creek drainage, with the permission of the private landowner (Scheerer et al. 1998). The project included a large wetland restorations and construction of a spring-fed pond (Scheerer et al. 2003). In 2002, this was the most abundant population in the Willamette Valley; the estimated number of Oregon chub in the wetlands was 19,270 (Scheerer et al. 2003).

Threats. A variety of factors are likely responsible for the decline of the Oregon chub. These include habitat loss and alteration; the proliferation of non-native fish and amphibians; accidental chemical spills; runoff from herbicide or pesticide application on farms and timberlands or along roadways, railways, and power line rights-of way; the application of rotenone to manage sport fisheries; desiccation of habitats; unauthorized water withdrawals, diversions, or fill and removal activities; sedimentation resulting from timber harvest in the watershed, and possibly the demographic risks that result from a fragmented distribution of small, isolated populations (USFWS 1998).

The decline of Oregon chub has been correlated with the construction of dams. Based on the date of last capture at a site, Pearsons (1989) estimated that the most severe decline occurred during the 1950s and 1960s. Ten of the 13 dams that make up the Willamette Valley flood control system were completed between 1953 and 1969 (USACE 2000). Other structural changes along the Willamette River corridor such as revetment and channelization, diking and drainage, and the removal of floodplain vegetation have eliminated or altered the slack water habitats of the Oregon chub (Willamette Basin Task Force 1969, Hjort et al. 1984, Sedell and Froggatt 1984, Li et al. 1987). Channel confinement, isolation of the Willamette River from the majority of its floodplain, and elimination or degradation of both seasonal and permanent wetland habitats within the floodplain began as early as 1872 and, for example, has reduced the 25 kilometer (15.5 mile) reach between Harrisburg and the McKenzie River confluence from over 250 kilometers (155 miles) of shoreline in 1854 to less than 64 kilometers (40 miles) currently (Sedell and Froggatt 1984, Sedell et al. 1990).

The establishment and expansion of non-native species in Oregon have contributed to the decline of the Oregon chub and limits the species' ability to expand beyond its current range. Many species of non-native fish have been introduced to, and are common throughout, the Willamette Valley, including largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), crappie (*Pomoxis* sp.), bluegill (*Lepomis macrochirus*), and western mosquitofish (*Gambusia affinis*). The bullfrog (*Rana catesbiana*), a non-native amphibian, also occurs in the valley and breeds in habitats preferred by the Oregon chub (Willamette Basin Task Force 1969, Hjort et al. 1984, Li et al. 1984, Scheerer et al. 1992). The period of severe decline of the Oregon chub does not coincide well with the initial dates of introduction of nonindigenous species. However, many sites formerly inhabited by the Oregon chub are now occupied by non-native species (Markle et al. 1991). Currently, 25 sites are known to contain Oregon chub; over half of these sites are also inhabited by non-native fishes or amphibians (Scheerer and McDonald 2000). Since 1995, non-native fish have been discovered for the first time in six locations containing Oregon chub; the Oregon chub populations have subsequently declined or remained in low abundance in all of these sites. The 1996 flooding in the Santiam River was probably responsible for three of these movements of non-native fish. The other three sites, located in the Middle Fork Willamette River drainage, were likely the result of unauthorized introductions or spread of non-native fish from reservoirs (Scheerer and Jones 1997). Because all remaining population sites are easily accessible, there also continues to be a potential for unauthorized introductions of non-native species, particularly mosquitofish and game fishes such as bass and walleye (*Stizostedion vitreum*).

Many of the known extant populations of Oregon chub occur near rail, highway, and power transmission corridors and within public park and campground facilities. These populations are threatened by chemical spills from overturned truck or rail tankers; runoff or accidental spills of vegetation control chemicals; overflow from chemical toilets in campgrounds; sedimentation of shallow habitats from construction activities; and changes in water level or flow conditions from construction, diversions, or natural desiccation (USFWS 1998). In the early 1990s, a train derailment on the railroad line that parallels the Middle Fork Willamette River spilled methanol near the Minnow Pond population of Oregon chub; the methanol burned and did not contaminate the chub's habitat, yet this incident illustrates the risk to Oregon chub populations along transportation corridors (USFWS 2003c). Oregon chub populations near agricultural areas are subject to poor water quality as a result of runoff laden with sediment, pesticides, and nutrients. Logging in the watershed can result in increased sedimentation and herbicide runoff.

Population dynamics. The current pattern of distribution and abundance of Oregon chub populations reflects the fundamental alteration in the natural processes under which the species evolved. Sites with Oregon chub can be categorized as having high or low connectivity to the Willamette and its tributaries; those sites with low connectivity tend to have large populations of chub and fewer species of non-native fish (Scheerer et al. 2002). Thus, Oregon chub now thrive only in habitats that are isolated and bear little resemblance to the species' dynamic natural environment. Efforts to restore floodplain function and connectivity may facilitate the introduction of non-native fishes into isolated habitats, which could have devastating effects to populations of Oregon chub (Scheerer 2002).

<u>Bull trout (*Salvelinus confluentus*)</u>

Background. Detail accounts of life history, taxonomy and behavior can be found in the final rule listing the Columbia River and Klamath River populations of bull trout as threatened (63 FR 31647), the proposal to designate critical habitat for the bull trout (67 FR 71235), and the Status of Oregon's Bull Trout; Distribution, Life History, Limiting Factors, management Considerations, and Status (Buchanan et al. 1997).

Historic Range. The historical range of the bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, Bond 1992). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada, (Cavender 1978, Brewin *et al.* 1997).

Distinct Population Segments (DPS) and Population Units. Population units of bull trout exist in which all fish share an evolutionary legacy and which are significant from an evolutionary perspective (Spruell *et al.* 1999). These population units can range from a local population to multiple populations, and theoretically should represent a DPS. Although such population units are difficult to characterize, genetic data have provided useful information on bull trout population structure. For example, genetic differences between the Klamath River and Columbia River populations of bull trout were revealed in 1993 (Leary *et al.* 1993). The boundaries of the five listed DPSs of bull trout are based largely on this 1993 information.

Since the bull trout was listed, additional genetic analyses have suggested that its populations may be organized on a finer scale than previously thought. Data have revealed genetic differences between coastal populations of bull trout, which includes the lower Columbia River and Fraser River, and inland populations in the upper Columbia River and Fraser River drainages (Williams *et al.* 1997, Taylor *et al.* 1999). There is also an apparent genetic differentiation between inland populations within the Columbia River basin. This differentiation occurs between the (a) mid-Columbia River (John Day, Umatilla) and lower Snake River (Walla Walla, Clearwater, Grande Ronde, Imnaha rivers, etc.) populations and the (b) upper Columbia River (Methow, Clark Fork, Flathead River, etc.) and upper Snake River (Boise River, Malheur River, Jarbidge River, etc.) populations (Spruell *et al.* 2003). Genetic data indicate that bull trout inhabiting the Deschutes River drainage of Oregon are derived from coastal populations and not from inland populations in the Columbia River basin (Leary *et al.* 1993, Williams *et al.* 1997, Spruell and Allendorf 1997, Taylor *et al.* 1999, Spruell *et al.* 2003). In general, evidence since the time of listing suggests a need to further evaluate the distinct population segment structure of bull trout DPSs.

Habitat Relationships. Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman *et al.*1997).

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman *et al.* 1997). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1995).

Spawning areas are often associated with cold-water springs, groundwater infiltration, and the streams with the coldest summer water temperatures in a given watershed (Pratt 1992, Rieman and McIntyre 1993, Rieman *et al.* 1997, Baxter *et al.* 1999). Water temperatures during spawning generally range from 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) (Goetz 1989). The requirement for cold water during egg incubation has generally limited the spawning distribution of bull trout to high elevations in areas where the summer climate is warm. Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1613 m (5000 feet). Similarly, in the Sprague River basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that "numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1774 m [5500 feet]."

Goetz (1989) suggested optimum water temperatures for rearing bull trout of about 7 to 8 degrees Celsius (44 to 46 degrees Fahrenheit) and for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit). For Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water [8 to 9 degrees Celsius (46 to 48 degrees Fahrenheit), within a temperature gradient of 8 to 15 degrees Celsius (46 to 60 degrees Fahrenheit)] available in a plunge pool.

In Nevada, adult bull trout have been collected at sites with a water temperature of 17.2 degrees Celsius (63 degrees Fahrenheit) in the West Fork of the Jarbidge River (S. Werdon, *pers. comm.*, 1998) and have been observed in Dave Creek where maximum daily water temperatures were 17.1 to 17.5 degrees Celsius (62.8 to 63.6 degrees Fahrenheit) (Werdon, *in litt.* 2001). In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 20 degrees Celsius (68 degrees Fahrenheit); however, these fish made up less than 50percent of all salmonids when maximum summer water temperature exceeded 15 degrees Celsius (59 degrees Fahrenheit) and less than 10 percent of all salmonids when temperature exceeded 17 degrees Celsius (63 degrees Fahrenheit)(Gamett 1999).

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). In the Swan River, Montana, abundance of bull trout redds was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter *et al.* 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, M. Gilpin, *in litt.* 1997, Rieman *et al.* 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

Threats. Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992, Schill 1992, Thomas 1992, Ziller 1992, Rieman and McIntyre 1993, Newton and Pribyl 1994, Idaho Department of Fish and Game *in litt.* 1995, McPhail and Baxter 1996). These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta *et al.* 1987, Chamberlain *et al.* 1991, Furniss *et al.* 1991, Meehan 1991, Nehlsen *et al.* 1991, Sedell and Everest 1991, Craig and Wissmar 1993, Henjum *et al.* 1994, McIntosh *et al.* 1994, Wissmar *et al.* 1994, MBTSG 1995a-e, 1996a-f; Light *et al.* 1996, USDA and USDI 1995, 1996, 1997; Frissell 1997)

Population Dynamics. Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders *et al.* 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, Dunham and Rieman 1999, Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman *et al.* 1997, Dunham and Rieman 1999, Spruell *et al.* 1999, Rieman and Dunham 2000). Accordingly, human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000). Recent research (Whiteley *et al.* 2003) does, however, provide stronger genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River basin of Idaho.

Ongoing Conservation Actions

Federal Conservation Actions. Federal conservation actions include: (1) the development of a draft *Bull Trout Recovery Plan*; (2) ongoing implementation of the *Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California* (PACFISH; USDA and USDI 1995) and the *Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada* (INFISH; USDA 1995); (3) ongoing implementation of the Northwest Forest Plan; (4) ongoing implementation of the Northwest Power and Conservation Council Fish and Wildlife Program targeting subbasin planning; (5) ongoing implementation of the Federal Caucus Fish and Wildlife Plan; and, (6) ongoing implementation of Department of Agriculture Conservation Reserve Programs.

State Conservation Actions. Since 1990, the State of Oregon has taken several actions to address the conservation of bull trout, including: (1) Establishing bull trout working groups in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek river basins for the purpose of developing bull trout conservation strategies; (2) establishment of more restrictive harvest regulations in 1990; (3) reduced stocking of hatchery-reared rainbow trout and brook trout into areas where bull trout occur; (4) angler outreach and education efforts are also being implemented in river basins occupied by bull trout; (5) research to further examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon; (6) reintroduction of bull trout fry from the McKenzie River watershed to the adjacent Middle Fork of the Willamette River, which is historical unoccupied, isolated habitat; (7) the ODEQ established a water temperature standard such that surface water temperatures may not exceed 10 degrees Celsius (50 degrees Fahrenheit) in waters that support or are necessary to maintain the viability of bull trout in the State (Oregon 1996); and, (8) expansion of the Oregon Plan for Salmon and Watersheds (Oregon 1997) to include all at-risk wild salmonids throughout the State.

Conservation Needs. Conservation needs reflect those biological and physical requirements of a species for its long-term survival and recovery. Based on the best available scientific information (Rieman and McIntyre 1993, MBTSG 1998, Hard 1995, Healey and Prince 1995, Rieman and Allendorf 2001), the conservation needs of the bull trout are to: (1) Maintain and restore multiple, interconnected populations in diverse habitats across the range of each DPS; (2) Preserve the diversity of life-history strategies (e.g., resident and migratory forms, emigration age, spawning frequency, local habitat adaptations); (3) Maintain genetic and phenotypic diversity across the range of each DPS; and, (4) Protect populations from catastrophic fires across the range of each DPS. Each of these needs is described below in more detail.

Maintain and Restore Multiple, Interconnected Populations in Diverse Habitats Across the Range of Each DPS. Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Rieman and McIntyre 1993, Hard 1995, Healey and Prince 1995, Spruell et al. 1999, Rieman and Allendorf 2001). Current patterns in bull trout distribution and other empirical evidence, when interpreted in view of emerging conservation theory, indicate that further declines and local extinctions are likely (Rieman et al. 1997, Dunham and Rieman 1999, Rieman and Allendorf 2001, Spruell et al. 2003). Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than five local populations are at increased risk of extirpation; core areas with between 5 to 10 local populations are at intermediate risk of extirpation; and core areas which have more than 10 interconnected local populations are at diminished risk of extirpation.

Maintaining and restoring connectivity between existing populations of bull trout is important for the persistence of the species (Rieman and McIntyre 1993). Migration and occasional spawning between populations increases genetic variability and strengthens population variability (Rieman and McIntyre 1993). Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbances (Saunders et al. 1991).

Because bull trout in the coterminous United States are distributed over a wide geographic area consisting of various environmental conditions, and because they exhibit considerable genetic differentiation among populations, the occurrence of local adaptation is expected to be extensive. Some readily observable examples of differentiation between populations include external morphology and behavior (e.g., size and coloration of individuals; timing of spawning and migratory forays). Conserving many populations across the range of the species is crucial to adequately protect genetic and phenotypic diversity of bull trout (Leary *et al.* 1993, Rieman and McIntyre 1993, Hard 1995, Healey and Prince 1995, Spruell *et al.* 1999, Taylor *et al.*1999, Rieman and Allendorf 2001). Changes in habitats and prevailing environmental conditions are increasingly likely to result in extinction of bull trout if genetic and phenotypic diversity is lost.

Preserve the Diversity of Life-history Strategies. The bull trout has multiple life history strategies, including migratory forms, throughout its range (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1997). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem of the Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1997, Rieman and McIntyre 1993, MBTSG 1998).

Maintain the Genetic Diversity and Evolutionary Potential of Bull Trout Populations. When the long-term persistence of a species, taxon, or phylogenetic lineage is considered, it is necessary to consider the amount of genetic variation necessary to uphold evolutionary potential which is needed for that taxon to adapt to a changing environment. Effective population size provides a standardized measure of the amount of genetic variation that is likely to be transmitted between generations within a population. Effective population size is a theoretical concept that allows one to predict potential future losses of genetic variation within a population due to small population size and genetic drift. Individuals within populations with very small effective population sizes are also subject to inbreeding depression because most individuals within small populations share one or more immediate ancestors (parents, grandparents, etc.) after only a few generations and will be closely related.

The effective population size parameter (N_e) incorporates relevant demographic information that determines the evolutionary consequences of members in a population contributing to future generations (Wright 1931). When prioritizing populations for conservation, N_e is an important parameter because it is inversely related to the rate of loss of genetic diversity and the rate of increase in inbreeding in a population that is finite, but otherwise randomly mating (Waples 2002). Within a population, the census number of sexually mature adults per generation (N) and N_e are the same when the following conditions are met: constant and large population size, variance in reproductive success is binomial (number of progeny per parent follows a Poisson distribution), and sex ratio is equal. Because most populations do not conform to these conditions, the N_e to N ratio is usually below 1.0 (Frankham 1995), and the N_e to N ratio is thought to be between 0.15 and 0.27 in bull trout populations based on computer modeling (Rieman and Allendorf 2001).

A N_e of 50 or more is recommended to avoid the immediate effects of inbreeding and should be considered a minimum requirement for the short-term conservation of populations (Franklin 1980, Soulé 1987). Increased homozygosity of deleterious recessive alleles is thought to be the main mechanism by which inbreeding depression decreases the fitness of individuals within local populations (Allendorf and Ryman 2002). Deleterious recessive alleles are introduced into the genome via random mutations, and natural selection is slow to purge them because they are usually found in the heterozygous form where they are not detrimental. When populations become small, heterozygosity decreases at the rate of $1/(2\ N_e)$ per generation which in turn causes an increase in the frequency of homozygosity of the deleterious recessive alleles. Hedrick and Kalinowski (2000) provide a review of studies demonstrating inbreeding depression in wild populations.

Effective population sizes of 500 to 5000 have been recommended for the retention of evolutionary potential (Franklin and Frankham 1998, Lynch and Lande 1998). Populations of this size are able to retain additive genetic variation for fitness related traits gained via mutation (Franklin 1980).

Bull trout specific benchmarks have been developed concerning the minimum N_e necessary to maintain genetic variation important for short-term fitness and long-term evolutionary potential. These benchmarks are based on the results of a generalized, age-structured, simulation model, VORTEX (Miller and Lacy 1999), used to relate effective population size to the number of adult bull trout spawning annually under a range of life histories and environmental conditions (Rieman and Allendorf 2001). In this study, the authors estimated N_e for bull trout to be between 0.5 and 1.0 times the mean number of adults spawning annually. Rieman and Allendorf (2001) concluded that an average of 100 (i.e., 100 x 0.5 = 50) adults spawning each year would be required to minimize risks of inbreeding in a population and 1000 adults (i.e., 1000 x 0.5 = 500) is necessary to maintain genetic variation important for long-term evolutionary potential. This latter value of 1000 spawners may also be reached with a collection of local populations among which gene flow occurs.

The combination of resident forms completing their entire life cycle within a stream and the homing behavior of the migratory forms returning to the streams where they hatched to spawn promotes reproductive isolation among local bull trout populations. This reproductive isolation creates the opportunity for genetic differentiation and local adaptations to occur. Nevertheless, within a core area local populations are usually connected through low rates of migration. This connection of local populations, linked by migration, is termed a metapopulation (Hanski and Gilpin 1997). Within a metapopulation, evolution primarily occurs at the local population level (i.e., it is the main demographic and genetic unit of concern). However, when longer time frames are considered (e.g., 10 plus generations), metapopulations become important. For example, metapopulations allow for the reintroduction of lost alleles and recolonization of extinct local breeding populations. Migration and gene flow among local populations ensures that the alleles within a metapopulation will be present in most local breeding populations and can be acted upon by natural selection (Allendorf 1983).

Maintain Phenotypic *Diversity.* Healy and Prince (1995) reported that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the sub-population within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). Healy and Prince (1995) conclude that while the loss of a few sub-populations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial. This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data; in other words, phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers. Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species (or DPSs). Reflecting this theme, the maintenance of local sub-populations has been specifically emphasized as a mechanism for the conservation of bull trout (Rieman and McIntyre 1993, Taylor et al 1999).

Proposed critical habitat. The USFWS proposed critical habitat for the bull trout (67 FR 71235) and anticipates completing this process by end of September 2004. The primary constituent elements of proposed bull trout critical habitat include:

1) Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.

2) Water temperatures ranging from 2 to 15C (36 to 59F), with adequate thermal refugia available for temperatures at the upper end of this range.

3) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and in stream structures.

4) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in)

in diameter and minimal substrate embeddedness are characteristic of these conditions.

5) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.

6) Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.

7) Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

8) Abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

9) Few or no predatory, interbreeding, or competitive nonnative species present.

Fender's blue butterfly (*Icaricia icarioides fenderi*)

Background. A detailed account of the taxonomy, life history and ecology of the Fender's blue butterfly can be found in the final rule listing the species as endangered (65 FR 3875).

Current and Historical Range. Fender's blue butterfly is a Willamette Valley endemic subspecies that was considered to be extinct until rediscovered by Dr. Paul Hammond in 1989 in McDonald Forest, Benton County, Oregon. The historical distribution of Fender's blue butterfly is not precisely known, due to the limited information collected on this species prior to its description in 1931. Recent surveys have determined that Fender's blue butterfly is confined to 33 habitat patches in Yamhill, Polk, Benton, and Lane counties, Oregon. One population at Willow Creek Nature Conservancy preserve in Eugene, Lane County, Oregon is found in wet Deschampsia-type prairie, while the remaining sites are generally found on drier upland prairies characterized by fescue species. The Willow Creek aggregate of populations is the largest of the south valley sites.

Habitat Relationships. Fender's blue butterfly is known to use Kincaid's lupine as its primary larval food plant but is also known to use spur lupine *(Lupinus laxiflorus = L. arbustus)* and sickle-keeled lupine *(L. albicaulis*) as secondary host plants. Female Fender's blue butterfly lay their eggs on lupine foliage in late May or early June; and larvae emerge to feed on foliage during late June. In July, larvae crawl to the base of the plant and enter diapause. From this point until the larvae emerge and begin feeding on foliage again the following April, the larvae remain at the base of the senescent plant, or in the litter immediately adjacent to the lupine stem. Fender's density has been positively correlated with the number of Kincaid's lupine flowering racemes, and more recently, to nectar production in native flowering species used as nectar sources by Fender's. Survivorship of larvae to adult butterflies has been estimated at 0.025-0.060 percent (Schultz and Crone 1998).

Recent research (Schultz and Dlugosh in litt. 1999) indicates that native wildflowers in the Willamette Valley prairies provide more nectar than nonnative flowers for adult butterflies, and that Fender's blue butterfly population density is positively correlated with the density of native wildflowers. In Lane County, key native flowers include: wild onion, (*Allium amplectans*), cat's ear mariposa lily (*Calachortus tolmiei*), common camas (*Camassia quamash*), Oregon sunshine (*Eriophyllum lanatum*), and rose checkermallow (*Sidalcea virgata)* (Schultz and Dlugosh in litt. 1999). Tall oatgrass (*Arrenatherum elatius*) and other non-native grasses can out-compete these native forb species (Hammond 1996). The abundance of exotic grasses can effectively preclude butterflies from using a Kincaid's lupine patch (Hammond 1996).

Habitat Connectivity. Anecdotal evidence indicates that under ideal conditions adult Fender's blue butterflies may disperse as far as 5-6 km (3.1 to 3.7 mi) from their natal lupine patches (Hammond and Wilson 1992; and Schultz 1994). According to Schultz (1997), adult dispersal of this magnitude is not likely anymore. Schultz (1997) found that the butterflies are generally found within 10 m (32.8 ft) of lupine patches, although they might disperse more than 2 km (1.2 mi) between lupine patches. Hammond (1998) reports recolonization of a site by Fender's blue butterfly from a distance of approximately 3 km (1.9 mi). Schultz (1997) further theorizes that Fender's blue originally would have had a high probability of dispersing between patches, which were historically located an average of 0.5 km (0.3 mi) apart. Current distribution of lupine patches range well beyond this distance, and barriers to migration between close sites may be present.

Today, remnant upland prairie acreage is extremely fragmented and remaining Fender's blue butterfly populations so small that migration processes are not expected to maintain the population over time. Extirpation of remaining small populations is expected from localized events and low genetic diversity of very small populations. The low availability of host lupine patches and fragmentation of habitat are seen today as the major ecological factors limiting reproduction, dispersal, and subsequent colonization of new habitat (Hammond 1994, Hammond and Wilson 1993 &1992, Schultz 1997, Schultz and Dugosch 1999),

Kincaid's lupine. Kincaid's lupine is a perennial forb generally associated with native fescue upland prairies that are characterized by heavier soils, with mesic to slightly xeric soil moisture levels. At the southern limit of its range, the subspecies occurs on well-developed soils adjacent to serpentine outcrops where the plant is often found under scattered oaks (Kuykendall and Kaye 1993). Kincaid's lupine is thought to have historically colonized areas along the edge of oak woodlands in upland prairies. Schultz (1997) theorizes that lupine patches were historically distributed no greater than 0.5 km (0.3 mi) apart, allowing dispersal of Fender's blue butterfly between lupine patches.

Within the Willamette Valley, Kincaid's lupine occupies 86 habitat patches averaging 1.395 km2 (0.539 mi2) in size. In the Umpqua Valley, Douglas County, Oregon, Kincaid's lupine occupies eight small patches, averaging 0.057 km2 (0.022 mi2) in size, and in Lewis County, Washington, three tiny patches, averaging 0.002 km2 (0.0008 mi2) in size.

Population Dynamics. Censuses of Fender's blue butterfly were started in 1991; most of the 22 census units have been surveyed every year since 1993 (Fitzpatrick and Schultz 2001, Hammond 2001, 1998, 1996 and 1994, Hammond and Wilson 1993, Schultz 1994-1998).

Total range-wide population numbers (once most sites were monitored) of Fender's blues have ranged from a low of 1,384 in 1998 to a high in 2000 of 3,492. Although population size appears to have increased between 1998 and 2000, this could be a result of poor weather conditions in 1998, and thus poor flight conditions, and it could also be an artifact of increasing survey effort at these sites. However, some of this increase may be attributed to habitat enhancement activities such as tree and shrub removal from lupine sites.

The USFWS is currently developing a recovery plan for the suite of listed species associated with Willamette Valley prairie habitat, including Fender's blue butterfly.

Anadromous Salmonids

Snake River (SR) Spring/Summer Chinook salmon. It is estimated that at least 1.5 million spring/summer Chinook salmon returned to the SR in the late 1800s, approximately 39 to 44 percent of all spring/summer Chinook in the Columbia River basin. Historically, Shoshone Falls (RM 615) was the uppermost limit to spring/summerChinook migration, and spawning occurred in virtually all suitable and accessible habitat in the SR basin (Fulton 1968 and Matthews and Waples 1991). The development of mainstem irrigation and hydroelectric projects in the mainstem SR basin have significantly reduced the amount of habitat available for spring/summerChinook such that between 1950 and 1960, an average of 125,000 adults returned to the SR, only 8 percent of the historic estimate. An estimated average of 100,000 wild adults would have returned from 1964 to 1968 each year after adjusting for fish harvested in the river fisheries below McNary Dam. However, actual counts of wild adults at Ice Harbor Dam annually averaged only 59,000 each year from 1962 to 1970. The estimated number of wild adult Chinook salmon passing Lower Granite Dam between 1980 and 1990 was 9,674 fish (Matthews and Waples 1991). A recent 5-year geometric mean (1992-1996) was only 3,820 naturally-produced spawners (Myers *et al.* 1998). This is less than 0.3 percent of the estimated historical abundance of wild SR spring/summerChinook.

SR spring/summerChinook migrate through the Columbia River from March through July, and spawn in smaller, higher elevation streams than do fall Chinook. Fry generally emerge from the gravel between February and June. SR spring/summerChinook exhibit a "stream" type juvenile life history pattern, rearing for one, or sometimes even two years in freshwater before migrating to the ocean from April through June. These smolts are often referred to "yearling" Chinook. Adults typically remain in the ocean for two or three years before returning to spawn (Matthews and Waples 1991).

Snake River Basin (SRB) steelhead. Historically, SRB steelhead spawned in virtually all accessible habitat in the SR up to Shoshone Falls (RM 615). The development of irrigation and hydropower projects on the mainstem SR have significantly reduced the amount of available habitat for this species (see discussion for spring/summerChinook, above). No valid historical estimates of adult steelhead returning to the SR basin before the completion of Ice Harbor Dam in 1962 are available. However, SRB steelhead sportfishing catches ranged from 20,000 to 55,000 fish during the 1960s (Fulton 1970). The run of steelhead was likely several times as large as the sportfish take. Between 1949 and 1971, adult steelhead counts at Lewiston Dam (on the Clearwater River) averaged about 40,000 per year. The count at Ice Harbor Dam in 1962 was 108,000 and averaged approximately 70,000 per year between 1963 and 1970.

A recent 5-year geometric mean (1990-1994) for escapement above Lower Granite Dam was approximately 71,000. However, the wild component of this run was only 9,400 adults; 7,000 early run timing stock (A-run) and 2,400 late run timing stock (B-run). In recent years average densities of wild juvenile steelhead have decreased significantly for both A-run and B-run steelhead. Many basins within the SR are significantly under-seeded relative to the carrying capacity of streams (Busby *et al.* 1996).

Steelhead populations exhibit both anadromous (steelhead) and freshwater resident (rainbow or red-band trout) forms. Unlike other Pacific salmon species, steelhead are capable of spawning on more than one occasion, returning to the ocean to feed between spawning events. SRB steelhead rarely return to spawn a second time. Steelhead can be classified into two reproductive types: Stream-maturing steelhead, which enter fresh water in a sexually immature condition and wait several months before spawning; and ocean-maturing steelhead, which return to freshwater with fully developed gonads and spawn shortly thereafter. In the Pacific Northwest, stream-maturing steelhead enter fresh water between May and October and are referred to as "summer" steelhead. In comparison, ocean-maturing steelhead return between November and April and are considered "winter" steelhead. Inland steelhead populations in the Columbia River basin are almost exclusively of the summer variety (Busby *et al.* 1996).

SRB steelhead can be further divided into two groupings: A-run steelhead and B-run steelhead. This dichotomy reflects the bimodal migration of adult steelhead observed at Bonneville Dam. A-run steelhead generally return to fresh water between June and August after spending 1 year in the ocean. These fish are typically less than 77.5 cm in length. B-run steelhead usually return to fresh water from late August to October after spending 2 years in the ocean and are generally greater than 77.5 cm in length.

Both A-run and B-run spawn the following spring from March to May in small to mid-sized streams. The fry emerge in 7 to 10 weeks, depending on temperature, and usually spend 2 or 3 years in fresh water before migrating to the ocean from April to mid-June.

These estimates are based on population averages and steelhead are capable of remarkable plasticity with in their life cycles.

Lower Columbia River (LCR) Chinook salmon. The LCR Chinook salmon ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Cello Falls (inundated by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, Spring-run Chinook salmon found in the Klickitat River, or the introduced Carson spring-run Chinook salmon strain, are not included in this ESU. Spring-run Chinook salmon in the Sandy River have been influenced by spring-run Chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers *et al.* 1998). Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998a).

Historical records of Chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run Chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

Apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable naturally-spawned populations. All basins are affected (to varying degrees) by habitat degradation. Hatchery programs have had a negative effect on the native ESU. Efforts to enhance Chinook salmon fisheries abundance in the lower Columbia River began in the 1870s. Available evidence indicates a pervasive influence of hatchery fish on natural populations throughout this ESU, including both spring- and fall-run populations. The large number of hatchery fish in this ESU make it difficult to determine the proportion of naturally-produced fish. The loss of fitness and diversity within the ESU is an important concern. The median population growth rate over a base period from 1980 through 1998 ranged from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

Upper Willamette River (UWR) Chinook salmon. The UWR Chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. In the past, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Albiqua Creek. Although the total number of fish returning to the Willamette has been relatively high (24,000), about 4,000 fish now spawn naturally in the ESU, two-thirds of which originate in hatcheries. The McKenzie River supports the only remaining naturally-reproducing population in the ESU (ODFW 1998a).

There are no direct estimates of the size of the Chinook salmon runs in the Willamette basin before the 1940s. The Native American fishery at the Willamette Falls may have yielded 908,000 kilograms of salmon (454,000 fish, each weighing 9.08 kg) (McKernan and Mattson 1950). Egg collections at salmon hatcheries indicate that the spring Chinook salmon run in the 1920s may have been five times the run size of 55,000 fish in 1947, or 275,000 fish (Mattson 1948). Much of the early information on salmon runs in the upper Willamette River basin comes from operation reports of state and Federal hatcheries.

Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. The life history of Chinook salmon in the UWR ESU includes traits from both ocean- and stream-type development strategies. Tag recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More Willamette fish are, however, recovered in Alaskan waters than fish from the LCR ESU. UWR Chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs, however, recently most fish have matured at age 4. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the upper Willamette basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

While the abundance of UWR spring Chinook salmon has been relatively stable over the long term and there is evidence of some natural production, at present natural production and harvest levels the natural population is not replacing itself. With natural production accounting for only one-third of the natural spawning escapement, natural spawners may not be capable of replacing themselves even in the absence of fisheries. The introduction of fall-run Chinook into the basin and the laddering of Willamette Falls have increased the potential for genetic introgression between wild spring- and hatchery fall-run Chinook. Habitat blockage and degradation are significant problems in this ESU.

The median population growth rate over a base period from 1980 through 1998 ranges from 1.01 to 0.63, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

Columbia River (CR) chum salmon. Chum salmon of the CR ESU spawn in tributaries and in mainstem areas below Bonneville Dam. Most fish spawn on the Washington side of the Columbia River (Johnson *et al.* 1997). Previously, chum salmon were reported in almost every river in the lower Columbia River Basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). Currently, the Washington Department of Fish and Wildlife (WDFW) regularly monitors only a few natural populations in the basin, one in Grays River, two in small streams near Bonneville Dam, and the mainstem area next to one of the latter two streams. Recently, spawning has occurred in the mainstem Columbia River at two spots near Vancouver, Washington, and in Duncan Creek below the Bonneville Dam.

Historically, the CR chum salmon ESU supported a large commercial fishery in the first half of this century, landing more than 500,000 fish per year as recently as 1942.

Commercial catches declined beginning in the mid-1950s and in later years rarely exceeded 2,000 per year. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and Chinook salmon, and some tributaries have a minor recreational harvest (WDF *et al.* 1993). Observations of chum salmon still occur in most of the 13 basins/areas that were identified in 1951 as hosting chum salmon; however, fewer than 10 fish are usually observed in these areas. In 1999, the WDFW located another Columbia River mainstem spawning area for chum salmon near the I-205 bridge (WDFW 2000).

Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington. Genetic variability within and between populations in several geographic areas is similar, and populations in Washington show levels of genetic subdivision typical of those seen between summer- and fall-run populations in other areas, and are typical of populations within run types (Salo 1991, WDF *et al.* 1993, Phelps *et al.* 1994, Johnson *et al.* 1997).

The median population growth rate is 1.04 over a base period from 1980 through 1998 for the ESU as a whole (McClure *et al.* 2000). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NOAA Fisheries is unable to estimate the risk of absolute extinction for this ESU.

Southern Oregon/Northern California Coasts (SONC) coho salmon. This ESU includes all naturally-spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California. In the 1940s, estimated abundance of coho salmon in this ESU ranged from 150,000 to 400,000 naturally-spawning fish. Today, coho populations in this ESU are very depressed, currently numbering approximately 10,000 naturally-produced adults. Although the Oregon portion of the coho salmon SONC ESU has declined drastically, the Rogue River Basin's portion increased substantially from 1974 to 1997. The bulk of current coho salmon production in this ESU consists of stocks from the Rogue River, Klamath River, Trinity River, and Eel River in Oregon.

Most SONC coho salmon enter rivers between September and February and spawn from November to January (occasionally into early spring). For many small streams in California that have sand bars at their mouths for much of the year except in winter, immigration is influenced by river flow (Weitkamp *et al.* 1995). Coho salmon eggs incubate for 35 to 50 days between November and March, and start emerging from the gravel 2 to 3 weeks after hatching (Hassler 1987). Following emergence, fry move into shallow areas near the streambanks. As the fry grow larger, they disperse up- and downstream to establish and defend a territory (Hassler 1987). During the summer, fry prefer pools and riffles with adequate cover. Juveniles overwinter in large mainstem pools, backwater areas, and secondary pools with large woody debris and undercut banks.

Juveniles primarily eat aquatic and terrestrial insects. After rearing in freshwater for up to 15 months, smolts enter the ocean between March and June (Weitkamp *et al.* 1995).

Oregon Coast (OC) coho salmon. This ESU is found in coastal streams draining the coast Range Mountains between Cape Blanco and the Columbia River. Estimated escapement of coho salmon in coastal Oregon was about 1.4 million fish in the early 1900s, with harvests of nearly 400,000 fish. Abundance of wild OC coho salmon declined during the period from about 1965 to 1975, and has fluctuated at a low level since that time (Nickelson *et al.* 1992). Production potential (based on stock-recruit models) shows a reduction of nearly 50 percent in habitat capacity. Spawner abundance estimates for naturally-produced OC coho for the past 13 years ranged from a low of 16,510 in 1990, to a high of nearly 239,000 in 2002 (ODFW 2003b).

Most OC coho salmon enter rivers from late September to mid-October after the onset of autumn freshets. Thus, a delay in fall rains will retard river entry and perhaps spawn timing. Peak spawning occurs from mid-November to early February. Depending on water temperature, eggs incubate for 35 to 50 days and start emerging from the gravel 2 to 3 weeks after hatching (Nickelson *et al.* 1992).

After they emerge, fry move into shallow areas near the streambanks. Juvenile rearing usually occurs in low gradient tributary streams, although they may move up to streams of 4 or 5 percent gradient. Juveniles have been found in streams as small as 1- to 2-m wide. When the fry are approximately 4 cm in length, they migrate upstream considerable distances to reach lakes or other rearing areas. Coho salmon fry prefer backwater pools during spring. In the summer, juveniles are more abundant in pools than in glides or riffles. During winter, the fishes predominate in off-channel pools of any type. Rearing in freshwater, which may take up to 15 months, is followed by migration to the sea as smolts between February and June (Weitkamp *et al.* 1995).

Recent Status Information. In September 2001, in the case Alsea Valley Alliance v. Evans, U.S. District Court Judge Michael Hogan struck down the 1998 ESA listing of Oregon Coast (OC) coho salmon and remanded the listing decision to NOAA Fisheries for further consideration. In November 2001, the Oregon Natural Resources Council appealed the District Court's ruling. Pending resolution of the appeal, in December 2001, the Ninth Circuit Court of Appeals stayed the District Court's order that voided the OC coho listing. While the stay was in place, the OC coho Evolutionarily Significant Unit (ESU) was again afforded the protections of the ESA.

On February 24, 2004, the Ninth Circuit dismissed the appeal in Alsea. On June 15, 2004, the Ninth Circuit returned the case to Judge Hogan and ended its stay. Judge Hogan's order invalidating the OC coho listing is back in force. Accordingly, OC coho are now not listed, and ESA provisions for listed species, such as the consultation requirement and take prohibitions, do not apply to OC coho.

In response to the Alsea ruling, NOAA Fisheries released its revised policy for considering hatchery stocks when making listing decisions on June 3, 2004 (69 FR

31354). NOAA Fisheries completed a new review of the biological status of OC coho salmon, and applying the new hatchery listing policy, proposed to list OC coho salmon as a threatened species on June 14, 2004 (69 FR 33102). NOAA Fisheries must make a final decision on the proposed OC coho salmon listing by June 14, 2005.

Lower Columbia River (LCR) coho salmon. The LCR coho salmon ESU includes all naturally-spawned populations of coho salmon from the Columbia River tributaries below the Klickitat River on the Washington side and below the Deschutes River on the Oregon side (including the Willamette River as far upriver as Willamette Falls), as well as coastal drainages in southwest Washington between the Columbia River and Point Grenville. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 10,418 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins: Oregon - Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Wasco, and Washington; Washington - Clark, Cowlitz, Grays Harbor, Jefferson, Klickitat, Lewis, Mason, Pacific, Skamania, Thurston, and Wahkiakum.

Most LCR coho salmon enter rivers from September to November after the. Thus, a delay in fall rains will retard river entry and perhaps spawn timing. Peak spawning occurs from mid-November to early January. Depending on water temperature, coho eggs incubate for 35 to 50 days and start emerging from the gravel 2 to 3 weeks after hatching (Nickelson *et al.* 1992).

After they emerge, fry move into shallow areas near the streambanks. Juvenile rearing usually occurs in low gradient tributary streams, although they may move up to streams of 4 or 5 percent gradient. Juveniles have been found in streams as small as 1- to 2-m wide. When the fry are approximately 4 cm in length, they migrate upstream considerable distances to reach lakes or other rearing areas. Coho salmon fry prefer backwater pools during spring. In the summer, juveniles are more abundant in pools than in glides or riffles. During winter, the fishes predominate in off-channel pools of any type. Rearing in freshwater, which may take up to 15 months, is followed by migration to the sea as smolts between February and June (Weitkamp *et al.* 1995).

One population that warrants specific discussion because of its complex history is late-run Clackamas River coho salmon. The Clackamas River, a tributary of the Willamette River, was excluded from the petition for lower Columbia River coho salmon considered by NMFS in 1991 (Johnson et al. 1991), but it is within the area under consideration for the current stock status review.

The Clackamas River historically had runs of coho salmon and other anadromous species. However, the river also has a long history of obstructions to fish passage by dams. Cazadero Dam (1905, River Kilometer (RKm) 47) and River Mill Dam (1911, RKm 38) were the first large dams to completely block river flow. Both dams were equipped with fish passage facilities, which were often blocked for egg taking. In 1917, the fish ladder at Cazadero Dam washed out, and for 22 years, until the fish ladder was finally restored in 1939, coho salmon were unable to access the upper Clackamas River.

Subsequently, the upper river was repopulated by natural immigration and, possibly, unrecorded releases. Because of the relatively low success of hatcheries at producing adult coho salmon at that time, the immigrants were most likely natural coho salmon from either the Clackamas River below RKm 47, the Willamette River, or elsewhere in the lower Columbia River. In 1958, North Fork Dam was built at RKm 50. This dam was built with an extensive fish passage facility that has allowed enumeration of salmon entering and leaving the upper Clackamas River.

Since the late 1990s both the upper Sandy River basin above Marmot Dam and the upper Clackamas River basin above North Fork Dam on the Clackamas River have been managed as native fish reserves. Returning adult fish are trapped and sorted at these facilities allowing only migration of native adults upstream of the sorting facilities.

Middle Columbia River (MCR) steelhead. The MCR ESU occupies the Columbia River Basin from above the Wind River in Washington and the Hood River in Oregon and continues upstream to include the Yakima River, Washington. The region includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of precipitation annually (Jackson 1993). Summer steelhead are widespread throughout the ESU; winter steelhead occur in Mosier, Chenowith, Mill, and Fifteenmile Creeks, Oregon, and in the Klickitat and White Salmon Rivers, Washington. The John Day River probably represents the largest native, natural spawning stock of steelhead in the region.

Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, which has an estimated run size of 100,000 (WDF *et al.* 1993). Assuming comparable run sizes for other drainage areas in this ESU, the total historical run size may have exceeded 300,000 steelhead (NOAA Fisheries 2000).

Life history information for this ESU has been summarized by NOAA Fisheries (2000). Most fish in this ESU smolt at two years and spend 1 to 2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell *et al.* 1985). All steelhead upstream of The Dalles Dam are summer-run (Schreck *et al.* 1986, Chapman *et al.* 1994, Busby *et al.* 1996). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age 1- and 2-ocean fish. A non-anadromous form co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

Current population sizes are substantially lower than historic levels, especially in the rivers with the largest steelhead runs in the ESU, the John Day, Deschutes, and Yakima Rivers. At least two extinctions of native steelhead runs in the ESU have occurred (the Crooked and Metolius Rivers, both in the Deschutes River Basin). For the MCR steelhead ESU as a whole, NOAA Fisheries (2000) estimates that the median population growth rate over the base period (1990-1998) ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000). In 2002, the count of Bonneville Dam steelhead totaled 481,036 and exceeded all counts recorded at Bonneville Dam since 1938, except the 2001 total, which was 633,464. Of the total return in 2002, 143,032 were considered wild steelhead (Fish Passage Center 2003a).

Lower Columbia River (LCR) steelhead. The LCR ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the LCR steelhead ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the upper Willamette Basin and coastal runs north and south of the Columbia River mouth. Not included in the ESU are runs in the Willamette River above Willamette Falls (Upper Willamette River ESU), runs in the Little and Big White Salmon Rivers (Middle Columbia River ESU), and runs based on four imported hatchery stocks: early-spawning winter Chambers Creek/lower Columbia River mix, summer Skamania Hatchery stock, winter Eagle Creek NFH stock, and winter Clackamas River ODFW stock (63 FR 13351 and 13352). This area has at least 36 distinct runs (Busby *et al.* 1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU, for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs (NOAA Fisheries 2000).

All runs in the LCR steelhead ESU have declined from 1980 to 2000, with sharp declines beginning in 1995 (NOAA Fisheries 2000). Historic counts in some of the larger tributaries (Cowlitz, Kalama, and Sandy Rivers) probably exceeded 20,000 fish; more recent counts have been in the range of 1,000 to 2,000 fish (NOAA Fisheries 2000). Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. For the LCR steelhead ESU, NOAA Fisheries (2000) estimates that the median population growth rate over the base period (1990-1998) ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

Upper Willamette River (UWR) steelhead. The UWR steelhead ESU occupies the Willamette River and tributaries upstream of Willamette Falls, extending to and including the Calapooia River. These major river basins containing spawning and rearing habitat comprise more than 12,000 km^2 in Oregon. Rivers that contain naturally-spawning winter-run steelhead include the Tualatin, Molalla, Santiam, Calapooia, Yamhill, Rickreall, Luckiamute, and Mary's, although the origin and distribution of steelhead in a number of these basins is being debated. Early migrating winter and summer steelhead have been introduced into the upper Willamette basin, but those components are not part of the ESU. Native winter steelhead within this ESU have been declining since 1971, and have exhibited large fluctuations in abundance.

Over the past several decades, total abundance of natural late-migrating winter steelhead ascending the Willamette Falls fish ladder has fluctuated several times over a range of approximately 5,000 to 20,000 spawners. However, the last peak occurred in 1988, and this peak has been followed by a steep and continuing decline. Abundance in each of year from 1993 to 1998, was below 4,300 fish, and the run in 1995 was the lowest in 30 years.

In general, native steelhead of the UWR are late-migrating winter steelhead, entering freshwater primarily in March and April. This atypical run timing appears to be an adaptation for ascending Willamette Falls, which functions as an isolating mechanism for UWR steelhead. Reproductive isolation resulting from the falls may explain the genetic distinction between steelhead from the upper Willamette River Basin and those in the lower river. UWR late-migrating steelhead are ocean-maturing fish. Most return at age 4, with a small proportion returning as 5-year-olds (Busby *et al.* 1996). Willamette Falls (Rkm 77) is a known migration barrier (NOAA Fisheries 2000). Winter steelhead and spring Chinook salmon historically occurred above the falls, whereas summer steelhead, fall Chinook, and coho salmon did not. Detroit and Big Cliff Dams cut off access to 540 km of spawning and rearing habitat in the North Santiam River. In general, habitat in this ESU has become substantially simplified since the 1800s by removal of large woody debris to increase the river's navigability.

Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. For the UWR steelhead ESU, the estimated median population growth rate for 1990-1998 ranged from 0.94 to 0.87, decreasing as the effectiveness of hatchery fish spawning in the wild increased compared with that of fish of wild origin (McClure *et al.* 2000).

Critical Habitat. NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. NOAA Fisheries has designated critical habitat for SR spring/summer Chinook salmon and SONC coho salmon. Designated critical habitat for SR spring/summer Chinook salmon ESU includes areas in the Snake River basin and a 300-foot riparian buffer along the Columbia River migration corridor as detailed in 58 FR 68543. Designated critical habitat for SONC coho salmon includes coastal river basins south of Cape Blanco in southern Oregon south to Punta Gorda in northern California as detailed in 64 FR 24049. The essential features of designated critical habitat within the action area that support successful spawning, incubation, fry emergence, migration, holding, rearing, and smoltification for ESA-listed salmonid fishes include: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (primarily juvenile), (8) riparian vegetation, (9) space, and (10) safe passage conditions.

4.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402.02 (the consultation regulations). The Services must determine whether the proposed action is likely to jeopardize the listed species or is likely to destroy or adversely modify critical habitat. This analysis involves initial steps of: (1) defining the biological requirements and current status of the listed species; and (2) evaluate the relevance of the environmental baseline to the species' current habitat. This part of the analysis focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., effects on essential habitat features).

Subsequently, the Services evaluate whether the action is likely to jeopardize the listed species by determining whether the action, taken together with any cumulative effects and added to the environmental baseline, can be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species or to destroy or adversely modify their designated critical habitat. This part of the analysis focuses on the species itself. It describes the action's effect on individual fish, wildlife, or plant–or populations, or both–and places these effects in the context of the species' numbers, distribution, and reproduction within ESU or DPS as a whole. Ultimately, the analysis seeks to answer the question of whether the proposed action is likely to jeopardize a listed species' continued existence or adversely modify critical habitat. If so, the Services may identify reasonable and prudent alternatives for the action that avoid jeopardy and adverse modification of critical habitat and meet other regulatory requirements.

4.1.3 Environmental Baseline

Regulations implementing section 7 of the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, state, or private actions and other human activities in the action area. The environmental baseline also includes the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions that are contemporaneous with the consultation in progress. In addition to the statewide, and often rangewide, status of each species within section 4.1.1, an extensive write up of the ecoregional context, habitat types and land management practices supporting the summary of the Environmental Baseline section can be found in Appendix C.

Summary of Environmental Baseline

Based on the summarization and consideration of information in Appendix C of this Opinion, not all of the biological requirements of the species and their habitats are being met under the environmental baseline in many of the forests, uplands, riparian areas, streams corridors, and watersheds occupied by listed species in Oregon. Improvements in the environmental conditions they currently experience may be necessary to meet the biological requirements for survival and recovery of many species. Further degradation of these conditions could appreciably reduce the likelihood of survival and recovery of many species.

4.1.4 Analysis of Effects

The ESA Section 7 implementing regulations (50 CFR 402.02) define "effects of the action" as:

> The direct and indirect effects of an action on the species or critical habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02).

The Services consider the EPS (Section 2.5) an integral part of the proposed action. By strict adherence and administration of these EPS, potential long-term adverse effects other than those from fish handling and limited aspects of bridge repair to listed species will be avoided, adequately minimized, and offset. Those that cannot be completely avoided, will be minimized to the greatest extent possible and offset by compensatory mitigation actions for NOAA species and through conservation actions for USFWS species. The EPS will also serve to avoid and minimize potential short-term adverse effects to listed species and maximize potential beneficial effects to listed species. The FHWA has proposed to implement all the EPS at program bridge repair/replacement project sites regardless of species range. Therefore, for the purposes of this effects analysis, the Services will assume all pertinent EPS will be fully implemented throughout project administration, design, construction, monitoring and reporting from project inception to completion of monitoring and reporting.

4.1.4.1 Effects of the Proposed Action

The effects analysis for individual species in the BA was done by evaluating the effects pathways based on the media through which effects are delivered to the species. Essentially, all effects on listed species are delivered through the displacement, disruption, degradation, removal, or addition of air, soil, chemicals, plants, and direct effects on individuals of a species. Also in the BA, and incorporated into the proposed action section of this Opinion, FHWA described the effects from very specific project elements/activities that may occur under the Bridge Program. The EPS were designed to avoid or minimize those specific effects. The Services agree with the descriptions in those specific potential effects sections, however, for the purposes of the effects analysis here, we will further examine and analyze potential effects from specific bridge construction activities analyzed in the BA and that are likely to adversely effect the listed species.

Auditory (Noise) and Visual Harassment

For the purposes of this effect pathway analysis we will be evaluating the effects of auditory and visual stimuli to three threatened avian species; the marbled murrelet, bald eagle, and northern spotted owl. The USFWS will discuss the general conditions affecting all species then distinguish between the research and anticipated effects, in the context of the proposed action, to each species individually. In addition to the information provided in the BA, this analysis uses information provided in the USFWS's programmatic Olympic National Forest BO (USFWS 2003d), the USFWS' updated regional guidance on harassment thresholds, and professional interpretation of these information sources. The Olympic National Forest Programmatic BO (ONFBO) provided a detailed review and summarization of the literature regarding marbled murrelet and northern spotted owl disturbance/harassment (USFWS 2003d). We will not repeat this effort but will draw upon some of the same research and findings.

The USFWS recognizes that bird species and individuals respond to auditory and visual stimuli differently based on life history, behavior, and existing level of exposure, and that there is a gradient of potential outcomes from a stimuli, ranging from not being detected to harassment (i.e., injury) (USFWS 2003d). The USFWS is using two basic effects definitions for this analysis which are important for quantifying adverse effects to a species: (1) a *disturbance* is any potential auditory or visual stimuli or deviation from ambient (baseline) conditions an individual bird, at a given site, is likely to detect and possibly react to; and (2) *harassment*, which is defined [50 CFR §§ 17.3] as "an intentional or negligent act or omission which creates the likelihood of injury by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering." The USFWS interprets a disturbance response to be something equivalent to showing apparent recognition or avoidance of the sight or sound by hiding, defending itself, moving its wings or body, or postponing a feeding so that the adult still feeds its young the same prey item. In this Opinion we are broadening our definition of disturbance somewhat by including what the ONFBO (USFWS 2003d) termed the "alert threshold." This includes the recognition of a stimulus by showing apparent interest in the sight or sound by the bird turning its head toward the stimuli. The USFWS has interpreted the harassment threshold to be exceeded if an adult is flushed from a nest or aborts a feeding visit such that the young does not receive the prey item or is kept from, or repeatedly flushed from, a winter roost or important foraging area. Ultimately, harassment may lead to reduced productivity or survival due to lower fledging weight, physical injury or death of adult, hatchling or egg, from reduced feeding visits, nest inattentiveness, flushes, and high energy expenditure (USFWS 2003d). Therefore, harassment primarily pertains to the critical nesting period for these three species and for communal winter bald eagles roosts.

Following these definitions, a disturbance for a wildlife species may rise, at some point, to the level of harassment (i.e., likely to result in injury equating to incidental take).

Therefore, this analysis is addressing the likelihood that potential disturbance associated with the bridge program will rise to the level of harassment based on the USFWS' current harassment thresholds for each species and the ambient (baseline) conditions existing along these highways.

Ambient (Background) Conditions. A disturbance can be measured in many ways, including, but not limited to: proximity, frequency, duration, and intensity. Noise and visual stimuli may also be attenuated by topography, vegetation, humidity, and construction methods (i.e., the use of sound dampening or visual screening devices). However, because noise attenuation factors vary greatly (e.g., humidity, topography, and vegetation) and do not work as well for birds nesting high in the canopy, they will not be addressed in detail here. For birds occurring at a specific site, disturbance factors need to be viewed in the context of the existing ambient conditions. The ONFBO (USFWS 2003d) defined *ambient* as naturally generated, and *background* as human generated stimuli, however, we are using *ambient* to describe all existing background stimuli, natural and man made. An individual nesting near a roadway has likely become habituated to a predictable sight and sound stimulus pattern which includes roadway generated, in addition to natural stimuli. It is likely that because they are predictable, and no harm (i.e., predation) has come from them in the past, they are not perceived as a threat. An individual nesting in the interior of a forest is often only accustomed to naturally generated stimuli. The introduction of a foreign sight or sound stimulus may elicit a disturbance or harassment response from an individual in this situation because the stimulus was not predictable and thus potentially perceived as a threat. The USFWS also believes that a stimulus, at a site with human activity, which exceeds the ambient proximity, frequency, duration or intensity conditions, may also result in a disturbance or harassment response.

The exception to this general pattern may be for northern spotted owls. Spotted owls are cryptic in appearance and behavior which helps them avoid detection and predation and often display behavior that appears to be naïve to human activity. This is the foundation for much of the research and monitoring used for spotted owls where close approaches by researchers are used to determine nesting and to capture them for banding (Forsman et al. 1984). In fact, often individual spotted owls become more agitated by the visual proximity of researchers after they have been captured and handled (David Leal, USFWS, pers. obs.) The USFWS has not determined whether a visual harassment threshold for spotted owls is justified.

There have been many observations of habituated individuals of all three species nesting in high activity/traffic areas. As expected, all of the proposed action bridges are primarily associated with highways and higher use roadways. These highways currently experience a wide range of vehicle and non-vehicle traffic levels. Individual birds nesting proximal to these roadways are doing so in the presence of high ambient noise levels in the 60 decibels relative to human hearing (dBh) to 70 dBh range from vehicles and likely experience other regular noises such as chain saws and guns of up to approximately 80 dBh. In the BA, high noise is defined as being 10 dBA above ambient noise conditions. Thus, high noise in the BA is roughly equivalent to the USFWS' definition of the 92 dBh harassment, or injury, threshold.

Average Daily Traffic (ADT) volumes for four selected highways which have bridge projects along them are presented in table 4-4. Of primary interest are the ADTs for these highways during the spring and summer periods which generally coincide with the critical nesting periods.

Table 4-4. Average daily traffic (ADT) volumes for selected sites within Oregon (ODOT 2002)

	Average Daily Traffic (ADT)			
Section	**Spring (Mar-May)**	**Summer (Jun-Aug)**	**Fall (Sep-Oct)**	**Winter (Nov-Feb)**
I-5, Oak Grove rest area	32000-34183	37597-40788	37692-33434	26500-33957
I-5, Baldock rest area	73779-76236	79000-86486	74193-81749	61078-73852
Hwy 58, Oakridge	2585-2977	3592-3999	3116-3640	2200-2337
Hwy 20, to Newport	4401-4509	4891-5863	4289-5200	3215-3867
I-84, near North Powder	7000-8680	9774-10715	8643-9410	5598-7678
I-84, Sandy R bridge	24232-28217	32015-35669	26831-30891	19086-24095

Average daily traffic volumes for the selected roadways ranged from approximately 2,500 vehicles per day to 86,500 vehicles per day. The number of vehicles obviously increased with proximity to major metropolitan areas, however, we tried not to include roadways in table 4-4 that were directly in the cities since most of these birds (with the exception of a few bald eagle pairs) nest in mature forest areas which are primarily outside of cities. In addition to vehicle traffic, birds nesting in proximity to these roadways may also encounter pedestrians, bicyclists, and maintenance workers on an irregular basis.

Marbled murrelet harassment. Based on the recent analyses of available disturbance and harassment data for the marbled murrelet in the ONFBO (USFWS 2003d) and internal discussion, the USFWS has adjusted its position regarding at what distance noise disturbance is likely to rise to the level of harassment (USFWS 2003d). Table 4-5 gives the distances for more common types of noise generating activities where the USFWS believes harassment to nesting murrelets may be likely.

Table 4-5. Current USFWS guidance on auditory and visual harassment thresholds for marbled murrelets (USFWS 2003d)

Activity	Harassment Threshold Distance
Blasting (greater than 2 lb charge)	1.0 mi (1.6 km)

Blasting (less than a 2 lb charge)	360 ft (110 m)
Effect pile driving, jackhammer, or rock drill	180 ft (55 m)
Helicopter or single-engine Aircraft	360 ft (110 m)
Chainsaws	135 ft (40 m)
Heavy equipment	105 ft (32 m)
Visual activity	300 ft (90 m)

The FHWA/Corps have proposed to fully implement the following marbled murrelet portion of the *Species Avoidance* EPS to avoid or minimize adverse effects to marbled murrelets.

From Species Avoidance and Adverse Effects Minimization EPS**:**
Marbled Murrelet. For high-noise producing activities within one mile of suitable nesting habitat and non-blasting high-noise producing activities within 300 feet of suitable nesting habitat:

i. Inventory. Identify areas of suitable nesting habitat within one mile of the construction site.

ii. Avoidance. All blasting activities within one mile of suitable nesting habitat will be conducted from September 15 to March 30. All non-blasting high-noise producing construction activities will be conducted outside the critical nesting period of April 1 to August 5. Non-blasting high noise producing construction activities conducted from August 6 to September 15 shall implement a daily limited operating period (LOP) of daytime work being conducted from two hours after sunrise to two hours before sunset. If night construction is needed, then activity will be conducted from one hour after sunset to one hour before sunrise.

iii. Minimization. High-noise producing construction activities may be conducted between April 1 and August 5, following the LOP with a variance from the USFWS.

In the BA the FHWA/Corps began to quantify the area where, according to current harassment thresholds, injury may occur. The distance of 1 mile was used for blasting, however, since blasting will be conducted outside the breeding season, no harassment is anticipated from that activity. For the purposes of this analysis the visual harassment threshold of 300 feet was used for both visual and auditory harassment for non-blasting activities. The visual harassment threshold was used due to the difficulty determining when you may only have auditory disturbance at less than 300 feet without visually seeing the source. Several assumptions were made for this analysis. First, the analysis uses the Johnson and O'Neil (2001) Westside lowland conifer-hardwood, southwest

Oregon mixed conifer-hardwood forest habitat types as the basis for screening murrelet habitat. While this is a valid starting point to screen for potential habitat there is no age classification involved. Marbled murrelets are known to primarily use mature or old growth trees for their nesting platforms, and optimally for their nesting stands. Due to past forest management practices old growth habitat has been greatly reduced in abundance across the range of the murrelet (USDA and USDI 1994b).

Therefore, the habitat screening in the BA likely excessively overestimates suitable marbled murrelet nesting habitat. In the absence of readily available forest age classification data throughout the murrelet range, the FHWA/Corps determined that 61 of the proposed action bridges, within the range of marbled murrelet in Oregon, had suitable habitat within a 300-foot radius around the API. This came out to be approximately 19,127 acres of functional (i.e., suitable) marbled murrelet habitat may be exposed to noise and/or visual harassment from construction activity. As stated earlier, the USFWS believes this to be a large overestimate and not a realistic estimate of harassment, because only a portion of that acreage will actually be suitable marbled murrelet nesting habitat.

A conservative yet more realistic harassment estimate may be achieved by looking at the habitat removal analysis which was conducted in the Evaluation of Effects Memorandum (BA Appendix 2B). The analysis for effects to habitat used a 500-foot radius around the center point of the bridge. This 500-foot radius was used as an estimate for habitat removal activities because in most all cases staging and detour routes would be as close to the bridge as possible to minimize travel distances and construction costs. Because most all pre-construction and construction activity would be conducted within this area it works as a more realistic estimate for visual disturbance/harassment than using the entire API. When this radius is applied to the 87 bridges potentially occurring in marbled murrelet habitat the result is 1,566 acres of potential visual harassment. The 500-foot buffer would in most cases encompass the 300-foot harassment threshold beyond a staging area or detour route. The USFWS believes this is still a conservative estimate but a more realistic estimate of suitable habitat for marbled murrelets where visual harassment due construction activity may occur.

Taking into account the ambient conditions marbled murrelets are likely to be exposed to, the noise generated by construction equipment (excluding blasting), the LOP being applied to avoid peak murrelet activity periods, and the harassment thresholds presented in table 4-5, the USFWS does not believe marbled murrelets will be harassed due to noise primarily because construction noise is not anticipated to be greater than 10 dBA above ambient conditions at the harassment thresholds in table 4-5. The USFWS does believe there is potential for visual harassment to marbled murrelets nesting within 500 feet of the center point of a bridge (totaling approximately 1,566 acres) because visual human activity will be outside the current ambient conditions experienced at those sites. While this distance is greater than the current 300-foot radius, it is a conservative estimate used to encompass all visual activity such as for staging areas and detour routes. This potential harassment will occur at 87 bridge sites across the range of the marbled murrelet in Oregon and over a 10 year period.

Northern spotted owl harassment. Based on the recent analyses of available disturbance and harassment data for the northern spotted owl in the ONFBO (USFWS 2003d) and internal discussion, the USFWS has adjusted its position regarding at what distance noise disturbance is likely to rise to the level of harassment (USFWS 2003d). Table 4-6 gives the distance for more common types of noise generating activities where the USFWS believes harassment to nesting spotted owls may be likely.

Table 4-6. Current USFWS guidance on auditory harassment thresholds for northern spotted owl (USFWS 2003d)

Activity	Harassment Threshold Distance
Blasting (greater than 2 lb charge)	1.0 mi (1.6 km)
Blasting (less than a 2 lb charge)	360 ft (110 m)
Effect pile driving, jackhammer, or rock drill	180 ft (55 m)
Helicopter or single-engine Aircraft	360 ft (110 m)
Chainsaws	195 ft (60 m)
Heavy equipment	105 ft (32 m)

The FHWA/Corps have proposed to fully implement the following northern spotted owl portion of the *Species Avoidance* EPS to avoid or minimize adverse effects to nesting spotted owls.

From Species Avoidance and Adverse Effects Minimization EPS:
Northern Spotted Owl. For blasting activities within one mile of suitable nesting and roosting habitat and non-blasting construction activity within 195 feet of nesting and roosting habitat:

iv. Inventory. Inventory the area of potential harassment for nesting and roosting (NR) habitat.

v. Avoidance. If NR habitat is present, then prohibit blasting and high-noise producing activities during the following critical nesting periods:

(1) March 1 to July 7 for the North Coast Province.

(2) March 1 to June 30 for the Rogue/Siskiyou NF and Medford District of BLM in the Southwest Province.

(3) March 1 to July 15 for the Umpqua NF in the Southwest Province.

(4) March 1 to July 15 for the Willamette Province.

(5) March 1 to September 30 for the Deschutes, Fremont, and Winema NF, and unlisted areas.

vi. Minimization. High-noise producing activity within the provincial critical nesting periods may be conducted with a variance from the USFWS.

As with the marbled murrelet, the FHWA/Corps attempted to quantify harassment based on the USFWS' harassment thresholds given in table 4-6. The FHWA/Corps initially screened for northern spotted owl functional (i.e., suitable) habitat using Johnson and O'Neil (2001) habitat types known to be spotted owl habitat. As with the murrelet analysis these habitat types did not have age classification data associated with them. The analysis used a 300-foot radius (a conservative analysis area to encompass all non-blasting noise harassment thresholds) around the center point of a bridge at 141 bridges identified to be within spotted owl habitat types. The analysis resulted in a total area of 915 acres where spotted owls may be likely to be adversely affected by noise harassment.

Based on (1) the ambient conditions northern spotted owls are likely to be exposed to, (2) the noise generated by construction equipment, (3) the EPS for northern spotted owls, (4) the behavior of spotted owls, and (5) the harassment thresholds presented in table 4-6, the USFWS does not believe northern spotted owls will be harassed due to noise. This is primarily because construction noise is not anticipated to be significantly greater than the ambient conditions, spotted owl behavior such as their nocturnal activity period, and the USFWS can deny or modify a request for a variance to the avoidance EPS where local conditions may call for a more conservative approach.

Bald eagle harassment. Bald eagle harassment thresholds were identified in the Pacific Bald Eagle Recovery Plan (USFWS 1986). These distances were established based on research on bald eagles throughout the country and have been adopted by the USFWS and used in consultation. Table 4-7 gives the visual and noise harassment thresholds for nesting bald eagles (USFWS 1986).

Table 4-7. Current USFWS guidance on auditory and visual harassment thresholds for the bald eagle (USFWS 1986)

Activity	Harassment Threshold Distance
Noise	0.25 mi (400 m)
Visual activity	0.5 mi (800 m)

The FHWA/Corps have proposed to fully implement the following bald eagle portion of the *Species Avoidance* EPS to avoid or minimize adverse effects to nesting bald eagles and for communal winter roosts.

From Species Avoidance and Adverse Effects Minimization EPS**:**
Bald Eagle. For blasting activities within one mile of known nest sites or communal roosts and non-blasting construction activities within 0.25 mile or 0.5 mile visually (i.e., line-of-site), of a known nest or communal roost:

vii. Inventory. Review the most recent Isaacs and Anthony bald eagle nesting survey database for nest locations.

viii. Avoidance. High-noise producing activities, including blasting, will be confined to between September 1 and October 30.

ix. Minimization. Construction activity, other than blasting, within the harassment threshold distances (0.25 mile for noise and 0.5

mile for visual) or during October 31 to December 31 shall follow the daily LOP and will require a variance from the USFWS.

x. Minimization. Staging areas and detour routes will be kept as far from a nest as practicable. If closer than 0.5 mile, then a variance from the USFWS is needed.

Within the BA, the FHWA/Corps analyzed the potential auditory and visual effects to bald eagles by first reviewing the current Isaacs and Anthony (2003) bald eagle nest survey database. They then screened to determine how many known bald eagle nests or communal winter roosts are within the 0.5 mile and 0.25 mile radii of the bridges. Based on this analysis the FHWA/Corps found that 12 bridges had bald eagle nests within 0.5 miles and 2 bridges had bald eagle nests within 0.25 miles of them. Because the visual harassment threshold encompasses the auditory threshold, essentially there are 12 known bald eagle nests which may likely experience visual harassment from pre-construction and construction activity. The USFWS considers this a conservative estimate because we are assuming all 12 nests within 0.5 miles have an open line-of-site to construction activity. It is probable that fewer than 12 nests will actually have a clear line-of-sight to visual activity.

Taking into account (1) the ambient conditions bald eagles are likely to be exposed to in proximity to the project bridges, (2) the noise generated by construction equipment (excluding blasting), (3) the LOP being applied to avoid peak bald eagle activity periods, and the harassment thresholds presented in table 4-7, the USFWS agrees that the individuals, eggs or young associated with up to 12 known bald eagle nests may likely experience visual harassment due to pre-construction and construction activity. This potential harassment will occur across the range of the bald eagle in Oregon and over a 10 year period.

Hydro-acoustic

Hydro-acoustic effects are generally created during activities that generate excessive noise in the form of intense sound pressure waves within the water column, typically pile-driving (NOAA Fisheries 2003a). Pile-driving for in-water structures can cause intense temporary underwater sounds that may affect the behavior of salmon up to approximately 2,000 feet away (NOAA Fisheries 2003c). These hydro-acoustic effects can kill salmonids (e.g., by ruptured swim bladders and causing lethal injury to other various organs), or can be sub-lethal (e.g., injury or harassment and displacement from productive feeding habitats). Sound pressure waves in excess of 190dB may be fatal to fish, however 155dB may be sufficient to stun, injure or harass small fish (Hastings 1995, 2003).

While there are approximately 430 individual bridge sites either being repaired or replaced under this proposed action, this will be conducted over a 10 year period across Oregon, thus spreading the potential for hydro-acoustic adverse effects over that time frame and across watersheds. However, the potential for hydro-acoustic effects at an individual bridge is not expected to be a major effect but smaller batches of bridges will likely be constructed at the same time to maximize efficiencies in construction. Based on this, the potential additive adverse effects from hydro-acoustic elements/activities, on local fish and wildlife populations at the project site, within a given system or 6^{th} field HUC, and at the DPS or ESU scale may be more significant.

The FHWA/Corps has proposed to fully implement the following hydro-acoustic section of the *Species Avoidance* environmental performance standard (Section 2.5) to avoid potential adverse effects to listed species in the form of potential severe sound pressure waves resulting from underwater noise producing activities:

From Hydro-acoustic Effects Minimization EPS:
Hydro-Acoustic. Prepare and implement a Noise Attenuation Plan (NAP) for steel piles driven with an impact pile driving hammer through water when listed fish may be present.

xi. The NAP will illustrate how hydro-acoustic sound pressure levels will be maintained below 150 dB rms (re: 1 micro Pascal) for a minimum of 50 percent of the impacts and peak sound pressure levels will be maintained below 180 dB (re: 1 micro Pascal) for all impacts in areas of potential fish presence.

xii. ODOT/FHWA will review and approve the NAP prior to steel pile driving activities in the water column.

xiii. During hydro-acoustic measurement monitoring, the hydrophone(s) shall be positioned at mid-depths, 30 feet from the pile being driven or following the most recent NOAA Fisheries guidance, as directed by contract with ODOT.

xiv. Acoustic measurements (monitoring) are not necessary assuming at least one of the following conditions are met:

(1) The pile is driven with a vibratory pile driving hammer.

(2) The pile is acoustically isolated from the water using measures including, but not limited to; dewatering, flow diversion, confined bubble curtains (unconfined bubble curtains may be used if contractor demonstrates that currents are less than 1.7 miles per hour), and other means, as approved by ODOT/FHWA.

(3) The best available science shows that sound pressure levels will not reach the impact thresholds identified above under the stream conditions at the time of pile driving (e.g., channel substrate, water velocity and depth).

Through the development and implementation of a hydro-acoustic isolation strategy or other approved NAP specific to each bridge repair/replacement activity and element capable of producing high underwater noise, the resulting potential for adverse hydro-acoustic effects to listed aquatic species, as functional group, will be adequately constrained to avoid lethal take. For the purposes of this consultation, listed aquatic species applies to all of the listed fish species, resident and anadromous, for which the Services have jurisdiction under the ESA unless otherwise specified.

Therefore, the Services do not expect any lethal effects to listed aquatic species from hydro-acoustic activities and any adverse effects will be avoided or constrained to only those likely to be discountable or insignificant in nature. In addition, the Services expect any realized hydro-acoustic sub-lethal effect (disturbance) to listed species will be avoided or constrained to only those likely to be minor and temporary in nature.

Increased Erosion, Turbidity, Sediment Transport, and Chemical Exposure

The likelihood of increased erosion, turbidity, sediment transport, and chemical exposure to aquatic or terrestrial environments are increased with the use; staging; and maintenance of construction machinery, equipment, and materials within and adjacent to listed species habitats.

The displacement and transport of soil can result in turbidity and sedimentation within aquatic and terrestrial habitats. The effects of suspended sediments (turbidity) may be sub-lethal or lethal, direct effects on their habitat, and are generally correlated to the concentration of sediment within the water column. Fish death can be a result of a combination of factors, and thus is difficult to attribute to suspended sediment alone (Waters 1995). The sub-lethal effects of turbidity generally include avoidance and distribution, reduced feeding and growth, respiratory impairment, reduced tolerance to disease and toxicants, and physiological stress (Lloyd 1987 *in* Waters 1995). Reproductive failure can be attributed to both deposited and suspended sediment. Deposited sediments can smother salmon redds by filling interstitial spaces or by entrapping emerging fry under a layer of consolidated sediments. Excessive turbidity can smother embryos and sac fry, and clog gills. Physical habitat is generally most affected by deposited sediments; naturally loose substrates such as cobble and gravel can become embedded with fine sediment, thus limiting available spawning habitat and diminishing the amount of available cover for overwintering juveniles and fry. Additionally, the infilling of pools reduces overhead cover for juveniles and adults (Waters 1995). Substrate embeddedness has also been shown to affect aquatic macroinvertebrate abundance and species composition, thus altering the availability and suitability of a critical food source. Lastly, soils can act as a delivery mechanism for transferring chemical pollutants from upland sources.

Chemical exposure can alter fecundity, increase disease, shift biotic communities, and reduce the overall health of listed species. If contamination levels are high enough, direct lethal effects are possible through the disruption of biological processes. The introduction of chemicals can be acute, occurring as a result of an accidental spill or equipment leaks during construction activities, or chronic, resulting from increased stormwater runoff to waterways. The potential for adverse effects of chemical exposure may be sub-lethal or lethal, and are generally correlated to the concentration of chemical contaminants within the species aquatic or terrestrial environment.

While there are approximately 430 individual bridge sites either being repaired or replaced under this proposed action, this will be conducted over a 10 year period across Oregon, thus spreading the potential for increased risk of erosion, turbidity, sediment transport, and chemical exposure resulting from bridge repair/replacement activities and elements over that time frame and across watersheds. The potential for increased risk of erosion, turbidity, sediment transport, and chemical exposure resulting from bridge repair/replacement activities and elements at an individual bridge is not expected to be a major effect. Smaller batches of bridges will likely be constructed at the same time to maximize efficiencies in construction. Based on this, the potential for increased risk of erosion, turbidity, sediment transport, and chemical exposure resulting from bridge repair/replacement activities and elements, on local fish and wildlife populations, within a given system or 6th field HUC, and at the DPS or ESU scale may be greater in magnitude than those at individual bridge sites.

The FHWA/Corps has proposed to fully implement the following sections of the *Water Quality* EPS (Section 2.5) to avoid potential adverse effects to listed species. The *Water Quality* EPS also dictates methods to ensure the potential for increased risk of erosion, turbidity, sediment transport, and chemical exposure resulting from bridge repair/replacement activities and elements are below thresholds associated with long-term adverse effects to listed species and their habitat, when they cannot be completely avoided.

From Water Quality EPS:
Pollution & Erosion Control. Prevent delivery of contaminants to soils and waters of the State caused by surveying and construction operations. Prepare and carry out a Pollution and Erosion Control Plan that contains the elements outlined in Sections 280.00 and 290.30 of ODOT's *Standard Specifications for Construction* (2002), meets requirements of all applicable laws and regulations, and includes the following:

d. The name and address of the party(s) responsible for accomplishment of the pollution and erosion control plan.

e. Practices to prevent erosion and sedimentation associated with access roads, stream crossings, drilling sites, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations, staging areas, and roads being decommissioned.

f. Practices to confine, remove, and dispose of excess concrete, cement, grout, and other mortars or bonding agents, including measures for washout facilities.

g. A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.

h. A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.

i. Practices to prevent construction debris from dropping into any waters of the U.S., and to remove any material that does drop with a minimum disturbance to the aquatic habitat and water quality. Include complete and detailed plans for removing any structure and constructing new structures. Outline specific containment measures necessary to keep bridge removal and construction debris out of waters of the U.S..

j. Inspection of erosion and sediment controls. During construction, monitor in-stream turbidity and inspect all erosion controls daily during the rainy season and weekly during the dry season, or more often as necessary, to ensure the erosion controls are working adequately.

   i. If monitoring or inspection shows that the erosion and sediment controls are ineffective, mobilize work crews immediately to make repairs, install replacements, or install additional controls as necessary.

   ii. Remove sediment from erosion and sediment controls once it has reached 1/3 of the exposed height of the control.

8. Staging Activities. Fuel, operate, maintain, and store vehicles and construction materials in areas that minimize disturbance to habitat and prevent adverse effects from potential fuel spills.

a. Limit staging areas to the minimum size necessary to complete the project. To reduce the staging area and potential for contamination, ensure that only enough supplies and equipment to complete a specific task will be stored on-site.

b. Complete vehicle staging, cleaning, maintenance, refueling, and fuel storage in a vehicle staging area placed 150 feet or more from any waters of the U.S. unless this distance is not appropriate because of the following site conditions:

   i. Physical constraints that make this distance not feasible (e.g., steep slopes, rock outcroppings).

   ii. Natural resource features would be degraded as a result of this setback.

   iii. Equal or greater spill containment and effect avoidance if staging area is less than 150 feet of any waters of the U.S..

c. If staging areas are within 150 feet of any waters of the U.S., full containment of potential contaminants shall be provided to prevent soil and water contamination, as appropriate.

d. Inspect all vehicles operated within 150 feet of any waters of the U.S. daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by the Services and the appropriate Regulatory Authorities.

e. Before operations begin and as often as necessary during operation, steam clean (or an approved equal) all equipment that will be used below bankfull elevation until all visible external oil, grease, mud, and other visible contaminates are removed.

f. Diaper all stationary power equipment (e.g., generators, cranes, stationary drilling equipment) operated within 150 feet of any waters of the U.S. to prevent leaks, unless other suitable containment is provided to prevent potential spills from entering any waters of the U.S..

9. Construction Discharge Water. Avoid adverse affects to water quality from construction discharge water (e.g., concrete washout, hydromilling, pumping for work area isolation, vehicle wash water, drilling fluids).

a. Discharge Containment. Design, build, and maintain facilities to collect and treat all construction discharge water, including any contaminated water produced by drilling, using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals, and other pollutants likely to be present. An alternate to treatment is collection and proper disposal offsite.

b. Discharge Velocity. If construction discharge water is released using an outfall or diffuser port, velocities may not exceed 4 feet per second.

c. Pollutant Containment. Do not allow pollutants including petroleum products, contaminated water, silt, welding slag, sandblasting abrasive, green concrete, or grout cured less than 24 hours to contact any area within 150 feet of waters of the U.S., unless approved by the Services and the appropriate Regulatory Authorities.

d. Drilling Discharge. All drilling equipment, drill recovery and recycling pits, and any waste or spoil produced, will be completely isolated, recovered, then recycled or disposed of to prevent entry into waters of the U.S..

i. Drilling fluids will be recycled using a tank instead of drill recovery/recycling pits, whenever feasible.

ii. When drilling is completed, attempts will be made to remove the remaining drilling fluid from the sleeve (e.g., by pumping) to reduce turbidity when the sleeve is removed.

iii. Follow the necessary terms and conditions of ODOT's most recent drilling programmatic biological opinion.

10. Piling Removal. Avoid adverse affects to aquatic habitats during removal of temporary or permanent piling.

a. Immediately place removed piling onto the appropriate dry storage site.

b. Attempt to remove the entire temporary or permanent piling unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

c. Ensure remaining treated wood piling is broken, cut, or pushed at least 3 feet below the sediment surface and covered with a cap of clean, native substrates that match surrounding streambed materials.

d. Fill the holes left by each treated timber piling with clean, native substrates that match surrounding streambed materials, whenever feasible.

11. Treated Wood. Avoid adverse affects to aquatic habitats during handling of treated wood.

a. Ensure that no treated wood debris falls into waters of the U.S.. If treated wood debris does fall into waters of the U.S., remove it immediately.

b. Dispose of all treated wood debris removed during a project, including treated wood pilings, at an upland facility approved for hazardous materials of this classification. Do not leave a treated wood piling in the water or stacked on the streambank.

c. Projects using treated wood that may contact flowing water or that will be placed over water where it will be exposed to mechanical abrasion are not authorized, except for pilings installed following NOAA Fisheries' guidelines.

12. Site Stabilization. Stabilize all disturbed areas following any break in work unless construction will resume within four days.

13. Stormwater Management. Avoid or minimize adverse effects resulting from changes to the quality and quantity of stormwater runoff for the life of the project by improving or maintaining natural runoff conditions within project watersheds.

a. Plan. Prepare and carry out a Stormwater Management Plan for any project that will produce a new impervious surface or a land cover conversion that slows the entry of water into the soil. Include the following:

i. Logic and science (e.g., engineering equations and models or scientific literature and findings) supporting the selected stormwater management option. For projects that require engineered facilities to meet stormwater requirements, use a continuous rainfall/runoff model, if available for the project area, to calculate stormwater facility water quality and flow control rates.

ii. Schedule to inspect and clean each facility as necessary to ensure that the design capacity is not exceeded and whether improvements in operation and maintenance are needed. Make improvements as needed.

b. Water Quality. Improve long-term water quality conditions associated with pollutant loading from the road network within the project watershed.

i. Drains. Eliminate direct discharge from the bridge deck to waters of the U.S..

ii. Treatment Level. Increase treatment of stormwater runoff discharged to waters of the U.S.. Reduce the annual pollutant loading[59] to waters of the U.S., relative to pre-project conditions by providing treatment for the water quality event.

iii. Groundwater. Protect groundwater from pollutant loading.

(1) Pretreat the water quality event stormwater runoff from pollution generating surfaces before infiltration to groundwater or discharge into waters of the U.S., as necessary to minimize any pollutant load likely to be present.

(2) Pretreatment may include, but is not limited to, biofiltration (filtration, adsorption, and biological decomposition from soils that have sufficient organic content and sorption capacity to remove pollutants), filtration (engineered filtration systems), settling/sediment ponds (engineered stormwater facilities), or any combination treatment train thereof.

iv. Placement. Avoid sensitive natural resource areas (e.g. riparian and wetland areas, unstable hill slopes, ESA-listed species habitat) during placement of stormwater treatment facilities.

v. Erosion. Prevent erosion caused by the conveyance of stormwater runoff. Consider the following:

(1) Maintain natural drainage patterns and, whenever possible, ensure that discharges from the project site occur at the natural location.

(2) Use a conveyance system comprised entirely of manufactured elements (e.g., pipes, ditches, outfall protection) that extends to the ordinary high water line of the receiving water, where risk of erosion precludes conveyance through sheet flow.

(3) Stabilize any erodible elements of the conveyance system as necessary to prevent erosion.

(4) Do not divert surface water from, or increase discharge to, an existing wetland if that will cause a significant adverse effect to wetland hydrology, soils, or vegetation.

(5) The velocity of discharge water released from an outfall or diffuser port may not exceed 4 feet per second (attraction flow for fish).

Through the development and implementation of the aquatic and terrestrial erosion, turbidity, sediment transport, and chemical exposure avoidance measures and plans (listed above) specific to each bridge repair/replacement activity and element capable of resulting in adverse effects to listed species, potential adverse affects will be adequately constrained to avoid lethal take of listed species.

Therefore, the Services do not expect any lethal effects from increased erosion, turbidity, sediment transport, and chemical exposure to listed aquatic species and adverse effects will be avoided or constrained to only those likely to be discountable or insignificant in nature. In addition, the Services expect any realized sub-lethal effect from increased erosion, turbidity, sediment transport, and chemical exposure to listed species will be avoided or constrained to only those likely to be minor and temporary in nature and long-term beneficial effects to water quality may occur at some or all of bridge repair/replacement projects from comprehensive stormwater management strategies and facilities. Any unavoidable short-term adverse effects will be distributed across Oregon and over a 10-year period.

Hydrologic Alteration

Changes in hydrology may occur as a result of increases in road density (e.g., impervious surfaces) or by stormwater conveyance within a watershed, particularly when these changes occur near streams. Hydrologic alterations may be manifested as increases in the frequency and magnitude of peak flows and as reductions in base flow levels, all of which can have sub-lethal and lethal effects on listed species. Increasing the magnitude of peak flows will often have an indirect effect on listed salmonids by promoting channel scour and degradation, the loss of floodplain connectivity, and overall habitat simplification. Decreasing base flows can allow water temperatures to increase beyond tolerable levels and can even dewater sections of rivers and backwater areas, cutting off important habitat for spawning and rearing listed salmonids. Decreased base flows can have sub-lethal or lethal effects on listed salmonids.

While there are approximately 430 individual bridge sites either being repaired or replaced under this proposed action, this will be conducted over a 10-year period across Oregon, thus spreading the potential for hydrologic alteration resulting from bridge repair/replacement activities and elements over that time frame and across watersheds. However, the potential for hydrologic alteration resulting from bridge repair/replacement activities and elements at an individual bridge is not expected to be a major effect but smaller batches of bridges will likely be constructed at the same time to maximize efficiencies in construction. Based on this, the potential for hydrologic alteration resulting from bridge repair/replacement activities and elements, on local fish and wildlife populations at the project site, within a given system or 6^{th} field HUC, and at the DPS or ESU scale may be more significant.

The FHWA/Corps has proposed to fully implement the following section of the *Water Quality* EPS (Section 2.5) to avoid potential long-term adverse effects to listed species and to ensure the potential for hydrologic alteration resulting from bridge repair/replacement activities and elements:

From Water Quantity EPS:
Water Quantity. Increase the annual site infiltration potential of the project watershed, with emphasis on the project area.

vi. Urbanized. For urbanized watersheds, reduce the post-project frequency, magnitude, and duration of the flow from ½ of the 2-year storm event up to the 50-year storm event as measured against pre-project frequency, magnitude and duration of flow from the same range of storm events.

vii. Wildland. For wildland (forest, rangeland) watersheds, reduce the post-project or maintain the pre-project frequency, magnitude, and duration of the flow from ½ of the 2-year storm event up to the 50-year storm event as measured against pre-project frequency, magnitude and duration of flow from the same range of storm events.

viii. Infiltration. Provide infiltration opportunities for stormwater runoff derived from the project area.

(1) Infiltration opportunities may include, but are not limited to; adequate soils, non-concentrated overland flow, vegetation management, land cover conversions, permeable bedded detention basins, and infiltration swales.

(2) Minimize, disperse, and infiltrate stormwater runoff onsite using sheet flow across permeable vegetated areas to the maximum extent possible without causing flooding, erosion impacts, or long-term adverse effects to groundwater.

ix. Discharge. Ensure that the post-project discharge is less than the pre-project discharge rates from 50 percent of the 2-year flow up to the 50-year flow.

Through the development and implementation of the hydrologic alteration avoidance measures and plans (listed above) specific to each bridge repair/replacement activity and element capable of resulting in adverse effects to listed species, potential adverse affects will be adequately constrained to avoid lethal take of listed species.

Therefore, the Services do not expect any lethal effects from hydrologic alteration to listed aquatic species and adverse effects will be avoided or constrained to only those likely to be discountable or insignificant in nature. In addition, the Services expect any realized sub-lethal effect from hydrologic alteration to listed aquatic species will be avoided or constrained to only those likely to be minor and temporary in nature and long-term beneficial effects to water quantity may occur at some or all of bridge repair/replacement projects from comprehensive stormwater management strategies and facilities. Any realized adverse effects will be distributed across Oregon and over a 10 year period.

Vegetation Removal

As described in the proposed action, clearing generally takes place within pre-marked areas in the specific bridge action area and often address staging areas, bridge construction, roadwork, and detour routes (FHWA/Corps 2004). For the purposes of this analysis we are focusing on the effects of vegetation clearing, including grubbing activities, of both riparian and adjacent upland vegetation.

The effects from vegetation removal carried out during the site specific bridge projects are variable. However, vegetation removal is likely to result in some degree of ground disturbance and compaction, generating the potential for soil erosion, and consequently resulting in temporary turbidity and sedimentation. Anadromous salmonid and resident fish species habitat features include substrate composition; water quality; water quantity, depth, and velocity; water temperature; channel gradient and stability; food availability; cover and habitat complexity; habitat area, access, and passage; and floodplain and habitat connectivity (Buchanan et al. 1997, USFWS 1998, Roni et al. 1999). Adverse effects may result from the loss of large woody debris (LWD) recruitment potential. Large woody debris in channels creates complexity and provides refuge habitat for fish, as well as habitat for macroinvertebrates. Tree loss would also likely increase penetration of sunlight into streams, potentially increasing water temperatures.

For terrestrial wildlife species, tree removal may also decrease the amount of available nesting, foraging, and roosting habitat available and may alter the thermoregulatory buffer to adjacent nest trees. Removal of mature trees over 100 years old may remove potential nest trees for marbled murrelet, bald eagle, or northern spotted owls.

EPS were developed with the assistance of the Services during the early involvement and technical assistance phases of this consultation to identify ways to minimize and avoid these adverse effects or to identify when compensatory mitigation will be required for unavoidable effects.

The FHWA/Corps have proposed to fully implement the following *Habitat Avoidance* EPS (section 2.5) to avoid or minimize the potential adverse effects to listed species and to ensure the potential for terrestrial and hydrologic alteration resulting from bridge repair/replacement activities and elements are below thresholds equated with jeopardy of listed species.

From Habitat Avoidance EPS:
Streambank Protection. Avoid and minimize adverse effects to natural stream and floodplain function by limiting streambank protection actions to those that are not

expected to have long-term adverse effects on aquatic habitats. Whether these actions will also be adequate to meet other streambank protection objectives depends on the mechanisms of streambank failure operating at site- and reach-scale.

a. Choice of Techniques. The following bank protection techniques are approved for use individually or in combination:

i. Woody plantings and variations (e.g., live stakes, brush layering, facines, brush mattresses).

ii. Herbaceous cover, where analysis of available records (e.g., historical accounts and photographs) shows that trees or shrubs did not exist on the site within historic times, primarily for use on small streams or adjacent wetlands.

iii. Deformable soil reinforcement, consisting of soil layers or lifts strengthened with fabric and vegetation that are mobile ('deformable') at approximately two- to five-year recurrence flows.

iv. Coir logs (long bundles of coconut fiber), straw bales, and straw logs used individually or in stacks to trap sediment and provide growth medium for riparian plants.

v. Bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, increase roughness and cross-section, and provide more favorable planting surfaces.

vi. Floodplain roughness (e.g., floodplain tree and large woody debris rows, live siltation fences, brush traverses, brush rows, and live brush sills) used to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed.

vii. Floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain.

viii. Flow-redirection structures known as barbs, vanes, or bendway weirs, when designed as follows, and as otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

(1) No part of the flow-redirection structure may exceed bank full elevation, including all rock buried in the bank key.

(2) Build the flow-redirection structure primarily of wood or otherwise incorporate large wood at a suitable elevation in an exposed portion of the structure or the bank key. Placing the large woody debris near streambanks in the depositional area between flow direction structures to satisfy this requirement is not approved, unless those areas are likely to be greater than 3 feet in depth, sufficient for target-species rearing habitats.

(3) Fill the trench excavated for the bank key above bankfull elevation with soil and topped with native vegetation.

(4) The maximum flow-redirection structure length will not exceed 1/4 of the bankfull channel width.

(5) Place rock individually without end dumping, unless approved in writing by the Services and the appropriate Regulatory Authorities.

(6) If two or more flow-redirection structures are built in a series, place the flow-redirection structure farthest upstream within 150 feet or 2.5 bankfull channel widths, from the flow-redirection structure farthest downstream.

(7) Include woody riparian planting as a project component.

b. Use of Large Wood and Rock. Whenever possible, use large wood as an integral component of streambank protection treatments. Avoid or minimize the use of rock, stone, and similar materials.

i. Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable.

ii. Rock may be used instead of wood for the following purposes and structures. The rock may not impair natural stream flows into or out of secondary channels or riparian wetlands. Whenever feasible, place topsoil over the rock and plant with woody vegetation.

(1) As ballast to anchor or stabilize large woody debris components of an approved bank treatment.

(2) To fill scour holes, as necessary to protect the integrity of the project, if the rock is limited to the depth of the scour hole and does not extend above the channel bed.

(3) To construct a footing, facing, head wall, or other protection necessary to prevent scouring or downcutting of, or fill slope erosion or failure at, an existing structure (e.g., culvert, utility line, or bridge support) to be repaired. New and replacement structures shall comply with the *Fluvial* Performance Standard.

(4) To construct a flow-redirection structure as described above.

3. Habitat Removal. Avoid or minimize habitat modification that will impair the ability of threatened, endangered, proposed, or selected sensitive species to complete essential biological behaviors, such as breeding, spawning, rearing, migrating, feeding, and sheltering.

g. Designated Critical Habitat. Maintain designated critical habitat within the project footprint.

   i. Review appropriate sources (e.g., Biological Assessment, Federal Register Notices) to determine if designated critical habitat is present or likely present within the project area.

   ii. Flag and survey the boundary of designated critical habitat, as appropriate.

   iii. Do not permanently degrade any primary constituent elements within the boundary of designated critical habitat.

h. Listed Species Nest Trees. Do not remove documented nest trees for bald eagle, marbled murrelet, or northern spotted owl.

i. Non-listed Species Nest Trees. Whenever feasible, do not remove documented nest trees of great blue herons and other non-listed bird species.

j. Breeding Habitat. Do not remove potential nesting, breeding, or alter reasonably likely spawning habitat during the breeding season of listed species, unless protocol surveys show the area is not occupied.

k. Functional Habitat. Whenever possible, do not modify or degrade functional habitats for listed species in the project area. If functional habitats for listed species cannot be avoided, then provide the justification(s), such as:

   i. Social: public safety, right-of-way

   ii. Physical: geomorphologic, built environment

   iii. Ecological: conflicting resources

      (1) Conserve habitat with the highest value relative to the listed species that will be affected, given the likelihood and timing of mitigation success.

      (2) Use ecological value (uniqueness, rarity, resource utilization) and ease of replacement (probability of success, recovery time lags) to evaluate and justify the decision.

l. Replacement. Mitigation must be functionally equivalent to the habitat modified or degraded.

The temporal and spatial scales of vegetation removal under this proposed action are important factors in evaluating the effects of the action. The temporal nature of vegetation removal is typically related to the age of the vegetation being removed and the time required to re-grow/replace it. Older trees take longer to be replaced and upland vegetation often takes longer to grow than riparian vegetation. Riparian vegetation such as red alder, cottonwood and willows grow rapidly but have comparatively shorter life expectancy compared to Douglas-fir and other regional conifer forest species. Large mature trees growing along roadways or stream corridors often have more developed (larger) limb structure due to the trees getting more sunlight as opposed to trees in dense stands. Not only are large mature trees important for LWD recruitment in streams to provide fish habitat but also nesting habitat for the listed birds as well as osprey nests and great blue heron nesting colonies. Therefore while the removal of younger riparian vegetation is considered a relatively temporary effect, the loss of mature trees can functionally be considered a long-term effect.

While there are approximately 430 individual sites with bridges either being repaired or replaced under this proposed action, this will be conducted over a 10-year period across Oregon, thus spreading the adverse effects of vegetation removal over that time frame and across watersheds. On an individual bridge scale, vegetation removal is not expected to be a major effect. However, smaller batches of bridges, typically in proximity to each other, will likely be constructed at the same time to maximize efficiencies in construction. Based on this, the potential additive adverse effects due to vegetation removal, on local fish and wildlife populations, within a given system or 6^{th} field HUC, and at the DPS or ESU scale may be greater in magnitude than those at individual bridge sites.

Marbled murrelet, bald eagle, and northern spotted owl habitat removal. In the BA the FHWA/Corps estimated the acres of habitat that may be lost do to removal for the marbled murrelet, bald eagle and northern spotted owl using essentially the same analysis. The analysis used a 500-foot radius around the center point of a bridge to distinguish the area where vegetation removal may occur for construction, staging, or detour route purposes and estimated, based on previous projects, that on average two acres of vegetation may be removed. The USFWS believes these acreages are a conservative estimate across the range of each species within Oregon. The FHWA/Corps estimated that for marbled murrelet 100 acres of suitable nesting habitat may be removed; for bald eagle four acres of potential nesting/roosting habitat may be removed; and for northern spotted owl a total of 282 acres of suitable nesting and roosting habitat may be removed. Because spotted owl and marbled murrelet habitat is similar at this analysis scale, the 100 acres of murrelet habitat is also counted as spotted owl habitat. Therefore, 100 acres of the spotted owl habitat is within the coast range (within 40 miles of the coast) with the remaining 182 acres east of that.

Fender's blue butterfly. In the BA, FHWA/Corps estimated an average of two acres of potential habitat at 74 bridges within the range of the butterfly in the Willamette valley could be removed or altered by construction activities totaling approximately 148 acres. The habitat to potentially be removed or altered would not have Kincaid's lupine, a Federally list plant, as a component due to the *Plant Avoidance* EPS and thus would be composed of the butterflies secondary host forage plants, sickle-keeled or spurred lupine.

From the Plant Avoidance EPS:
Plant Avoidance. Avoid disturbance to State and Federally-listed plants and their occupied habitat.

f. Survey project areas during appropriate flowering period within the range of listed plants. Refer to the BA and the relevant Environmental Baseline Reports for plant ranges. A survey is not required if the area has had a documented survey[60] within the last 10 years.

g. Flag and map occupied habitat necessary to sustain the identified population within the area of potential disturbance, prior to construction.

h. Ensure construction personnel, equipment, and associated pollutants (e.g., sediments, chemical contaminants, discharge water, non-native grass or weed seed) do not enter the occupied habitat. Delineate as a no work zone or fence the occupied habitat.

i. Maintain the hydrologic and microclimatic conditions necessary for the continued existence of the identified population within the project area.

j. If plants are found, then a management buffer will be developed to protect plants from indirect effects such as herbicide drift.

There are 38 known sites for Fender's blue butterfly across its range in the Willamette Valley totaling approximately 463 acres (table 4-9). Of this total area, approximately 25 sites (66 percent) and 242 acres (52 percent of the total area) have Kincaid's lupine is at least a co-dominant host plant, and thus would be avoided as directed under the *Plant Avoidance* EPS. The remaining 13 sites (34 percent) comprise approximately 221 acres

Table 4-9. Known Fender's blue butterfly sites and habitat by host plant.

Host Plant(s)	Sites	Acres	Percent of Area
Kincaid's lupine	25	121	26%
Kincaid's lupine + Spurred lupine	1	121	26%
Sickle-keeled lupine	4	21	4.5%
Spurred lupine	7	198	43%
Unknown sp. (Cardwell Hill site)	1	2	0.4%
Total	**38**	**463**	**99.9%**

(48 percent of the total area). None of the known sites will be removed due to the proposed action based on site maps and bridge location proximity. As stated in the murrelet and spotted owl effects analyses, the two acre per bridge figure was likely an overestimate of the amount of habitat to be removed, but in the absence of actual bridge design information the USFWS believes this more conservative analysis was appropriate. In addition this assumes the entire two acres is composed of spurred or sickle-keeled lupine which is very unlikely. Therefore, based on (1) the amount of known occupied habitat, (2) the knowledge that no known Fender's blue sites will be removed, and (3) the recognized overestimation that all habitat being removed per bridge (two acres) is occupied secondary forage habitat (spurred or sickle-keeled lupine), the USFWS believes the 148 acres of potential, unsurveyed habitat is an overestimate of the likely potential habitat that will be removed. The USFWS believes that based on the assumptions listed above, 75 acres may be a more realistic, yet still conservative, assumption of the amount of potential secondary forage habitat to be removed or altered.

Fluvial Alteration

Alterations to fluvial processes can have sub-lethal and lethal effects on listed species as well as direct effects on habitat. Alterations in channel hydraulics are triggered by the direct removal of habitat elements, which contribute to channel complexity, or by altering the flow regime of rivers and streams. These alterations can indirectly affect aquatic and semi-aquatic species by altering distribution and by degrading habitat. The addition of hardened structures (i.e., bridge bents) within a fluvial channel can alter the hydrology of the system by increasing flow velocities, encouraging scour, and limiting the natural movement of bedload materials,thus causing habitat loss and sub-lethal effects on aquatic and semi-aquatic species. Changes to the hydrologic regimes of streams and rivers are a possible pathway for these types of effects.

While there are approximately 430 individual bridge sites either being repaired or replaced under this proposed action, this will be conducted over a 10-year period across Oregon, thus spreading the potential for fluvial alteration resulting from bridge repair/replacement activities and elements over that time frame and across watersheds. However, the potential for fluvial alteration resulting from bridge repair/replacement activities and elements at an individual bridge is not expected to be a major effect but smaller batches of bridges will likely be constructed at the same time to maximize efficiencies in construction. Based on this, the potential for fluvial alteration resulting from bridge repair/replacement activities and elements, on local fish and wildlife populations, within a given system or 6th field HUC, and at the DPS or ESU scale may be greater in magnitude than those at an individual site.

The FHWA/Corps has proposed to fully implement the following sections of the *Fluvial* environmental performance standard (Section 2.5) to avoid potential adverse effects to listed species and to ensure the potential for fluvial alteration resulting from bridge repair/replacement activities and elements are below thresholds equated with incidental take of listed species. The FHWA/Corps has also proposed to fully implement the *Compensatory Mitigation* environmental performance standard (Section 2.5) for bridge repair/replacement activities and elements such as bridge repair using riprap for scour protection at existing bridges to ensure any unavoidable long-term adverse effect is functionally offset within the same 6th field hydrologic unit:

From Fluvial EPS:
Fluvial. Allow normative physical processes within the stream-floodplain corridor.

a. Channel Processes. Design water crossings other than overflow crossings that (1) promote natural sediment transport patterns for the reach, (2) provide unaltered fluvial debris movement, and (3) allow for longitudinal continuity and connectivity of the stream-floodplain system. If one of the three objectives cannot be restored at the project site, then locate an alternate, non-Bridge Program project within the same project watershed that will achieve an equal or greater function. Temporary fill below the bankfull elevation that results in embedded streambed material is not allowed, unless approved in writing by the Services and the appropriate Regulatory Authorities.

i. Ensure the functional floodplain is absent of roadway, embankment, or approach fills.

(1) For purposes of this project, the functional floodplain will be determined using the following process, unless another process (e.g., channel migration zone) is more appropriate for site conditions and is approved in writing by the Services and the appropriate Regulatory Authorities :

(a) Step 1: Determine the bankfull width, depth, and elevation.

(b) Step 2: Determine the floodprone elevation and width.

(c) Step 3: Determine the Entrenchment Ratio (E).

(i) If E < 2.2, then the floodprone area is considered the functional floodplain.

(ii) If E > 2.2, then 2.2 times the bankfull width is considered the functional floodplain.

(d) Process Considerations:

(i) The bankfull discharge level (elevation) can be located using field indicators as defined by Dunne and Leopold (1978). Bankfull indicators include: (1) topographic break from vertical bank to flat floodplain, (2) topographic break from steep slope to gentle slope, (3) change in vegetation from bare to grass, moss to grass, grass to sage, grass to trees, or from no trees to trees, (4) textural change of depositional sediment, (5) elevation below which no fine debris (needles, leaves, cones, seeds) occurs, and (6) textural change of matrix material between cobbles or rocks (Dunne and Leopold 1978).

(ii) Surveys of the bankfull discharge elevation should be conducted upstream and/or downstream of the bridge, outside of the area influenced by the bridge. Five to seven channel widths (one average meander wavelength; 10 widths is preferred) is often used as a minimum distance to survey upstream and downstream, however, site conditions will dictate the appropriate distance for surveying.

(iii) Bankfull width (BFW) is the active channel width at the bankfull discharge elevation as defined above. Averaging several width measurements (taken at riffle sections, if available) are preferable to a single measurement. Comparing upstream and downstream measurements is valuable for determining various physical processes in operation at specific sites. Avoid measuring widths where bank stabilization structures are located. Vast disparities in upstream and downstream bankfull widths may indicate stream instability and should be further investigated.

(iv) Average bankfull depth can be determined by either averaging the measured depths across the stream channel at the bankfull width level, or by dividing the cross-sectional area by the bankfull width.

(v) The floodprone width (FPW) is determined by finding the elevation at twice the maximum bankfull depth at a riffle or three times the average bankfull depth. The width of the floodplain, or floodprone area, is then measured at this elevation. Using three times the average depth is a more robust approach because it is not as sensitive to the exact location of the cross-section.

(2) As a means of evaluating bridge placement, appropriate span length, and overall program goals, perform scour analysis to:

(a) Evaluate the bridge length so that there is equivalent contraction scour at the bridge crossing as in the area upstream of the bridge crossing or would be expected under natural conditions up to the 10-year flood event.

(b) Ensure that the discharge at which incipient motion begins under the bridge is similar to the discharge at which incipient motion begins upstream of the bridge.

(c) Ensure scour through the bridge opening is equivalent to reach conditions outside of the influence of the bridge structure and road prism.

ii. Remove man-made constrictions within the functional floodplain of the project area.

(1) Reduce existing fill volumes in the functional floodplain: Possible measures to reduce fill volumes could include removing existing approach fills, installing relief conduits through existing fill, or removing other floodplain fill volumes located within the project area.

(2) Avoid increases and decrease, as feasible, net fill volumes within the floodprone area.

(3) Remove vacant bridge support structures in the functional floodplain. Possible measures may include removing structures to below the modeled scour depth or removing structures located within debris transportation corridors.

iii. Design and locate bridge support structures with the following considerations:

(1) Avoid inducing localized scour of streambanks and reasonably likely spawning areas.

(2) Bridge supports will avoid supplemental scour prevention (e.g., riprap) and incorporate scour protection (e.g., drilled shafts, piles driven below critical scour depth).

(3) Bridge supports will allow the fluvial transport of large wood through the project area.

(a) Avoid the need for removal or modification (e.g., cutting, limbing) of large wood resting against bridge support structures.

(b) Design span length to facilitate potential large wood movement through the project area with the following considerations:

(i) The site-potential tree height and the large wood transport capacity of the project watershed upstream of the bridge.

(ii) The orientation of the bridge crossing and bent locations relative to stream flow in order to capitalize on the orientation of drift material relative to the bridge structure.

b. <u>Floodway Processes</u>. Design crossings that allow lateral connectivity between the stream and floodplain.

i. Bridge the functional floodplain.

ii. Accommodate potential flow pathways at multiple flood stages by:

(1) Locating bridge opening to maximize floodplain function;

(2) Providing flood-relief conduits (bottomless arch and embedded culvert design only) within existing road fill at potential flood flow pathways based on analysis of flow patterns (or floodplain topography) at multiple flood stages, as necessary;

(3) Locating bridge abutments with consideration of channel migration patterns over the designed lifetime of the bridge.

From Compensatory Mitigation EPS:
Ensure the proposed action meets the goal of no net loss of habitat function by offsetting unavoidable permanent and temporary adverse effects to habitats. Offsetting actions will be such that they are commensurate with the amount, type, timing, and significance of adverse effects to resources as much as possible. Activities that reduce or remove habitat function or that delay or prevent development of desired function or condition of habitat will require a Compensatory Mitigation Plan that describes how this will be achieved. General considerations for these plans include:

j. Make mitigation plans compatible with adjacent land uses or, if necessary, use an appropriate buffer to separate mitigation areas from developed or agricultural lands so that desired functions and value will not be significantly reduced by the direct or indirect impacts of adjacent land uses. Adjacemt/proximal land use and land management will be accounted for in the assessment of the functional site value.

k. Base the level of required mitigation on a functional assessment of adverse effects of the proposed project, and functional replacement (i.e., 'no net loss of function'), whenever feasible, or a minimum one-to-one linear foot or acreage replacement ratio shall be applied. As necessary, the replacement ratio shall be adjusted to accommodate the risk of failure associated with some habitat projects and in recognition of the long periods of time sometimes necessary for successful habitat projects to provide desired function and conditions.

l. Acceptable mitigation must be consistent with all program-specific EPS and may include:

i. Re-establishment or rehabilitation of natural or historic habitat functions when self-sustaining, natural processes are used to provide the functions.

ii. Participation in ODOT's conservation banks, as approved in writing by the Services and the appropriate Regulatory Authorities.

m. Actions that require construction of permanent structures, active maintenance, creation of habitat functions where they did not historically exist, or that simply preserve existing functions are not authorized, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

n. Whenever feasible, complete mitigation before, or concurrent with, project construction to reduce temporal loss of ecosystem functions and simplify compliance.

o. When project construction begins before mitigation is completed, show the Services that a mitigation project site has been secured and appropriate financial assurances are in place.

   iii. Complete all work necessary to carry out the mitigation plan no later than the first full growing season following the start of project construction, whenever feasible.

   iv. If beginning the initial mitigation actions within that time is infeasible, then include other measures that mitigate for the consequences of temporal losses in the mitigation plan.

p. Include all pertinent elements of a site restoration plan, outlined above, and the following elements.

   i. Consideration of the following factors during mitigation site selection and plan development.

      (1) Watershed considerations related to specific resource needs of the affected area.

      (2) Existing technology and logistical concerns.

   ii. A description of the legal means for protecting mitigation areas, and a copy of any legal instrument relied on to secure that protection. Mitigation areas will be secured and protected on a permanent basis, utilizing the legal and procedural tools best suited to doing so.

q. Information related to unavoidable impacts to bull trout, short-nose and Lost River suckers, Oregon chub, marbled murrelet, bald eagle, northern spotted owl, and Fender's blue butterfly will be included so that ODOT can implement appropriate program-level mitigation planning and actions for these species.

r. All mitigation actions associated with the Bridge Program will comply with the USFWS' Conservation Banking for Threatened and Endangered Species (68 FR 24753), and the Corps' Regulatory Guidance Letter on Compensatory Mitigation (USACE 2002), as appropriate.

Through implementation of the *Fluvial* environmental performance standard and compensatory mitigation for any unavoidable long term adverse effect of any bridge repair/replacement activity, the Services believe that long-term adverse effects to listed species will be adequately constrained

Therefore, the Services do not expect any lethal effects from fluvial alteration to listed aquatic species and adverse effects will be avoided or constrained to only those likely to be discountable or insignificant in nature, or for NOAA Fisheries species, be offset by a compensatory mitigation action within the same 6th field hydrologic unit. In addition, the Services expect any realized non-lethal effect from hydrologic alteration to listed aquatic species will be avoided or constrained to only those likely to be minor and temporary in nature and long-term beneficial effects to fluvial processes may occur at some or all of bridge repair/replacement projects from implementation of the fluvial environmental performance standard.

In-water Work and Fish Capture and Release

Timing and Construction Procedures can influence potential adverse effects to listed species from in-water work. Lethal, and sub-lethal effects are often unavoidable where in-water work cannot be conducted at a time or in such a manner that listed species are not present during construction or within isolated work areas. During periods of in-water work and through in-water work isolation, downstream or upstream passage may be partially of fully blocked. A given project can only block downstream passage with specific written permission from the Services.

While there are approximately 430 individual bridge sites either being repaired or replaced under this proposed action, this will be conducted over a 10 year period across Oregon, thus spreading the potential for in-water work and fish capture and release resulting from bridge repair/replacement activities and elements over that time frame and across watersheds. However, the potential for in-water work and fish capture and release resulting from bridge repair/replacement activities and elements at an individual bridge is not expected to be a major effect but smaller batches of bridges will likely be constructed at the same time to maximize efficiencies in construction. Based on this, the potential for in-water work and fish capture and release resulting from bridge repair/replacement activities and elements, on local fish and wildlife populations, within a given system or 6th field HUC, and at the DPS or ESU scale may be greater in magnitude than those at an individual site.

Fish capture and relocation is considered a minimization measure in and of itself. However, effects (sub-lethal and lethal) on listed fish species can occur during any activity that requires handling or that would otherwise displace listed fish species, (e.g., by blocking passage or access to habitats and displace fish from cover.) Handling and lethal take, including delayed mortality from stress and injury, from fish capture and release was estimated by FHWA/Corps in the BA using the following set of assumptions (ODOT 2004a):

1. All water-spanning bridges within an ESU will require in-water work area isolation and fish capture and release.

2. Each project requiring in-water work area isolation is likely to capture and release up to 100 salmonids per in-water work season (NOAA Fisheries 2003a).

3. Species composition of captured and handled salmonids is assumed to: 1) be evenly distributed among ESUs intersected by a given bridge project, and 2) involve a maximum of 100 handled fish per bridge. Thus, the number of handled fish for a particular ESU was assumed to be 100 if the bridge affected only that ESU. If a given bridge project affected multiple ESUs, then the maximum 100 fish handled per bridge was divided by the number of ESUs affected by that bridge.

4. Captured salmonids are assumed to belong to the ESU in which a given bridge site is located. For example, all steelhead trout captured downstream of Willamette Falls would be assumed to be part of the Lower Columbia River ESU.

5. Take of adult anadromous salmonids due to harassment or capture and release activities is expected to be non-lethal take. Adult fish can be harassed out of the area prior to and during work area isolation, reducing the need to capture and release them.

6. For ESA-listed salmonids to be captured and handled, 98 percent or more are expected to survive with no long-term effects, and less than two percent are expected to be injured or killed (including those that die later as a result of injury). However, a higher estimate for lethal take of six percent of handled fish has been used to allow for variations in experience and work conditions, to provide coverage for unforeseen takings from bridge construction with no in-water work, to provide coverage for bridge repair and replacement operations that occur over more than one work season (i.e., requiring multiple fish capture and release operations), and to account for those bridges which may require minor in-water work extensions.

7. For bull trout, it is assumed that lethal take may occur—of six percent or less of the number of fish handled, at each project requiring in-water work area isolation within a bull trout core area. Up to 20 bull trout adults and juveniles (in aggregate) at each bridge are expected to be handled. The number of bull trout encountered relative to other salmonids is lower due to their more restricted distribution within the Columbia River and Klamath DPS, their preference for colder waters than are expected to occur at most bridge locations during in-water work periods, and the lack of hatchery contribution to bull trout numbers.

8. Juvenile Lost-river and Short-nose suckers are assumed to be handled at a lower rate than ESA salmonids under NOAA Fisheries jurisdiction. A maximum of 20 juvenile suckers (of each species are expected to be handled at each bridge within the range of either species; six percent of which may be killed by handling stress or injury.

9. Assumed lethal take for Oregon chub is two percent or less of the anticipated 100 Oregon chub at each bridge within the range of the chub, due to handling stress or

injury, or from unforeseen takings resulting from bridge construction. A lower percentage of take is assumed for Oregon chub than for other species based on discussion with Paul Sheerer (ODFW) regarding salvage experience and mortality associated with Oregon chub.

Although fish capture and relocation will likely result in take, it is assumed that take would be minimized from that which would occur without fish capture and release from Bridge program elements occurring within the isolated work area.

Anadromous salmonid outmigrants, particularly during downstream passage through the mainstem Columbia River, are less likely to be affected than juvenile salmonids rearing at or near the bridge site during capture and handling efforts associated with the Bridge Program. Data cited in Floyd (2003) indicate that juvenile outmigrants within the Columbia River are primarily in a migration phase and tend to pass quickly through the system. Additionally, steelhead, Chinook salmon, and sockeye salmon tend to stay out in the river rather than orienting to the shoreline. Chinook salmon will seek resting and feeding areas, particularly during periods of low flow. Individuals of those ESUs that would be present in the Columbia River only as migrants and would not otherwise be present in proximity to Bridge Program activities (i.e., Upper Columbia River Chinook and steelhead, Snake River Fall-run Chinook and Snake River sockeye) are unlikely to be encountered during capture and handling efforts. Snake River Fall Run Chinook salmon do occupy shallows of the Columbia River estuary, although no program bridges occur in these areas. All other listed salmonids as well as listed resident fish are likely to be captured and released at various locations, depending on species distribution with it's range, during temporary water management and work area isolation bridge repair/replacement activities.

In addition to direct effects to listed fish from in-water work, indirect effects are also anticipated from vegetation removal and associated effects as discussed above. In-water work will alter linear bank line habitat and acres of riparian habitat. Indirect effects to listed fish from habitat alteration were estimated by FHWA/Corps in the BA using the following set of assumptions (ODOT 2004a):

1. Temporary vegetation impacts assume an impacted area of 150 linear of feet of stream by 150 feet deep on both sides of a bridge (combined area of 45,000 sq. ft.). Permanent impacts assume 20 linear feet by 150 feet deep, or 6,000 sq. ft. per bridge. For bull trout, vegetation impacts will occur where bridge projects are within 2 miles of proposed critical habitat, including bridges outside core areas. For Oregon chub, vegetation impacts (both length of streambank and riparian area) are assumed to be twice that of other species due to the complex nature of chub habitat which typically encompasses sloughs, ponds, and other off-channel habitat areas.

The FHWA/Corps has proposed to fully implement the following sections of the *Species Avoidance* environmental performance standard (Section 2.5) to avoid and minimize potential adverse effects to listed species and to ensure the potential for in-water work resulting from bridge repair/replacement activities and elements are conducted during least sensitive life stages or migration times and that fish capture and release activities minimize otherwise lethal and sub-lethal take of individuals during in-water work:

From Species Avoidance EPS:
Fish Avoidance. Minimize incidental take of listed fish and adverse effects to fish species from in-water work activities.

k. Timing of In-water Work. Complete work below the bankfull elevation during the preferred in-water work period included in Appendix B of this Opinion, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

l. Cessation of Work. Cease project operations under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.

m. Fish Screens. Have a fish screen installed, operated, and maintained according to NOAA Fisheries' fish screen criteria on each water intake used for project construction, including pumps used to isolate an in-water work area. Screens for water diversions or intakes that will be used for irrigation, municipal or industrial purposes, or any use besides project construction are not authorized.

n. Fish Passage. Provide passage for any adult or juvenile fish species present in the project area during and after construction and for the life of the project, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities[61].

o. Isolation of In-water Work Area. If adult or juvenile fish are reasonably certain to be present, or if the work area is within 300 feet upstream of reasonably likely spawning habitats, completely isolate the work area from the active flowing stream using inflatable bags, sandbags, sheet pilings, or similar materials, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities. Prepare a Work Area Isolation Plan for all work below the bankfull elevation requiring flow diversion or isolation. Include the sequencing and schedule of dewatering and re-watering activities, plan view of all isolation elements, as well as a list of materials to adequately provide appropriate redundancy of key plan functions (e.g., an operational, properly sized backup generator). Pile driving may occur without isolation during the in-water work period, providing compliance has been achieved with all other relevant performance standards.

p. Capture and Release. Before, intermittently during, and immediately after isolation and dewatering to isolate an in-water work area, attempt to

[61] Ensure compliance with Oregon Revised Statutes (ORS) 509.585 regarding fish passage.

capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.

i. The entire capture and release operation must be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

ii. Do not use electrofishing if water temperatures exceed 64^{o}F, unless no other fish capture method is feasible or successful.

iii. If electrofishing equipment is used to capture fish, comply with NOAA Fisheries' electrofishing guidelines.

iv. Handle all fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.

v. Ensure water quality conditions, including dissolved oxygen levels, within fish transport systems (e.g., buckets) are sufficient to promote fish recovery. Brief holding times; clean, cold, and circulated water; and aerators may be used to maintain water quality conditions.

vi. Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.

vii. In the event of mortalities, do not transfer Federally-listed fish to anyone except the Services, unless otherwise approved in writing by the Services and the appropriate Regulatory Authorities.

viii. Obtain all other Federal, State, and local permits necessary to conduct the capture and release activity, such as an ODFW Incidental Take Permits and/or a Scientific Taking Permits.

ix. Allow the Services and the appropriate Regulatory Authorities to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.

x. Report salvage effort results, as called for in relevant permits, including the name and address of the supervisory fish biologist, methods used to isolate the work area and minimize disturbances to fish, stream conditions before and following placement and removal of barriers, the means of fish removal, the number and species of fish removed, the condition of all fish released, and any incidence of observed injury or death.

Through the development and implementation of in-water work avoidance and minimization strategies and plans (listed above) specific to each bridge repair/replacement activity and element capable of requiring in-water work, the resulting potential for adverse effects to listed aquatic species will be constrained and minimized, including lethal take of listed aquatic species, to the maximum extent possible.

Therefore, the Services expect any realized lethal effect from in-water work and fish capture and release to listed aquatic species will be limited to only those individuals for which lethal mortality is unavoidable during fish capture and removal efforts and for which severe or lethal adverse effects would be otherwise imminent from in-water work. In addition, the Services expect any realized sub-lethal effects, direct or indirect, from in-water work, fish capture and release, and habitat alteration to listed species will be limited to only those individuals for which mortality is unavoidable. The Services have adopted numerical estimates for lethal and sub-lethal take of listed fish species from in-water work and fish capture and release efforts, linear bank line, and acreages of riparian habitat alterations from the BA and are incorporated into Section 4.2.1 *Amount and Extent of the Take* of this Opinion.

4.1.4.2 Effects on Critical Habitat

Anadromous Salmonids

The Services designate critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. Effects to designated critical habitat from these categories would be similar to the effects to listed species described above in section 4.1.4.1.

Bull trout Proposed Critical Habitat

The nine Primary Constituent Elements (PCE) of bull trout critical habitat identified in the proposed critical habitat rule can be negatively affected in a number of ways. Individual bridge projects may result in removal of riparian vegetation that provides shade, and water-edge habitat. This may result in increased stream temperatures, and reduced hiding cover and refugia for bull trout. Increased sedimentation resulting from project activities can reduce overall water quality, and depreciate the value of spawning gravels within, and adjacent to project areas. Projects that change stream flow characteristics may alter habitat parameters both above and below them for a considerable distance. The changes may occur through changing natural stream meander, changing the ratio of pools to riffles, changing the ratio, and lengths of slack versus fast water areas. Fish passage projects may allow undesirable non-native species, which compete with bull trout, access to bull trout habitat, thus reducing the habitat quality for foraging.

The discussion that follows lists each PCE and describes how actions authorized under the Bridge Delivery Program may affect those elements.

PCE 1) Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.

All individual bridge repair or replacements have the potential to negatively affect this element. The possibility that chemical contamination will occur from a variety of sources exists. The use of mechanized equipment will expose the habitat to petroleum products, some of the construction activities may expose the habitat to green concrete, or PAH. Many construction activities have the potential to cause some degree of increased sedimentation. Increases in sedimentation on stream substrate will reduce the suitability of that substrate to support bull trout breeding and juvenile rearing.

PCE 2) Water temperatures ranging from 2 to 15C (36 to 59F), with adequate thermal refugia available for temperatures at the upper end of this range.
Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence.

Most individual bridge replacement projects will remove, or alter some riparian vegetation. Often removal of such vegetation will also reduce stream shade, which allows longer exposure of the stream surface to direct sunlight. This can lead to increased water temperatures, with resulting lower dissolved oxygen levels. The warmer water temperatures and decreased oxygen levels reduce the habitats holding capacity, and desirability. They also can lead to habitat conversion, where differing species more adapted to these conditions (e.g., brook trout), can push the bull trout out of the habitat.

PCE 3) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and in stream structures.
Most individual bridge repair actions and a portion of the bridge replacements will continue to affect this element. Projects that change stream dynamics, even slightly, or short term can have profound effects on habitat quality, and composition. Placing structures that change stream flow velocities, or directions can change pool to riffle ratios, or slack versus fast water ratios for some distance away from the project site. These changes can cause shifts in the aquatic community, removing prey base, spawning sites and hiding cover for bull trout. The removal, or relocation of large wood can also change site dynamics, and stream complexity. Such changes can cause shifts that allow undesirable (non-native) species to enter the habitat and compete with bull trout.

PCE 4) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions.
Any construction activity that produces sediment will affect this element. Increases in sediment will increase the degree of embeddedness, and decrease the availability of suitable spawning gravel, and substrate for juvenile rearing. Because of the high degree of sensitivity displayed by bull trout in all life stages (including adults), any increase in sedimentation can have a negative affect on habitat quality.

PCE 5) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.
Construction activities that may change flows (both instream, and inflows from upland areas) have the capacity to negatively affect this element. Wherever impermeable surfaces are created, overland flows from stormwater will be increased. This can lead to faster input of waters into the stream system than would naturally occur. These types of flow changes can cause increased sedimentation, streambank instability, and erosion. Changes in peak flows can cause changes to the riparian plant community, which in turn, can cause changes to the aquatic community, reducing the desirability of the affected habitat to bull trout.

PCE 6) Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.
Changes within the riparian area resulting from individual bridge repair or replacement projects will occur. These changes may include the interception of groundwater that contributed to habitat quality for bull trout. Mechanical changes to the streambed, and streambanks could alter the function of groundwater within bull trout habitat. These changes, although often subtle, may have long lasting effects on habitat quality.

PCE 7) Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.
Because individual projects have the potential to cause temporary flow changes, and increased water temperature, it is likely that this element will be adversely affected. Thermal barriers to bull trout migration are already a significant threat to bull trout within many areas of the State. Increasing temperature on more sections of stream may make connectivity even more difficult for bull trout. Projects that reduce flows make this problem worse, as water in streams with low flows is more easily heated than that in streams with larger, deeper flow volumes. No individual bridge projects should result in a permanent barrier to bull trout passage. However, some projects may act as temporary physical barrier to bull trout, making habitat inaccessible during portions of the year.

PCE 8) Abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
Construction activities associated with both bridge repair and replacement projects may affect this element. Changes in stream flow, temperature, sedimentation, cobble embeddedness, riparian vegetation, and altered access can result in changes within the aquatic and riparian systems. These changes can result in a reduction in prey base, as the system shifts away from the parameters preferred by bull trout.

PCE 9) Few or no predatory, interbreeding, or competitive nonnative species present.
Construction activities associated with both bridge repair and replacement projects may affect this element. Changes in stream flow, temperature, sedimentation, cobble embeddedness, riparian vegetation, and altered access can result in changes within the aquatic and riparian systems. These changes can make bull trout habitat suitable for

other non-native predatory fish that compete with bull trout. Such changes can ultimately make bull trout unsuitable. If the incursion of non-native fish includes brook trout, the genetic integrity of the bull trout population is placed at risk. Bull trout x brook trout hybrids are known to occur in several streams in eastern Oregon. These hybrids present a continued risk to the usefulness of the habitat as they are not sterile, and will re-cross themselves freely with either bull trout, or brook trout.

Even though the implementation of the Bridge Program will have some adverse effects on the PCEs of the proposed critical habitat for bull trout, those effects are expected to be minor overall.

Within the BA, 84 bridges in the Columbia River bull trout DPS were identified as being within 2 miles of proposed critical habitat and no bridges were within 2 miles of proposed critical habitat within the Klamath River DPS. Of the 84 bridges within 2 miles of proposed critical habitat, 23 bridges are not within 2 miles of a core area. A conservative 2 mile radius was used in the effects analysis to capture potential down stream effects, therefore a portion of these bridges are not in proposed critical habitat but are upstream or downstream. Further, as described in the species effects analysis, the EPS have been designed to substantially minimize the amount and severity of the potential effects to the physical and biological habitat components represented by the PCEs. In particular, the *Fluvial* EPS was designed to improve fluvial processes by designing bridges that span more of the flood plain and use techniques that do not promote large inchannel piers/bents to accommodate natural channel processes to a greater extent. The *Water Quality* EPS is designed to minimize entry into streams of sediments and contaminants. The *Site Restoration* EPS is intended to restore proper functioning conditions for riparian vegetation in areas where construction activity removed it. In many cases this may be an improvement by replacing exotic species (e.g., Himalayan blackberry) with native species. As a result, while potential short-term effects are likely, the USFWS anticipates that no PCE will be eliminated or significantly reduced within any proposed critical habitat unit through implementation of the Bridge Program.

4.1.4.4 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." The Services are not aware of any specific future non-federal activities within the action area that would cause greater effects to listed species than presently occurs. The action area includes significant tracts of private and state lands. Land use on these non-federal lands includes rural development, agricultural, and commercial forestry. Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their use. The Services generally do not consider existing rules governing timber harvests, agricultural practices, and rural development on non-federal lands within Oregon to be sufficiently protective of watershed, riparian, and stream habitat functions to support the survival and recovery of listed species. Therefore, habitat functions for listed salmon and steelhead may be at risk as a result of future activities on some non-federal lands within the state.

Non-federal activities within the action area are expected to increase due to a projected 34 percent increase in human population by the year 2024 in Oregon (ODAS 1999). Thus, The Services assume that future private and state actions will continue within the action area, increasing as population density rises.

4.1.5 Integration and Synthesis of Effects

In the fourth step of its effects analysis, The Services determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of the species' survival and recovery in the wild or lead to the destruction or adverse modification of critical habitat. The Services use the consultation regulations to determine whether actions would further degrade the environmental baseline at a spatial scale relevant to the listed species.

Full implementation of EPS during all aspects of implementation and permitting of the proposed action is vital to avoidance and minimization of adverse effects to listed species. The Services participated in the development of FHWA/Corps' OTIA III Statewide Bridge Delivery Program and worked closely with ODOT in the development of the Program's BA, to ensure that the EPS constrain potential adverse effects and maximize potential beneficial effects adequately to meet the biological requirements of the 10 ESUs covered by this consultation. Nevertheless, some adverse effects may occur from permitting and funding of the proposed action.

Effects of Corps' permitting and of FHWA's funding of the proposed action may include:

1) Noise/Visual Harassment;
2) Hydro-acoustic;
3) Increased Erosion, Turbidity, Sediment Transport, and Chemical Exposure;
4) Hydrologic Alteration;
5) Vegetation Removal;
6) Fluvial Alteration; and
7) In-water Work and Fish Capture and Release

The above effects are expected to be localized and constrained by the EPS, avoid potential long-term adverse effects and greatly minimize short-term adverse effects when and where they cannot be completely avoided. Any unavoidable short-term adverse effect is minimized and is constrained to only those likely to be minor, repetitive, and predictable in nature and any remaining long-term adverse effect requires compensatory mitigation action adequate to functionally off-set the adverse effect. Some of the above effects are likely to be beneficial in nature to listed species and persist over the short- and long-term. Based on these factors, The Services have determined that any adverse effects from FHWA/Corps' funding and permitting of the OTIA III Statewide Bridge Delivery

Program are unlikely to be of a magnitude, duration or extent that would reduce the long-term survival of the listed species.

4.1.6 Conclusion

After reviewing the best available scientific and commercial information available regarding the current status of the three ESA listed resident riverine fish species and 10 anadromous salmonid ESUs discussed in this Opinion (Table 1-1), the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, the Services conclude that the FHWA/Corps' proposed action of funding and permitting the OTIA III Statewide Bridge Delivery Program is not likely to jeopardize the continued existence of shortnose and Lost River suckers, bull trout, Snake River Spring/summer-run Chinook salmon, Upper Willamette River Chinook salmon, Lower Columbia River Chinook salmon, Oregon Coast coho salmon, Southern Oregon/Northern California coho salmon, Lower Columbia River coho salmon, Columbia River chum salmon, Upper Willamette River steelhead, Middle Columbia River steelhead, and Lower Columbia River steelhead, and is not likely to destroy or adversely modify designated or proposed critical habitat.

Our conclusion is based on the following considerations: (1) The OTIA III Statewide Bridge Delivery Program requires individual review of each bridge repair or replacement project to ensure and demonstrate to the Services how the proposed action will be in compliance with this Opinion, and that each applicable Environmental Performance Standard (Section 2.5 as described in the proposed action and referred to in the reasonable and prudent measures and terms and conditions of this Opinion) is fully implemented during project administration, design, construction, monitoring, and reporting; (2) taken together, the Environmental Performance Standards applied to each project will ensure any short-term effects to water quality, habitat access, habitat elements, channel conditions and dynamics, flows and watershed conditions will be brief, minor, and scheduled to occur at times that are least sensitive for the aquatic species' life-cycles; (3) the underlying requirement of an ecological design approach that protects and stimulates natural habitat forming processes is expected to result in reduction of ongoing adverse impacts associated with existing bridges, and, in many cases, will result in long-term beneficial effects as these bridges are repaired or replaced; (4) the functional objectives, prioritization, and landscape context of the conservation and mitigation actions, as identified in the CMCS are expected to result in significant contribution to species and habitat conservation and ecosystem recovery; and (5) the individual and combined effects of all the actions proposed in this way are not expected to impair the currently properly functioning habitats, appreciably reduce the functioning of already impaired habitats, or retard the long-term progress of impaired habitats toward proper functioning condition essential to the long-term survival and recovery at the watershed (6^{th} Field HUC), population, DPS or ESU scale.

In addition to the general considerations listed above the following specific factor applies to the bull trout:

Bull trout

1. The proposed action will permanently remove up to 7 acres and temporarily remove up to 51 acres of bull trout habitat within the Columbia River DPS in Oregon and permanently remove 0.1 acre and temporarily remove up to 1 acrea of bull trout habitat within the Klamath Falls DPS in Oregon. The amount of habitat being permanently removed was based on the estimates of the new bridges being wider thus shading out some riparian vegetation growth permanently. Temporary habitat removal is based on riparian habitat removal during construction but restored on site following construction. This amount of habitat represents a minor portion of the existing habitat within the range of the species and is expected to be distributed spacially and temporally such that no individual population center will be subject to losses that alter site-specific productivity or viability. Habitat restoration and enhancement actions implemented by ODOT will result in development of other habitats that are the functional equivalent of those adversely affected by the project, and the species will be prioritized for additional habitat projects that result in a net conservation benefit to the species

After reviewing the current status of the remaining USFWS listed terrestrial wildlife and off-channel fish species, the marbled murrelet, bald eagle, northern spotted owl, Oregon chub, and Fender's blue butterfly, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, the USFWS has determined that the proposed OTIA III Statewide Bridge Delivery Program is not likely to jeopardize the continued existence of these species. The USFWS also concurred with a "may affect not likely to adversely affect" determination for designated marbled murrelet and northern spotted owl critical habitat in Section 3.0 of this document. These conclusions were reached for the following general reasons:

(1) The OTIA III Statewide Bridge Delivery Program requires individual review of each bridge repair or replacement project to ensure and demonstrate to the USFWS how the proposed action will be in compliance with this Opinion, and that each applicable Environmental Performance Standard (Section 2.5 as described in the proposed action and referred to in the reasonable and prudent measures and terms and conditions of this Opinion) is fully implemented during project administration, design, construction, monitoring, and reporting; (2) taken together, the Environmental Performance Standards applied to each project will ensure any short-term adverse effects are substantially avoided or minimized; and (3) the functional objectives, prioritization, and landscape context of the conservation and mitigation actions, as identified in the CMCS are expected to offset adverse impacts to species and result in net benefits that support overall conservation and recovery.

In addition, several specific factors applied to individual species as described below.

Marbled Murrelet

1. The proposed action will adversely affect the species by removing up to 100 acres of potentially suitable marbled murrelet habitat dispersed across the species' range in Oregon. The amount of habitat removed (staging area, detour bridge and detour route) per bridge was extrapolated from past bridge projects and was conservatively estimated to be up to 2 acres per bridge. This will represent a very small amount of habitat, both on an individual site basis and cumulatively, and will be widely distributed. This amount and distribution of habitat loss, if it actually occurs, would effect only a minor portion of the existing habitat within each province and across the landscape overall.

2. All of the habitat being removed is near or within major highway corridors. The utilization and value of this habitat is probably already somewhat degraded due to associated human use and management activities. As a result, it is not very likely that habitat supporting high amounts of nesting or occupancy will be impacted

3. Adverse effects to marbled murrelet due to harassment (up to 1,566 acres of potentially suitable habitat) associated with demolition and construction activities will be spread across the range of the murrelet in Oregon, last up to two seasons per bridge, and in total will occur over a 10 year period. As described for habitat removal above, little of the habitat which will be impacted due to disturbance is expected to support high-levels of nesting or occupancy, and it will be distributed broadly across the species range in Oregon. Moreover, the intensity of disturbance-related impacts is not likely to be significant enough to lead to mortality of murrelets

In summary: habitat removal impacts will be small at the site-specific level and will represent only a small fraction of habitat available in any given ecoprovince; most habitat removal and disturbance impacts will be concentrated in areas not expected to support significant levels of nesting or occupancy; and, disturbance impacts will be distributed over a ten-year period and will not be of an intensity likely to cause mortality at any given location. For these reasons, the proposed action is not likely to reduce the size, distribution, or productivity of populations at the local, regional, or rangewide scales.

Bald eagle

1. The proposed action will adversely affect the species by removing up to 4 acres of potentially suitable bald eagle habitat within 0.25 miles of two nest sites in Oregon. This will represent a very small amount of habitat available within the local vicinity of each nest and within the ecoprovinces in which the nests occur.

2. Adverse effects to bald eagles due to harassment associated with demolition and construction activities will occur within 0.5 miles of 12 nest sites spread across the

range of the eagle in Oregon. These effects will last up to two seasons within the vicinity of each individual nest, and in total will be spread over a 10 year period across the state. The duration and intensity of disturbance-related impacts to each nest is not likely to be significant enough to lead to mortality of associated bald eagles. However, activity could result in one year (two years maximum) abandonment of a speciecif nest sites or use of an alternate nest site.

In summary: habitat removal and disturbance impacts will be limited a very small percentage of nest sites in Oregon; habitat removal impacts will occur to a very small amount of habitat available within the local vicinity of each affected nest and within the ecoprovinces in which the nests occur; and disturbance impacts will be distributed over a ten-year period and will not be of an intensity likely to cause mortality at any given location. For these reasons, the proposed action is not likely to reduce the size, distribution, or productivity of populations at the local, regional, or rangewide scales.

Northern spotted owl

1. The proposed action will affect up to 282 acres of potentially suitable northern spotted owl habitat dispersed across the range of the owl in Oregon. Because these impacts will be widely distributed, it is not likely that they will substantially alter the amount of habitat available within any given occupied owl site. Cumulatively, this amount and distribution represents a minor portion of the existing habitat within each province and across the landscape overall, making it unlikely that landscape level habitat availability or connectivity will be altered.

2. All of the habitat being removed is near or within major highway corridors. The utilization and value of this habitat is probably already somewhat degraded due to associated human use and management activities. It is not very likely that substantial levels of roosting, foraging, occupancy, nesting, or productivity are currently supported by this habitat.

In summary: habitat removal impacts will be small at the site-specific level and will represent only a small fraction of habitat available in any given ecoprovince; and, most impacts will be concentrated in areas not expected to support significant levels of roosting, foraging, nesting, or occupancy. For these reasons, the proposed action is not likely to reduce the size, distribution, or productivity of populations at the local, regional, or rangewide scales.

Oregon chub

1. The proposed action will permanently remove up to 3.9 acres and temporarily remove up to 29 acres of Oregon chub habitat. This habitat will be dispersed across the range of the chub in Willamette Valley of Oregon. The amount of off channel aquatic habitat removed was estimated from chub surveys at bridge sites and expert knowledge at other potential sites. This amount of habitat represents a minor portion of the existing habitat within the range of the species and is

expected to be distributed such that no individual population center will be subject to losses that alter site-specific productivity or viability. Habitat restoration and enhancement actions implemented by ODOT will result in development of other habitats that are the functional equivalent of those adversely affected by the project, and the species will be prioritized for additional habitat projects that result in a net conservation benefit to the species.

Fender's blue butterfly

1. The proposed action will affect up to 75 acres of potential Fender's blue butterfly habitat dispersed across the range of the butterfly in Oregon. All of this habitat is expected to be comprised of secondary forage plants rather than the primary forage plant sources associated with regular, high-levels of use by the species. Moreover, it is expected to occur in small patches distributed across the range of the species and occur near or within major highway corridors, meaning that it is most likely already subject to some level of degradation, and further limiting potential utilization by the species. The size and viability of known critical population centers, the size and quality of large, contiguous habitat patches, and overall connectivity between these populations and habitat areas will not be significantly reduced by the proposed action.

2. Habitat restoration and enhancement actions implemented by ODOT will result in development of other habitats that are the functional equivalent of those adversely affected by the project, and the species will be prioritized for additional habitat projects that result in a net conservation benefit to the species.

4.1.7 Reinitiation of Consultation

To the extent FHWA/Corps retains discretionary involvement or control over this action as described in 50 CFR 402.16, the FHWA/Corps must reinitiate consultation if: 1) The action is modified in a way that causes an effect on the listed species that was not previously considered in this Opinion; 2) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; 3) a new species is listed or critical habitat is designated that may be affected by the action; or 4) if the amount or extent of incidental take is exceeded (50 CFR 402.16).

If ODOT's, or any agent's there of, exercise of program or project discretion is likely to result in or has resulted in effects on listed species and critical habitat that are not consistent with those described in this Opinion, if FHWA/Corps does not ensure the proposed action (Section 2.0) is administered as proposed, or if FHWA/Corps does not provide the information described in the Incidental Take Statement (Section 4.2) by the dates specified in the proposed EPS and terms and conditions of this Opinion, the Services may consider any of those circumstances to be a modification of the action that causes an effect on listed species not previously considered, potentially resulting in the need to reinitiate consultation.

4.2 Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule [50 CFR 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is further defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 CFR 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 CFR 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." [50 CFR 402.02] The ESA at Section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a Section 7(b)(4) incidental take statement [16 USC 1536].

4.2.1 Amount and Extent of the Take

The Services anticipate that activities associated with the OTIA III Statewide Bridge Delivery Program detailed in the proposed action (Section 2) are reasonably certain to result in incidental take of ESA-listed species because of potential adverse effects from noise/visual harassment; hydro-acoustic; increased erosion, turbidity, sediment transport, and chemical exposure; hydrologic alteration; vegetation removal; fluvial alteration; and in-water work, fish capture, and release.

The marbled murrelet, bald eagle, northern spotted owl, shortnose and Lost River suckers, Oregon chub, bull trout, Snake River Spring/summer-run Chinook salmon, Upper Willamette River Chinook salmon, Lower Columbia River Chinook salmon, Southern Oregon/Northern California coastal coho salmon, Columbia River chum salmon, Upper Willamette River steelhead, Middle Columbia River steelhead, and Lower Columbia River steelhead and Fender's blue butterfly may be adversely affected during bridge repair and replacement activities as detailed in Section 1.0 of this Opinion. The proposed EPS, as detailed in Section 2.5 of this Opinion, will reduce or eliminate potential project adverse effects, and any remaining adverse effects of construction will be minimized or offset by project site restoration and/or compensatory mitigation actions. These EPS will be followed on all bridge repair and replacement activities administered under the OTIA III Statewide Bridge Delivery Program and subject to this Opinion, and will be provided to all contractors who are responsible for project delivery. The Services regard these EPS as integral components of this take statement and consider them to be part of the action.

The Services expect incidental take to occur from harassment, harm, and lethal mortality as specified in tables 4-10 and 4-11 due to the action covered by this Opinion. In the accompanying Opinion, the Services determined that this level of anticipated take is not likely to result in jeopardy to the species or adverse modification of designated and proposed critical habitat. The extent of the take is limited to marbled murrelet, bald eagle, northern spotted owl, shortnose and Lost River suckers, Oregon chub, bull trout, Snake River Spring/summer-run Chinook salmon, Upper Willamette River Chinook salmon, Lower Columbia River Chinook salmon, Southern Oregon/Northern California coastal coho salmon, Columbia River chum salmon, Upper Willamette River steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead and Fender's blue butterfly within the action area and to the associated upland, riparian and aquatic habitats in the action area as defined in Section 1.2 of this Opinion. Downstream effects are not expected to result in any quantifiable take, other than that identified in Table 4-1.

Table 4-10. Quantification and extent of incidental take for fish species under NOAA Fisheries and USFWS jurisdiction

			Riparian Vegetation Disturbance			
ESU	**Handling**	**Lethal**	**Permanent**		**Temporary**	
			Area (acres)	**Length (feet)**	**Area (acres)**	**Length (feet)**
Chinook						
Lower Columbia River	405	24	2.5	720	18.6	5,400
Snake River, Spring & Summer	550	33	1.5	440	11.4	3,300
Upper Willamette River	6,000	360	11.3	3,280	84.7	24,600
Coho						
Oregon Coast	6,150	369	8.5	2,480	64	18,600
Lower Columbia River	455	27	2.8	800	20.7	6,000
N. Cal./S. Ore. Coast	1,500	90	2.1	600	15.5	4,500
Chum						
Columbia River	355	21	2.2	640	16.5	4,800
Steelhead						
Lower Columbia River	280	17	1.8	520	13.4	3,900
Middle Columbia River	2,800	168	4.1	1,200	31.0	9,000
Snake River	550	33	1.5	440	11.4	3,300
Upper Willamette River	2,250	135	6.2	1,800	46.5	13,500
Cutthroat trout						
S.W. WA/Columbia River	505	30	2.9	840	21.7	6,300
Bull Trout						
Columbia River DPS	980	59	7	1,960	51	14,700
Klamath Falls DPS	20	1	0.1	40	1.0	300
Sucker						
Shortnose	120	7	0.8	240	6.2	1,800
Lost River	120	7	0.8	240	6.2	1,800
Chub						
Oregon chub	1,400	28	3.9	1,120	29	8,400

Table 4-11. Quantification and extent of incidental take for terrestrial wildlife species under USFWS jurisdiction

Species	**Habitat Removal**	**Harassment**

	Acres	Acres	Known nests
Marbled murrelet	100	1,566	N/A
Bald eagle	4	N/A	12*
Northern spotted owl	282	0	0
Fender' blue butterfly	75	N/A	N/A

* indicates the individuals, eggs or young associated with 12 nest sites.

The incidental take statement included in this Opinion, does not become effective for Oregon Coast coho salmon, Lower Columbia River coho salmon, and bull trout proposed critical habitat until the Services adopt the conference opinion as a biological opinion, after the listings are final. Until the time that the species are listed or critcal habitat is designated, the prohibitions of the ESA do not apply.

The USFWS will not refer the incidental take of any bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

4.2.2 Reasonable and Prudent Measures

The Services believe that the following reasonable and prudent measures are necessary and appropriate to avoid or minimize take of listed species resulting from the action covered by this Opinion. In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Services as specified in the incidental take statement. The reporting requirements are established in accordance with 50 CFR 13.45 and 18.27 for USFWS and 50 CFR 220.45 and 228.5 for NOAA Fisheries. The FHWA/Corps shall include measures that will:

1. Avoid or minimize the likelihood of incidental take from program implementation by ensuring adequate program administration. Ensure compliance with the environmental performance standard for program administration including detailed monitoring, reporting, and communication at the both the program and project scale.

2. Avoid or minimize the likelihood of incidental take from projects, project elements and project activities associated with listed species at the project scale by ensuring compliance with all the proposed EPS in listed Section 1.2.1 this Opinion.

4.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the FHWA/Corps and/or their contractors must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1 To implement reasonable and prudent measure #1 (*Program Administration*; Monitoring, Reporting and Communication), the FHWA shall ensure compliance with all performance standards developed for this program:

a. Monitoring & Reporting. Develop and carry out a monitoring and reporting program to confirm that the performance standards are being properly followed and that the performance standards are achieving the goals of habitat improvement and avoidance or minimization of adverse effects to the ecosystem.

i. Program Elements:

(1) Program Management Plan (PMP). Develop and maintain a PMP which includes a Program Execution Plan (PEP) and Program Procedures Plan (PPP) for all aspects of the Environmental Management Program. The PMP will outline the strategy for contractor selection, training, and supervision. Include the process of evaluating contractors for selection of future work, accounting for previous performance. Provide the relevant portions of the PMP to the Services prior to initiation of project activities.

(2) Pre-Construction Assessment (PCA). Review each individual bridge project to ensure that all effects are within the range considered in the biological opinion, quantify project level take estimates or extent of take per established metrics, verify program level exempted take is not likely to be exceeded, and that all appropriate environmental performance standards are being properly followed. Submit the PCA to the Services and the appropriate Regulatory Authorities at least 30 days prior to starting construction activities.

(3) Construction Monitoring. Monitor active projects during environmentally sensitive work activities and at a frequency adequate to detect compliance with the appropriate environmental performance standards. Provide environmental monitor with appropriate authority and professional experience to ensure compliance with relevant environmental performance standards and other applicable environmental rules and regulations.

(4) Post-Construction Monitoring. Monitor relevant project features to ensure compliance with long-term beneficial effects goals outlined in the biological assessment. Report on success, failures, and remedial actions for site restoration and compensatory mitigation sites. Evaluate achievement of each relevant conservation measure outlined in the environmental performance standards.

(5) Annual Program Reporting. Submit an annual monitoring report by February 28 of each year that describes the efforts and actions of the preceding year and the anticipated efforts and actions of the following year. Summarize relevant project reports, such as pre-construction assessment reports, construction and post-construction monitoring reports, fish capture and release effort reports. Include summaries of observed and estimated take and established effects metrics accumulated over the year, including area of riparian disturbance, length of linear streambank disturbance, net fill volumes in jurisdictional wetlands, net fill removed from the functional floodplain, and net area of impervious surfaces treated for detention and contamination.

(6) Annual Program Coordination. Discuss the annual monitoring report with the Services and the appropriate Regulatory Authorities by March 31 of each year. Pursue means of refining and improving program clarity and effectiveness.

ii. Report Contents. Include relevant project information in all reports prepared for this program.

(1) General Report Contents. Include the following, and other data as appropriate:

(a) Bridge identification (e.g., number, highway, crossing);

(b) Bridge location (e.g., county, legal description, ecoregion, species range, drainage);

(c) Project schedule (e.g., construction start and end dates, timing of environmentally sensitive work activities);

(d) Project team contact information (e.g., ODOT, BPM Firm, and contractor contacts);

(e) Photo documentation of habitat conditions within the project area. Label each photo with date, time, project name, photographer's name, and subject comment.

(2) PCA Report Contents. Include the following, and other data as appropriate:

(a) List of project actions.

(b) List of applicable environmental performance standards and how they will be followed.

(c) List of plans prepared.

(d) List of variances requested with supporting documentation.

(e) Date, time, and location of pre-construction meeting.

(f) Estimate of exempted take and established effects metrics required for the project

(3) Monitoring Report Contents. Monitoring reports shall be available within 30 days of the monitoring visit and shall include the following, and other data as appropriate:

(a) Site conditions at time of monitoring visit.

(b) Evaluation of compliance for each relevant environmental performance standard.

(c) Remedial actions suggested and required.

(4) Annual Program Monitoring Report Contents. Include the following, and other data as appropriate:

(a) Summary of work completed.

(b) Summary of variances requested, denied, and approved.

(c) Summary of monitoring dates and efforts.

(d) Summary of relevant reports.

(e) Comparison of annual observed take and effects metrics to remaining exempted take and effects metrics.

(f) Summary of fills/removals within waters of the U.S..

(g) Number and location of program bridges in design, construction, or restoration stage.

(h) Summary of mitigation/conservation credits/debits created and used that year.

(i) Summary of non-compliance situations and actions taken to remediate.

(j) Identification of anticipated variances for following year.

(k) Recommendations for program improvements.

iii. Program Oversight. Retain a third party oversight firm to ensure the Bridge Program Management firm is maintaining compliance with all terms of the contract, including meeting environmental requirements.

b. Variance Protocol.

i. Request a variance for actions not clearly addressed in the environmental performance standards. Requests may be included in the PCA report or other appropriate means and should include the following:

(1) Justification for the proposed variance.

(2) Description of additional actions necessary to offset potential effects, as appropriate.

(3) Demonstration of how the resulting effects are within the range considered in the biological opinion.

(4) Reevaluation of take and established effects metrics if different than identified in the PCA.

ii. Services will respond with an approval, approval with additional conservation measures, or disapproval within 30 calendar days of receipt of the variance request.

iii. Variances of the environmental performance standards that result in greater effects or greater take than provided in the biological opinion will not be granted and will require separate consultation.

c. Communication Protocol.

i. Communication Plan. Develop and carry out a communication plan to ensure appropriate, efficient, and timely coordination between Action Agency, the Services, the appropriate Regulatory Authorities, and other parties. The communication plan will define lines of communication to address concerns that arise during project design and construction (Appendix D).

ii. Electronic Format. Store all reports in an electronic format easily accessible by the Services and the appropriate Regulatory Authorities.

iii. Project Changes. Notify the Services and the appropriate Regulatory Authorities of any project changes[62] as soon as possible.

d. Conservation and Mitigation for Species under USFWS Jurisdiction. Ensure the proposed mitigation or conservation action meets the goal of net conservation benefit by providing on-ground benefits to species and habitats that are greater than necessary to simply compensate for cumulative project-level impacts. The increment of "surplus" benefit, at the program scale, is anticipated to be sufficient to advance recovery and conservation goals by providing a meaningful improvement in the size,

[62] See discussion of variances and project changes above in Section 2.5 of this Opinion for clarification of project changes and procedures.

distribution, and productivity of species populations, or in amount, distribution, and quality of habitats relative to that which existed prior to implementation of the Bridge Program.

i. Implement habitat protection, restoration, or enhancement actions to address the permanent and temporary habitat losses listed in Tables 4-10 and 4-11, as described in section 2.3.1.

ii. Ensure that all mitigation and conservation actions for these species are consistent with all applicable standards contained in the *Compensatory Mitigation* EPS (Section 2.5).

e. Reporting Address. Submit a copy of all program or project reports to the following addresses:

Director, Oregon State Habitat Office
Habitat Conservation Division
NOAA Fisheries
Attn: 2004/00209
525 NE Oregon Street
Portland, OR 97232

State Supervisor
U.S. Fish and Wildlife
Oregon Fish and Wildlife Office
2600 S.E. 98th Ave. Suite 100
Portland, OR 97211

i. Salvage notice. If a dead, injured, or sick endangered or threatened species specimen is found, initial notification must be made to the NOAA Fisheries Law Enforcement Office, Vancouver Field Office, 600 Maritime, Suite 130, Vancouver, Washington 98661; phone: 360.418.4246, or 800.853.1964; or the USFWS Office of Law Enforcement, 9025 S.W Hillman Ct., Suite 3134, Wilsonville, Oregon 97070; phone 503.682.6131. Care will be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

2 To implement reasonable and prudent measure #2 (Projects, Project Elements and Project Activities), the FHWA/Corps shall ensure compliance with all performance standards developed for this program at the project scale:

a. Ensure full compliance and implementation the following proposed environmental performance standards during the design and throughout project construction as detailed in Section 2.0 of this Opinion:

   i. Species Avoidance.

   ii. Habitat Avoidance.

   iii. Water Quality.

   iv. Site Restoration.

   v. Compensatory Mitigation.

   vi. Fluvial.

4.2.4 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purpose of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1) The Services recommend that the action agencies or their representatives involved in the OTIA III Statewide Bridge Delivery Program pursue survey and research opportunities regarding occurrence, life history and genetics of lamprey species in Oregon stream systems. During the early involvement of this consultation it became apparent that little is known of the effects of construction activity, such as pile driving, on lamprey amocetes present in the vicinity.

2) The USFWS and ODOT are currently collaborating on development of an Oregon chub conservation bank that will be used for bridge program mitigation as well as for other ODOT transportation programs. The USFWS believes the protection in perpetuity of these banks will benefit ODOT as well as conserve chub. The USFWS recommends ODOT complete this positive conservation program.

3) The Services recommend that FHWA/ODOT pursue developing conservation banks in perpetuity for other listed species which may be encountered during highway projects. Such species include the Willamette Valley plants and Fender's blue butterfly, rough popcorn flower, Gentner's fritillary, Klamath basin suckers, and the vernal pool dependent species. The Services recognize the ongoing conservation work ODOT has started and encourages this process.

4) The Services recommend that ODOT pursue additional proactive measures to conserve bat species in Oregon through its bridge replacement program.

Primarily, the USFWS encourages ODOT to explore ways in which bridge design will facilitate nocturnal and maternity roosts without conflict with bridge maintenance or engineering issues.

5) The Services recommend that FHWA/ODOT pursue a literature search to provide current information to help guide the development of a stream and river crossing design policy that identifies fluvial features such as the channel migration zone and incorporates protection and renewal of fluvial habitat forming processes. The Services recognize the ongoing conservation work ODOT has started and encourages continuation and possible expansion of this process.

In order for the Services to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Services request notification of the implementation of any conservation recommendations.

5.0 MAGNUSON-STEVENS ACT

5.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

- NOAA Fisheries must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A)).

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries' EFH conservation recommendations, the Federal agency(ies) must explain its reasons for not following the recommendations (§305(b)(4)(B)).

The EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; "spawning, breeding, feeding, or growth to maturity" covers a species' full cycle (50 CFR 600.10). "Adverse effect" means any impact which reduces quality and/or quantity of EFH and may include direct (*e.g.* contamination or physical disruption), indirect (*e.g.* loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

The EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affected designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

5.2 Identification of EFH

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths along the coasts of Washington, Oregon and California, seaward to the boundary of the United States exclusive economic zone (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by PFMC 1999), and longstanding, naturally impassable barriers (*i.e.* natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone offshore of Washington, Oregon, and California north of Point Conception to the United States-Canadian border (PFMC 1999).

Detailed description and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1999), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas *et al*. (1998) provides additional detail on the groundfish EFH habitat complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the FHWA, Corps, and ODOT Biological Assessment. Table 5-1 contains a list of species with designated EFH potentially affected by this proposed action.

Table 5-1. Species with designated EFH in the waters of Oregon.

Groundfish Species			
Leopard shark (*Trakis semifasciata*)	Black-and-Yellow Rockfish (*S. chryosomelas*)	Redstripe rockfish (*S. proriger*)	Shortspine thornyhead (*S. alascanus)*
Soupfin shark	Blue rockfish	Rosethorn rockfish	Arrowtooth flounder

(*Galeorhinus galeus*)	(*S. mystinusi)*	(*S. helvomaculatus*)	(*Antheresthes stomias*)
Spiny dogfish (*Squalus acanthias*)	Bocaccio (*S. paucispinis)*	Rosy rockfish (*S. rosaceus*)	Butter sole (*Isopsetta isolepis*)
Big skate (*Raja binoculata*)	Brown rockfish (*S. auriculatus*)	Rougheye rockfish (*S. aleutianus*)	Curlfin sole (*Pleuronichthys decurrens*)
California skate (*R. inornata*)	Canary rockfish (*S. pinniger*)	Sharpchin rockfish (*S. zacentrus*)	Dover sole (*Microstomus pacificus*)
Longnose skate (*R. rhina*)	Chilipepper (*S. goodei*)	Shortbelly rockfish (*S. jordani)*	English sole (*Parophrys vetulus*)
Spotted ratfish (*Hydrolagus colliei*)	China rockfish (*S. nebulosus*)	Shortraker rockfish (*S. borealis*)	Flathead sole (*Hippoglossoides elassodon*)
Finescale codling (*Antimora microlepis*)	Copper rockfish (*S. caurinus*)	Silverygray rockfish (*S. brevispinis*)	Pacific sanddab (*Citharichthys sordidus*)
Pacific rattail (*Coryphaenoides acrolepis*)	Darkblotched rockfish (*S. crameri*)	Speckled rockfish (*S. ovalis*)	Petrale sole (*Eopsetta jordani*)
Lingcod (*Ophiodon elongatus*)	Flag rockfish (*S. rubrivinetus*)	Splitnose rockfish (*S. diploproa*)	Rex sole (*Glyptocephalus zachirus*)
Cabezon (*Scorpaenichthys marmoratus*)	Gopher rockfish (*S. carnatus*)	Squarespot rockfish (*S. hopkins*)	Rock sole (*Lepidopsetta bilineata*)
Kelp greenling (*Hexagrammos decagrammus*)	Grass rockfish (*S. rosenblatti*)	Stripetail rockfish (*S. saxicola*)	Sand sole (*Psettichthys melanostictus*)
Pacific cod (*Gadus macrocephalus*)	Greenspotted rockfish (*S. chlorostictus*)	Tiger rockfish (*S. nigrocinctus*)	Starry flounder (*Platichthys stellatus*)
Pacific whiting (hake) (*Merluccius productus*)	Greenstriped rockfish (*S. elongatus*)	Vermillion rockfish (*S. miniatus*)	
Sablefish (*Anoplopoma fimbria*)	Harlequin rockfish (*S. variegatus*)	Widow rockfish (*S. entomelas*)	**Pacific Salmon Species**
Aurora rockfish (*Sebastes aurorai)*	Pacific ocean perch (*S. alutus*)	Yelloweye rockfish (*S. ruberrimus*)	Chinook salmon (*Oncorhynchus tshawytscha*)
Bank rockfish (*S. rufus)*	Pink rockfish (*S. eos*)	Yellowmouth rockfish (*S. reedi*)	Coho salmon (*O. kisutch*)
Black rockfish (*S. melanops*)	Quillback rockfish (*S. maliger*)	Yellowtail rockfish (*S. flavidus*)	
Blackgill rockfish (*S. melanostomus*)	Redbanded rockfish (*S. babcocki*)	Longspine thornyhead (*Sebastolobus altivelis*)	

5.3 Proposed Action

The proposed actions and action areas are described in Section 2.0 and Section 1.2, respectively, of this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of groundfish, coastal pelagic species, and Pacific salmon (Table 5-1).

5.4 Effects of the Proposed Action

Assessment of the potential adverse effects of the managed species' EFH from the proposed actions is based, in part, on the habitat descriptions in Section 2.0 and 4.0 of this Opinion and on information provided in the FHWA, Corps, and ODOT biological assessment. As described in detail in Section 4.1.4 of this Opinion, the proposed action may result in short and long-term adverse effects to a variety of habitat parameters. These adverse effects are:

1) Hydro-acoustic;
2) Increased Erosion, Turbidity, Sediment Transport, and Chemical Exposure;
3) Hydrologic Alteration;
4) Vegetation Removal; and
5) Fluvial Alteration

5.5 Conclusion

NOAA Fisheries concludes that the proposed action may adversely affect the EFH for the groundfish, coastal pelagic, and Pacific salmon species listed in Table 5-1.

5.6 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. The Terms and Conditions outlined in Section 4.2.3 of this Opinion are generally applicable to designated EFH for the species in Table 5-1, and address these adverse effects. Consequently, NOAA Fisheries requests that they be implemented as EFH conservation recommendations.

5.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B) and 50 CFR600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

5.8 Supplemental Consultation

The FHWA/Corps must reinitiate consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

6.0 MARINE MAMMAL PROTECTION ACT

The Marine Mammal Protection Act of 1972 (MMPA) established a moratorium, with certain exceptions, on the taking of marine mammals in waters of the United States. The term "marine mammal" is defined as any mammal which is morphologically adapted to the marine environment, including sea otters and members of the orders Sirenia, Pinnipedia, and Cetacea. The term "take" is statutorily defined to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal". Harass has been defined by Congress to mean "any act of pursuit, torment, or annoyance". Harassment for the purposes of the MMPA is divided into two categories:

- Level A Harassment – has the potential to injure a marine mammal or marine mammal stock in the wild; or

- Level B Harassment – has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

All marine mammals that appear in the coastal waters of Oregon are protected under the MMPA. In addition, the Steller sea lion (*Eumetopias jubatus*), sperm whale (*Physeter macrocephalus*), humpback whale (*Megaptera novaengliae*), northern right whale (*Eubalaena glacialis*), blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), and sei whale (*Balaenoptera borealis*) are also protected under the ESA and the Steller sea lion is addressed in the ESA informal consultation (section 3.0) of this Opinion. The FHWA/Corps determined the proposed action had no potential to affect the additional marine mammal species listed above.

6.1 Marine Mammal Distribution

Marine mammals primarily live in ocean waters, bays, and estuaries, but some species will forage inland in coastal streams and rivers. Whales are found almost exclusively in open sea aquatic habitats, whereas pinnipeds (such as seals and sea lions) require both aquatic and terrestrial habitats. Pinniped species regularly use land for haulouts, and breed in remote rookery areas along the coast. Pinnipeds congregate during the pupping and breeding season in rookeries that are protected from disturbance and predators, such as isolated beaches, reefs, and rock islands (NOAA Fisheries 2003d). Pinnipeds also use haulout areas to congregate and throughout the year. These may include rocks, reefs, beaches, jetties, breakwaters, navigational aids, or floating docks. Several pinniped species are known to forage inland as they follow salmon runs and other prey species' migrations up river. Because of the geographic distribution of cetaceans and pinnipeds in the ocean and coastal areas, Bridge Program construction activities are unlikely to affect cetaceans, though they may affect pinniped species.

To determine which bridge repair and replacement activities have the potential to affect marine mammals, GIS effects screening analysis was used to screen all program bridges. The screening process incorporated the known habitat types occupied by marine mammals and the known range of various marine mammals, notably inland pinniped distribution.

The following assumptions were used in the marine mammal screening process:

- Marine mammal range extends as far inland as the head of tides for Coastal streams and rivers (ODSL 1989) including the Columbia River as far inland as Bonneville Dam and Willamette Falls on the Willamette River in Oregon City (REO 2002), and the lower reaches of the Chetco River, Rogue River, Umpqua River, Siuslaw River, Alsea River, Siletz River, Nestucca River, and Nehalem River (NOAA Fisheries 2004).

- Marine mammals may be present at identified haulouts and rookeries (ODFW 2003c).

- Coastal Dune and Beaches, Coastal Headlands and Islets, Bays and Estuaries, Marine Nearshore, Marine Shelf, and Oceanic are the only Johnson and O'Neil (2001) habitat types capable of providing marine mammal habitat.

- Construction activity (i.e., noise and disturbance) will have no effect on marine mammals beyond 1,640 feet (except near seal and sea lion rookeries, where this distance is considered to be 3,000 feet). This distance is based upon mitigation measures used for similar construction projects ([February 6, 2003, 68 FR 6116] [July 23, 2001, 66 FR 38258] [October 29, 1998, 63 FR 58012], Caltrans 2001). Steller sea lion rookeries are designated critical habitat in Oregon and are protected by a 3,000-foot buffer surrounding the critical habitat designated in the Federal Register (August 27, 1993 58 FR 45269) and the Three Arch National Wildlife Refuge rookery.

- Bridges meeting all of the following criteria will be documented as having no potential to affect marine mammals:

    - Bridge APIs that are greater than 1,640 feet from a Johnson and O'Neil (2001) habitat type identified as potentially supporting marine mammals (Kiilsgaard and Charley 1999).

    - Bridges APIs greater than 1,640 feet from an identified head of tide for coastal rivers and streams (except the Columbia River as far inland as Bonneville Dam and Willamette Falls on the Willamette River in Oregon City, and the lower reaches of the Chetco River, Rogue River, Umpqua River, Siuslaw River, Alsea River, Siletz River, Nestucca River, and Nehalem River) (ODSL 1989).

    - Bridges with APIs that are in the Grays/Elokoman, Lower Columbia/Clatskanie, Lower Willamette, Lower Columbia/Sandy 4th field HUC and are greater than 1,640 feet from the Columbia and Willamette River (REO 2002).

- o Bridges with APIs greater than 3,000 feet from an identified marine mammal rookery or haulout (ODFW 2003c).

Based on these screening criteria, there are 14 bridges where repair or replacement activities have the potential to affect marine mammals. One bridge (00924A, Schooner Creek Bridge) is located within 3,000 feet of a documented harbor seal haulout.

6.2 Effects Pathways

This biological assessment provides an analysis of the potential effects of the proposed action on the habitat elements that are critical for sustained, viable populations of marine mammals. Actions can affect the viability of marine mammals by altering one or more physical, chemical, or biological parameters. Effects to marine mammals are delivered via the displacement, disruption, removal, or other alteration of effects pathways including air, chemicals, or incidental take of the species (e.g., via direct physical injury). Further discussion of each of these effects pathways follows.

<u>Air</u>

Noise Disturbance. Adverse effects to marine mammals from noise disturbance may lead to flushing from haulout sites, an increase in energy expenditure, or an overall avoidance or abandonment of functional habitat. Construction activities have the potential to affect marine mammals both in the water and at haulout sites along the Oregon Coast. Close approach by humans may cause resting pinnipeds such as sea lions to go into the water, and disturbances that cause stampedes on rookeries may cause trampling or abandonment of pups (NMFS 1992). Areas exposed to repeated disturbance may be permanently abandoned or exhibit reduced use, which could adversely affect the condition and survival of young through the interruption of normal nursing cycles (NMFS 1992). Occasional disturbance at low levels may have little long-term effect (NMFS 1992).

There is no documented threshold for noise disturbance for marine mammals. However, NOAA Fisheries has considered the effects of construction noise, such as pile driving and blasting, on marine mammals within a 1,640-foot radius of the activities (Caltrans 2001). For the purposes of this analysis, noise disturbance effects on marine mammals are considered possible within a distance of 1,640 feet from the bridge APIs.

Visual Disturbance. Visual disturbance due to human activity can adversely affect marine mammals; however, there is no documented visual disturbance threshold for marine mammals. Critical habitat for Steller sea lions in Oregon includes an air zone that extends 3,000 feet vertically and an aquatic zone that extends 3,000 feet seaward (horizontally) from historically occupied sea lion rookeries (58 FR 45269). For the purposes of this analysis, effects are considered possible within a distance of 3,000 feet from known marine mammal haulout or rookery sites. This is likely an over-estimate considering marine mammals are not always present at these locations.

Chemicals. Because marine mammals inhabit the marine environment and occasionally the lower reaches of larger river systems, there is little potential for a construction-related spill to affect them.

Species Habitat. Marine mammal haulout and rookery sites include remote islands, rocks, reefs, and beaches, often in areas exposed to wind and waves where access by terrestrial predators is limited (NMFS 1992). In addition, marine mammals are known to utilize manmade structures such as breakwaters, navigational aids, and floating docks for haulout sites (58 FR 45269). The Bridge Program has the potential to remove or adversely modify man-made structures that support hauled out marine mammals.

6.3 Minimization and Avoidance Measures

The effects of actions proposed under this consultation may be delivered by one or multiple pathways. These effects can vary in magnitude and severity between the individual organism, population, and community scales. The degree to which the proposed action affects viable marine mammal populations is dependent on the intensity, magnitude, duration, timing, and repetition of the action causing the effect. Minimization and avoidance measures for the OTIA III Statewide Bridge Delivery Program consist of specific EPS that provide for habitat and species conservation during bridge repair and replacement. Section 2.3 provides detailed information regarding these EPS and conservation measures.

6.4 Analysis of Effects

No activity associated with the Bridge Program would cause Level A Harassment as defined by the MMPA, and those activities that could cause Level B Harassment will be avoided by the implementation of the EPS.

<u>Air</u>

Noise Disturbance. Construction noise occurring within 1,640 feet of marine mammal habitat has the potential to affect marine mammals that are either hauled out (resting), breeding, feeding, or simply swimming by. To avoid adverse effects from Bridge Program activities, construction will be carried out in conformance with EPS, including the Wildlife Avoidance Environmental Performance Standard, which will minimize noise levels and restrict loud noises to certain times of the year (see section 3.3). The Wildlife Avoidance Environmental Performance Standard will further require monitors to be on site during certain construction activities to ensure that construction noise does not harm or disrupt any marine mammals within or entering into the 1,640-foot noise disturbance threshold.

Visual Disturbance. For purposes of the Bridge Program, visual disturbance occurring within 3,000 feet of marine mammal habitat may affect marine mammals. To avoid adverse effects on marine mammals from visual disturbance, the Wildlife Avoidance Environmental Performance Standard will be implemented, and will require monitors to be on site during construction activities to prevent construction activities from harming or disrupting any marine mammals at rookeries or haulouts within the 3,000-foot visual disturbance threshold.

Chemicals. Because marine mammals inhabit the marine environment and occasionally the lower reaches of larger river systems, there is little potential for a construction-related spill (which are usually a few gallons at most) to affect them. Any spills that reach water in areas where marine mammals are likely to be present are likely to be quickly diluted to undetectable levels. Implementation of the Pollution and Erosion Control Environmental Performance Standard (Section 2.3) will ensure that chemical spills at construction sites are either avoided, or contained and cleaned up before they reach a marine environment; thus, there should be no adverse effects on marine mammals through the chemical effects pathway.

Species Habitat. Direct removal or modification of haulouts or rookery sites may affect marine mammals. Indirect effects may also occur through effects on prey species. However, implementation of the EPS outlined in Section 2.3, including the *Wildlife Avoidance* EPS and the *Water Quality* EPS (which includes bridge demolition conservation measures), should ensure that direct and indirect effects on marine mammals are avoided.

Evaluation of Potential Effects

There are a total of 14 bridges where repair and replacement activities may affect marine mammals (Table 6-1). These bridges are generally not located in preferred marine mammal habitat; therefore, there is a low probability that marine mammals will be present during construction activities. As a result of this and of the application of the EPS (Section 2.5), (particularly the *Wildlife Avoidance* Environmental Performance Standard) at these bridges, the Bridge Program will result in negligible Level B Harassment, and negligible incidental take of marine mammals.

6.5 Conclusion and Recommendations

From the material presented by the FHWA/COE in the BA, it is NOAA Fisheries understanding that the majority of the proposed action (bridge repair/replacement projects) are unlikely to result in incidental harassment (taking), of non-listed marine mammals (pinnipeds), by construction noise. For those individual projects identified in Table 6-1, where the proximity of construction to an established pinniped haul out site is likely to result in disturbance of animals on the haul out, we recommend that FHWA/Corps obtain an Incidental Harassment Authorization (IHA) pursuant to the Section 101(a)(5)(D) of the Marine Mammal Protection Act. For IHA application information, please contact Brent Norberg or Lynne Barre in the Protected Resources Division, Marine Mammal Section at 206-526-6733

Table 6-1. Program Bridges with potential to affect marine mammals

Bridge Number[1]	Highway Type[2]	MP[3]	County[4]	Crossing[5]
09591	IS084	48.36	Columbia	Lewis and Clark Bridge (Columbia River)
04516A	IS005	307.70	Multnomah	Jansen Pedestrian Tunnel
01950	US101	234.76	Coos	Central Oregon Railroad (North Bend)
08281	OR042	0.07	Coos	US 101
06875	IS084	17.68	Multnomah	Sandy River
06945	IS084	17.82	Multnomah	Connector 2 to Jordan Road
06875A	IS084	17.68	Multnomah	Sandy River
06945A	IS084	17.82	Multnomah	Connector 2 to Jordan Rd
00925A	US101	119.27	Lincoln	Drift Creek
00924A	US101	118.17	Lincoln	Schooner Creek
03173A	OR042	5.37	Coos	Beaver Creek
07333	IS005	308.38	Multnomah	Columbia River and North Hayden Island Drive
00922A	US101	114.88	Lincoln	Devils Lake Outlet (D River)
013491	OR018	0.04	Lincoln	US 101

1 ODOT bridge identification number
2 Interstate Route (IS), U.S. route (US), or Oregon Route (OR)
3 Milepost where bridge is located
4 County where bridge is located
5 Description of feature that the bridge is crossing and ODOT highway designation

7.0 MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (16 U.S.C. §§ 703 – 712) of 1918, as amended, implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under the MBTA, taking, killing or possessing migratory birds is unlawful.

Unless permitted by regulations, the MBTA provides that it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received and migratory bird, part, nest, egg or product.

The following section of the Wildlife Avoidance EPS was developed to outline a process to work toward avoiding migratory birds nesting on bridges and identify when, after these efforts have been attempted, take may be needed and therefore a permit attained. For permit information please contact our Migratory Bird Division at 503-231-6164.

8. Wildlife Avoidance (Bridge Demolition). Minimize injury and death to wildlife species from bridge demolition activities.

   a. Migratory Birds. Avoid destruction of occupied nests (i.e., containing eggs or young) and adult birds protected by the Migratory Bird Treaty Act (MBTA).

      i. Prevent nesting by native birds[63] on structures to be removed.

         (1) Inspect bridge for signs of nesting.

         (2) Apply exclusionary methods prior to nest building (approximately March 15). Exclusionary methods may include noise cannons, power-washing (i.e., physical removal), netting (ensure proper mesh size and maintain the netting).

      ii. Remove existing nests only if no eggs or young are found.

      iii. If eggs have been laid and nest cannot be avoided, then seek guidance from USFWS for compliance with the Migratory Bird Treaty Act.

8.0 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661-667e) of March 10, 1934, authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with Federal and State agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife.

The FWCA amendments enacted in 1946 require consultation with the USFWS and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources."

The 1958 amendments added provisions to recognize the vital contribution of wildlife resources to the Nation and to require equal consideration and coordination of wildlife conservation with other water resources development programs, and authorized the Secretary of Interior to provide public fishing areas and accept donations of lands and funds.

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[63] Exotic birds, such as European starling, rock pigeons, and house sparrows are not protected by the MBTA.

The amendments also titled the law as the Fish and Wildlife Coordination Act (FWCA) and expanded the instances in which diversions or modifications to water bodies would require consultation with the Fish and Wildlife Service.

The action agencies are addressing FWCA issues by implementing the EPS throughout the state and not just limiting them to stream sections where listed species occur. This will help conserve candidate and species of concern that would be affected by the same factors as the listed species. Aquatic species of concern to the USFWS include but are not limited to the coastal cutthroat trout and native lamprey species. In addition, the CMCS level I team, through the RGP process, is developing a mitigation strategy that will address ecoprovince habitat priorities and a quantitative, repeatable assessment process that is intended to result in larger more valuable mitigation sites across the region that may be used for ODOT mitigation beyond the Bridge Program.

9.0 LITERATURE CITED

Allendorf, F.W. 1983. Isolation, gene flow, and genetic differentiation among populations. Pages 51-65 in C. Schonewald-Cox, S. Chambers, B. MacBryde, and L. Thomas, editors. Genetics and Conservation. Benjamin and Cummings, Menlo Park, CA.

Allendorf, F.W. and N. Ryman. 2002. The role of genetics in population viability analysis. Pages 50-85 *in* S.R. Beissinger and D.R. McCullough, editors. Population Viability Analysis. The University of Chicago Press, Chicago, IL.

Andreasen, J.K. 1975. Systematics and status of the Family Catostomidae in southern Oregon. Ph.D. Thesis, Oregon State University, Corvallis, Oregon.

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. N. Am. Wildl. Nat. Res. Conf. 47:332-342.

Bald Eagle Working Team for Oregon and Washington. 1990. Working implementation plan for bald eagle recovery in Oregon and Washington. Washington Department of Wildlife. Olympia, Washington.

Barrowclough, G.F. and R.J. Gutierrez. 1990. Genetic variation and differentiation in the spotted owl. Auk 107:737-744

Barrows, C. and K. Barrows. 1978. Roost characteristics and behavioral thermoregulation in the spotted owl. West. Birds 9:1-8.

Bart, J. 1995. Amount of suitable habitat and viability of northern spotted owls. Conservation Biology 9: 943-946.

Bart, J., and E. D. Forsman. 1992. Dependence of northern spotted owls Strix occidentalis caurina on old-growth forests in the western USA. Biological Conservation 62: 95-100.

Baxter, C.V. 2002. Fish Movement and Assemblage Dynamics in a Pacific Northwest Riverscape. Ph.D. Dissertation, Oregon State University, Corvallis, OR.

Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, Logging Roads, and the Distribution of Bull Trout Spawning in a Forested River Basin: Implications for Management and Conservation. Transactions of the American Fisheries Society 128:854-867.

Baxter, J.S., and J.D. McPhail. 1999. The influence of redd site selection, groundwater upwelling, and over-winter incubation temperature on survival of bull trout (*Salvelinus confluentus*) from egg to alevin. Canadian Journal of Zoology/Revue Canadien de Zoologie 77:1233-1239.

Beak Consultants Incorporated. 1987. Shortnose and Lost River sucker studies: Copco Reservoir and the Klamath River. Report prepared for the city of Klamath Falls, Oregon. June 30, 1987.

Beissinger, S.R. 1995. Population trends of marbled murrelet projected from demographic analyses. *In* Ralph, C.J., G.L. Hunt, M.G. Raphael, J.F. Piatt, *Tech. Editors*. 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 420 p.

Beissinger, S.R., and N. Nur. 1997. Population trends of the marbled murrelet projected from demographic analysis. Appendix B in Recovery plan for the threatened marbled murrelet (Brachyramphus marmoratus) in Washington, Oregon and California. U. S. Fish and Wildlife Service, Portland, Oregon.

Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. Pages 191-232 *in* E.D. Salo and T.W. Cundy, editors. Streamside Management Forestry and Fisheries Interactions. Institute of Forest Resources, University of Washington, Seattle, Washington, Contribution No. 57.

Bienz, C.S. and J.S. Ziller. 1987. Status of three lacustrine sucker species (Catostomidae). Report to the U.S. Fish and Wildlife Service, Sacramento, California..

Bingham, B.B., and B.R. Noon. 1997. Mitigation of habitat “take”: Application to habitat conservation planning. Conservation Biology 11: 127-138.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 *in* P.J. Howell, and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop, Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Bonneau, J.L., and D.L. Scarnecchia. 1996. Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. Transactions of the American Fisheries Society 125: 628-630.

Botkin, D., K. Cummins, T. Dunne, H. Regier, M. Sobel, and L. Talt. 1995. Status and future of salmon of western Oregon and northern California: Findings and options. Report #8. The Center for the Study of the Environment, Santa Barbara, California. http://www.naturestudy.org/services/publica.htm.

Boulanger, J.G., K. M.G. Kaiser, and A.E. Derocher. 1996. Evaluating uncertainty in estimating population trends of marbled murrelets. Pages 53-63 *in* A. W. Diamond and A. W. Nettleship, editors: Biology and conservation of forest birds. Society of Canadian Ornithologists, Fredericton, New Brunswick, Canada.

Bradley, R.W. 2002. Breeding ecology of radio-marked marbled murrelets (Brachyramphus marmoratus) in Desolation Sound, British Columbia. M.S. Thesis, Simon Fraser University, British Columbia. 86 pages.

Brewin, P.A., M.K. Brewin, and M. Monita. 1997. Distribution maps for bull trout in Alberta. Pages 206-216 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.

Bryce, S. and A. Woods. 2000. Draft level III and IV ecoregion descriptions for Oregon. Available: http://www.sscgis.state.or.us/data/metadata/k250/ecoregion.pdf.

Buchanan, D.M., and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 1-8 *in* W.C. Mackay, M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force(Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.

Buchanan, D.V., M.L. Hanson, and R.M. Hooton. 1997. Status of Oregon's bull trout, distribution, life history, limiting factors, management considerations, and status. Report to Bonneville Power Administration. Contract No. 1994BI34342, Project No. 199505400 (BPA Report DOE/BP-34342-5). Oregon Department of Fish and Wildlife, Portland, OR.

Buchanan, J.B. L.L. Irwin, and E.L. McCutchen. 1995. Within-stand nest site selection by spotted owls in the eastern Washington Cascades. J. Wildl. Manage. 59:301-310.

Buettner, M. 1997. Upper Klamath Lake fish die-off, 3rd consecutive year - 1997. Report to Bureau of Reclamation, Klamath Falls, Oregon, 29 September 1997.

Buettner, M. and C. Scoppettone. 1990. Life history and status of Catostomids in Upper Klamath Lake, Oregon. U.S. Fish and Wildlife Service, National Fisheries Research Center, Reno Field Station, Nevada. Completion report.

Buettner, M. and C. Scoppettone. 1991. Distribution and information on the taxonomic status of the Shortnose sucker, Chasmistes brevirostris, and Lost River sucker, Deltistes luxatus, in the Klamath River Basin, California. Completion report. California Department of Fish and Game Contract FC-8304. U.S. Fish and Wildlife Service, Seattle National Fishery Research Center, Reno Substation, Nevada.

Burger, A.E. 1995. Inland habitat associations of marbled murrelets in British Columbia. *In* Ralph, C.J., G.L. Hunt, M.G. Raphael, J.F. Piatt, *Tech. Editors.* 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 420 p.

Burger, A.E. 2001. Using radar to estimate populations and assess habitat associations of marbled murrelets. Journal of Wildlife Management 65:696-715.

Burger, A.E. 2002. Conservation assessment of marbled murrelets in British Columbia, a review of biology, populations, habitat associations and conservation. Pacific and Yukon Region, Canadian Wildlife Service. 168 pages.

Burkey, T.V. 1989. Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments. Oikos 55:75-81.

Burkey, T.V. 1995. Extinction rates in archipelagoes: Implications for populations in fragmented habitats. Conservation Biology 9: 527-541.

Burnham, K.P., D.R. Anderson, and G.C. White. 1996. Meta-analysis of vital rates of the northern spotted owl. Pages 92-101 *in* Forsman et al, editors. Demography of the northern spotted owl. Studies in avian biology no.17, Cooper Ornithological Society. Fort Collins, CO.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Leirheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27. 281 p.

Caltrans (California Department of Transportation). 2001. Marine mammal impact assessment: Pipe instillation demonstration project San Francisco-Oakland Bay bridge east span seismic safety project. Unpublished report of the California Department of Transportation. Sacramento, California.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American northwest. California Fish and Game 64:139-174.

CETAS (Collaborative Environmental and Transportation Agreement for Streamlining). 2001. A vision for joint environmental and transportation agreement for streamlining. February 2001 Oregon Department of Transportation unpublished agreement, Salem Oregon.

CDFG (California Department of Fish and Game). 1993. Lost River and shortnose sucker life history and population dynamics in Clear and Tule Lakes, California. Progress Rept. 1. Contract Number FG1610.

CH2M Hill. 1995. Water Quality Model of the Klamath River. Report for USBR. Dec. 1995.

Chamberlain, T.W., R.D. Harr, and F.H. Everest. 1991. Timber harvesting, silviculture and watershed processes. Pages 181-205 *in* W. R. Meehan, editors. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.

Chen, J., J.F. Franklin, and T.A. Spies. 1993. Contrasting microclimates among clearcut, edge and interior of old-growth forest. Agricultural and Forest Meteorology 63:219-237.

Coots, M. 1965. Occurrences of the Lost River sucker, Deltistes luxatus (Cope), and Shortnose sucker, Chasmistes brevirostris (Cope), in Northern California. California Department of Fish and Game 51:68-73.

Cope, E.D. 1879. The fishes-of Klamath Lake, Oregon. Amer. Nat. 13:784-785.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79.31.

Craig, S.D., and R.C. Wissmar. 1993. Habitat conditions influencing a remnant bull trout spawning population, Gold Creek, Washington (draft report). Fisheries Research Institute, University of Washington. Seattle, Washington.

Craighead, J.J., and F.C. Craighead. 1956. Hawks, owls and wildlife. Stackpole, Harrisburg, PA U.S.A.

Cunningham, M.E., R. Shively and E. Janney. 2002. Monitoring of Lost River and shortnose suckers in the lower Williamson River, Oregon: Annual report 2001. In Monitoring of adult Lost River and shortnose suckers in the Upper Klamath Basin, 2001. Draft annual report (February 2002) of research to the U.S. Bureau of Reclamation, Mid-Pacific Region, Klamath Area Office. 134 pgs. Contract #00AA200049.

Dark, S.J., R.J. Gutiérrez, and G. I. Gould. 1998. The barred owl (Strix varia) invasion in California. Auk 115:50-56.

De Santo, T.L., and M.F. Willson. 2001. Predator abundance and predation of artificial nests in natural and anthropogenic coniferous forest edges in southeast Alaska. Journal of Field Ornithology 72(1):136-149.

Dechesne, S.B.C., and J.L. Smith. 1997. Wildlife inventory Queen Charlotte Islands/Haida Gwaii 1994-1996. Husby Group of Companies. 49 pages.

Desjardins, M. and D.F. Markle. 2000. Distribution and biology of suckers in Lower Klamath Reservoirs. 1999 Final report submitted to PacifiCorp, Portland, Oregon.

Dunbar, D.L., B.P. Booth, E.D. Forsman, A. E. Hetherington, and D. J. Wilson. 1991. Status of the spotted owl, Strix occidentalis, and barred owl, Strix varia, in southwestern British Columbia. Canadian Field Naturalist 105:464-468.

Dunham, J.B., and B.E. Rieman. 1999. Metapopulation structure of bull trout: Influences of physical, biotic, and geometrical landscape characteristics. Ecological Applications 9:642-655.

FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest ecosystem management; and ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Government Printing

Office 1993-793- 071. U.S. Government Printing Office for the U.S.D.A. Forest Service; U.S. Department of Interior, Fish and Wildlife Service, Bureau of Land Management, and National Park Service; U.S. Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service; and the U.S. Environmental Protection Agency.

FHWA (Federal Administration) 1995. Hydraulic Circular NO. 18, Evaluating Scour at Bridges, Third Edition (FHWA-IP-90-017, November 1995) or equivalent.

FHWA (Federal Administration) 2000. Critter Crossings: Linking Habitats and Reducing Roadkill. (http://www.FHWA.dot.gov/environment/wildlifecrossing).

Fishpro. 2000. Fish passage conditions on the Klamath River. Submitted to The Karuk Tribe and PacifiCorp.

Fish Passage Center. 2003. Adult Fish Passage at Columbia River dams. http://www.fpc.org/adultqueries/Adult_Table_Species_allCurrent.asp

Fitzpatrick, G.S. and C.B. Schultz. 2001. 2000 status of the Fender's blue butterfly (*Icaricia icarioides fenderi*) in Lane County, Oregon: Population estimates and site evaluations. An unpublished report to Oregon Natural Heritage Program and US Fish and Wildlife Service.

Floyd R. 2003. Biological Assessment: ODOT State-wide Maintenance Activities Requiring a Section 404 fill permit or section 10 permit Effects on Endangered, Threatened, Proposed, and Candidate Species in Oregon. Unpublished report Oregon Department of Transportation. Salem, Oregon.

Folliard, L. 1993. Nest site characteristics of northern spotted owls in managed forest of northwest California. M.S. thesis. Univ. Idaho, Moscow, ID.

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87: 1-64.

Forsman, E.D, and R. G. Anthony. 1999. Analysis of demographic rates of northern spotted owls. Executive Summary. April 19, 1999.

Fraley, J.J., and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and river system, Montana. Northwest Science 63:133-143.

Frankham, R. 1995. Effective population size/adult population size ratios in wildlife: a review. Genetical Research 66:95-107.

Franklin, A.B., K.P. Burnham, G.C. White, R.J. Anthony, E.D. Forsman, C. Sanchez, J.D. Nicols, and J. Hines. 1999. Range-wide status and trends in northern spotted owl populations. Colorado Coop. Fish and Wildl. Res. Unit, Fort Collins, Colorado and Oregon Coop. Fish and Wildl. Res. Unit, Corvallis, OR. Unpublished report.

Franklin, A.B., D.R. Anderson, R.J. Gutiérrez, and K.P. Burnham. 2000. Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecological Monographs 70: 539-590.

Franklin, A. B., K. P. Burnham, G. C. White, R. G. Anthony, E. D. Forsman, C. Schwarz, J. D. Nichols, and J. Hines. 1999. Range-wide status and trends in northern spotted owl populations. Colorado Cooperative Fish and Wildlife Research Unit, U.S. Geological Survey, Biological Resources Division, Colorado State University, Ft. Collins, Colorado, and Oregon Cooperative Fish and Wildlife Research Unit, U.S. Geological Survey, Biological Resources Division, Department of Fish and Wildlife, Oregon State University, Corvallis, Oregon. 71 pp.

Franklin, I.A. 1980. Evolutionary changes in small populations. Pages 135-150 *in*: Soulé M. and B.A. Wilcox (eds). Conservation Biology: an evolutionary-ecological perspective. Sinauer Associates, Sunderland, MA.

Franklin, I.R. and R. Frankham. 1998. How large must populations be to retain evolutionary potential? Animal Conservation 1:69-70.

Frissell, C.A. 1997. A spatial approach to species viability: Conservation of fishes in the Columbia River Basin. Biological Station Open File Report Number 101-97. Flathead Lake Biological Station, University of Montana, Polson, MT.

Fulton, L.A. 1968. Spawning areas and abundance of Chinook salmon, *Oncorhynchus tshawytscha*, in the Columbia River basin–past and present. U.S. Fish and Wildlife Service, Special Scientific Report, Fisheries 571:26.

Fulton, L.A. 1970. Spawning areas and abundance of steelhead trout and coho, sockeye, and chum salmon in the Columbia River basin–past and present. U.S. Fish and Wildlife Service, Special Scientific Report, Fisheries 618.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. American Fisheries Society Special Publication 19:297-323.

Gamett, B. 1999. The history and status of fishes in the Little Lost River drainage, Idaho. Salmon-Challis National Forest, Idaho Department of Fish and Game, U.S. Bureau of Land Management, Sagewillow, Inc. May 1999 draft.

Gilbert, C.H. 1898. The fishes of the Klamath Basin. Bull. U.S. Fish Comm. 17(1897):I-13.

Goetz, F. 1989. Biology of the bull trout, *Salvelinus confluentus*, literature review. U.S. Department of Agriculture, U.S. Forest Service, Willamette National Forest, Eugene, Oregon.

Golden, M.P. 1969. The Lost River sucker. Oregon Game Comm. Admin.Report No. 1-69.

Gutermuth, B., C. Watson, and J. Kelly. 2000b. Link River hydroelectric project (Eastside and westside powerhouses) Final entrainment study report. Cell Tech, Klamath Falls, Oregon and PacifiCorp Environmental Services, Portland, Oregon.

Gutermuth, B., C. Watson, and R. Weider. 1999. Link River hydroelectric project - Eastside and westside powerhouses annual entrainment study report (March 1997 - July 1998). New Earth Corp., Klamath Falls, Oregon.

Gutermuth, B., D. Beckstrand, and C. Watson. 1998. New Earth harvest site monitoring, 1996-1997. Final report. New Earth/Cell Tech, Klamath Falls, Oregon.

Gutermuth, B., D. Breckstrand, and S. Peck. 1997. New Earth harvest site monitoring project - annual study report, 1996. Unpublished report. New Earth/Cell Tech, Klamath Falls, Oregon.

Gutermuth, B., E. Pinkston, and D. Vogel. 2000a. A-canal fish entrainment during 1997 and 1998 with emphasis on endangered suckers. Completion report. New Earth/Cell Tech, Klamath Falls, Oregon and Natural Resource Scientists, Inc., Red Bluff, California.

Gutierrez, R. J., A. B. Franklin, and W. S. LaHaye. 1995. Spotted owl (Strix occidentalis). in: A. Poole and F. Gill, editors. The birds of North America, No. 179. The Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C.

Hamer, T. E., D. L. Hays, C. M. Senger and E. D. Forsman. 2001. Diets of northern barred owls and northern spotted owls in an area of sympatry. Journal of Raptor Research 35(3):221-227.

Hammond, P.C. 1994. 1993 Study of the Fender's Blue Butterfly (*Icaricia icarioides fenderi*). Unpublished report to the Oregon Natural Heritage Program and U.S. Fish and Wildlife Service.

Hammond, P.C. 1996. 1995 Study of the Fender's blue butterfly (*Icaricia icarioides fenderi*) in Benton, Polk, and Yamhill counties. Unpublished report to the Oregon Natural Heritage Program and U.S. Fish and Wildlife Service.

Hammond, P.C. 1998. 1997 Study of the Fender's blue butterfly (*Icaricia icarioides fenderi*) in Benton, Polk, and Yamhill Counties, Oregon. Unpubl. Rept. to Oregon Natural Heritage Program and U. S. Fish and Wildlife Service.

Hammond, P.C. 2001. 2000 Study of the Fender's blue butterfly (*Icaricia icarioides fenderi*) in Benton, Polk, and Yamhill Counties, Oregon. Unpubl. Rept. to Oregon Natural Heritage Program and U. S. Fish and Wildlife Service.

Hammond, P.C. and M.V. Wilson. 1992. Fender's blue butterfly populations: habitat descriptions and threats to survival. Unpublished report to the Oregon Natural Heritage Program, Portland, OR.

Hammond, P.C. and M.V. Wilson. 1993. Status of the Fender's blue butterfly. Unpublished report on file at U.S. Fish and Wildlife Service, Oregon State Office.

Hanski, I. and M.E. Gilpin. 1997. Metapopulation Biology: Ecology, Genetics and Evolution. Academic Press, London, UK.

Hard, J. 1995. A quantitative genetic perspective on the conservation of intraspecific diversity. American fisheries Society Symposium 17:304-326.

Harris, P.M. and D. Markle. 1991. Biochemistry and morphology of Upper Klamath Lake suckers. Final report to Oregon Department of Fish and Wildlife. Oregon State University, Corvallis, Oregon.

Hassler, T.J. 1987. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)--coho salmon. U.S. Fish and Wildl. Serv. Biol. Rep. 82(11.70). 19 pages.

Hastings, M.C. 1995. Physical effects of noise on fishes. In Proceedings of INTER-NOISE 95, The 1995 International Congress on Noise Control Engineering – Volume II. pp. 979–984. Newport Beach, California, July 10-12, 1995.

Hastings, M.C. 2002. Clarification of the meaning of sound pressure levels and the known effects of sound on fish. August 26, 2002; revised August 27, 2002. pp 8.

Hayes, B.S. and R. Shively. 2002. Monitoring of Lost River and shortnose suckers at shoreline spawning areas in Upper Klamath Lake, Oregon: Anuual report 2001. *In* Monitoring of adult Lost River and shortnose suckers in the Upper Klamath Basin, 2001. Draft annual report (February 2002) of research to the U.S. Bureau of Reclamation, Mid-Pacific Region, Klamath Area Office. 134 pgs. Contract #00AA200049.

Healy, M.C. and A. Prince. 1995. Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. American Fisheries Society Symposium 17:176-184.

Hedrick, P.W. and S. T. Kalinowski. 2000. Inbreeding depression in conservation biology. Annual Review of Ecology and Systematics 31:139-162.

Hemmingsen, A.R., R.A. French, D.V. Buchanan, D.L. Bottom, and K.P. Currens. 1992. Native Trout project. Oregon Department of Fish and Wildlife, Fish Research Project F-136-R, Annual progress report. Portland, Oregon.

Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds. National forests east of the Cascade Crest, Oregon, and Washington. A report to the Congress and President of the United States Eastside Forests Scientific Society Panel. American Fisheries Society, American Ornithologists Union Incorporated, The Ecological Society of America, Society for Conservation Biology, The Wildlife Society. The Wildlife Society Technical Review 94-2. www.wildlife.org/publications/index.cfm?tname=pubs&pubid=pub05.

Henny, C.J. 1988. Large osprey colony discovered in Oregon in 1899. The Murrelet 69: 33-36.

Hershey, K.T. 1995. Characteristics of forests at spotted owl nest sites in the Pacific Northwest. M.S. thesis, Oregon State University, Corvallis, Oregon.

Herter, D.R., and L.L. Hicks. 2000. Barred owl and spotted owl populations and habitat in the central Cascade Range of Washington. Journal of Raptor Research 34: 279-286.

Hjort, R., P. Hulett, L. LaBolle, and H. Li. 1984. Fish and invertebrates of revetments and other habitats in the Willamette River, Oregon. U.S. Army Eng. Waterways Exp. Sta. EWQOS Tech. Rep. E-84-9.

Hoelscher, B., and T.C. Bjornn. 1989. Habitat, density and potential production of trout and char in Pend Oreille Lake tributaries. Project F-71-R-10, Subproject III, Job No. 8. Idaho Department of Fish and Game, Boise, Idaho.

Holt, R. 1997. Upper Klamath Lake fish disease exam report. Oregon Department of Fish and Wildlife, Corvallis, Oregon.

Howe, C.B. 1968. Ancient tribes of the Klamath country. Binfords and Mort, Portland, Oregon.

Howell, P., K. Jones, D. Scarnecchia, L. LaVoy, W. Knedra, and D. Orrmann. 1985. Stock assessment of Columbia River anadromous salmonids, 2 volumes. Final Report to nneville Power Administration, Portland, Oregon (Project 83-335).

Howell, P.J., and D.V. Buchanan. 1992. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Huettman, F., E. Cam, D. B. Lank, R. Bradley, L. Lougheed, L. McFarlane Tranquilla, C. Lougheed, Y. Zharikov, P. P.-W. Yen, N. Parker, and F. Cooke. Manuscript. Breeding habitat selectivity for large-scale habitat features by marbled murrelets in fragmented and virgin old-growth forest landscapes. Wildlife Monographs.

Isaacs, F.B. and R.G. Anthony, and R. J. Anderson. 1983. Distribution and productivity of nesting bald eagles in Oregon. 1978-1982. The Murrelet 64:33-38

Isaacs, F.B. and R.G. Anthony. 2003. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River recover zone, 1971 through 2003. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, Oregon.

Isaacs, F.B., and R.G. Anthony. 1987. Abundance, foraging, and roosting of Bald Eagles wintering in the Harney Basin, Oregon. Northwest Sci. 61:114-121.

Jackson, P.L. 1993. Climate. P. 48-57 in: Jackson, P.L and A. J. Kimerling (eds.). Atlas of the Pacific Northwest. Oregon State University Press, Corvallis, Oregon.

Jakober, M. 1995. Autumn and winter movement and habitat use of resident bull trout and west slope cutthroat trout in Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

Jefferson, C.A. 1975. Plant communities and succession in Oregon coastal salt marshes. PhD. Dissertation. Oregon State University, Corvallis, Oregon.

Johnson, D. H. 1992. Spotted owls, great horned owls, and forest fragmentation in the central Oregon Cascades. M. S. Thesis, Oregon State University, Corvalis, OR.

Johnson D.H. and T.A.O'Neil. 2001. Wildlife-habitat relationships in Washington and Oregon. Oregon State University Press. Corvallis, Oregon.

Johnson, O.W., W.S. Grant, R.G. Cope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-32. 280 p.

Kelly, E.G., E.D. Forsman, and R.G. Anthony. 2003. Are barred owls replacing spotted owls? Condor 105:45-53.

Killsgaard, C. and B.A. Charley. 1999. GIS database of Oregon current wildlife-habitat types (orcurhab.zip). Northwest Habitat Institute. Database was developed using Johnson, D.H. and O'Neil, T.A. 2001 wildlife-habitat relationships in Oregon and Washington. Oregon State University Press. Available: (http://www.nwhi.org).

Koch, D.L. and G.P. Contreras 1973. Preliminary survey of the fishes of the Lost River system including Lower Klamath Lake and Klamath Strait drain with special reference to the Shortnose (Chasmistes brevirostris) and Lost River suckers (Catostomus luxatus). Center for Water Resources Research, Desert Research Institute, University of Nevada, Reno, Nevada.

Kuykendall, K. and T.N. Kaye. 1993. Status Report for *Lupinus sulphureus* ssp. *kincaidii*. Draft report to Oregon Department of Agriculture, Corvallis, OR.

Laidig, K.J., and D.S. Dobkin. 1995. Spatial overlap and habitat association of Barred Owls and Great Horned Owls in southern New Jersey. Journal of Raptor Research 29:151–157.

Lank, D.B., N. Parker, E.A. Krebs, and L.M. Tranquilla. 2003. Geographic distribution, habitat selection, and population dynamics with respect to nesting habitat characteristics, of marbled murrelets. Centre for Wildlife Ecology, Simon Fraser University, Burnaby, Canada. 66 pages.

Leary, R.F., F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of Bull trout in the Columbia and Klamath River drainages. Conservation Biology 7:856-865.

Lee, D.C., JR. Sedell, B.E. Reiman, R.F. Thurow, J.E. Williams. 1997. Broadscale assessment of aquatic species and habitats. P. 1058-1496 in: T.M. Quigley and S.J. Arbelbide, eds. An Assessment of Ecosystem Components in the Interior Columbia Basin and portions of the Klamath and Great Basins. U.S. Forest Service General Technical Report PNW-GTR-405. Portland, OR. http://www.icbemp.gov/science/scipubs.shtml.

Lee, C., E, Rybak, J. Weaver, K. Aubry, R. Naney, G. Gunderson, J. Lehmuhl, W. Zielinski, G. Koehler, P. Murphy, C. Lorimor and V. Agnew. 1998. Survey protocol for the lynx (*lynx canadensis*). U.S. Fish and Wildlife Service, U.S. Forest Service, Wildlife Conservation Society, Washington Dept. of Fish and Wildlife, Wenatchee National Forest.

Leskiw, T., and R. J. Gutiérrez. 1998. Possible predation of a Spotted Owl by a Barred Owl. Western Birds 29:225–226.

Li, H., C. Schreck, C. Bond, E. Rexstad. 1987. Factors influencing changes in fish assemblages of Pacific Northwest streams. Pages 193-202 *in* W.J. Mathews and D.C. Heinz, editors. Community and evolutionary ecology of North American stream fishes. University of Oklahoma Press, Norman, OK.

Light, J., L. Herger, and M. Robinson. 1996. Upper Klamath basin bull trout conservation strategy, a conceptual framework for recovery. Part one. The Klamath Basin Bull Trout Working Group.

Loftus, M.E. 2001. Assessment of potential water quality stress to fish. Supplement to effects of water quality and lake level on the biology and habitat of selected fish species in Upper Klamath Lake. Prepared for Bureau of Indian Affairs by R2 Resource Consultants.

Luginbuhl, J.M., J.M. Marzluff, J.E. Bradley, M.G. Raphael, and D.E. Varland. 2001. Corvid survey techniques and the relationship between corvid relative abundance and nest predation. Journal of Field Ornithology 72(4):556-572.

Manley, I.A. 1999. Behavior and habitat selection of marbled murrelets nesting on the Sunshine Coast. Masters of Science Thesis. Department of Biological Sciences, Simon Fraser University, Burnaby, Canada. 163 pages.

Markle, D., T. Pearsons, and C. Bills. 1989. Taxonomic status and distributional survey of the Oregon chub. Final report, OSU # 30-262-9714. Oregon State University, Corvallis, Oregon.

Markle, D., T. Pearsons and D. Bills. 1991. Natural history of Oregonichthys (Pisces: Cyprinidae), with a description of a new species from the Umpqua River of Oregon. Copeia 1991 (2):277-293.

Markle, D.F. and D.C. Simon. 1993. Preliminary studies of systematics and juvenile ecology of Upper Klamath Lake suckers. Annual report. Oregon State University. Department of Fisheries and Wildlife, Corvallis, Oregon.

Markle, D.F. and M. Cooperman. 2002. Relationship between Lost River and shortnose sucker biology and management of Upper Klamath Lake. In: Water Allocation in the Klamath Reclamation Project, 2001: An Assessment of Natural Resource, Economic, Social and Institutional Issues in the Upper Klamath Basin. W.S. Braunworth, Jr., T. Welch and R. Hathaway (eds.). Oregon Sate University Extension Service, Corvallis, Oregon. in review

Markle, D.F., M. Cunningham, and D.C. Simon. 2000. Ecology of Upper Klamath Lake Shortnose and Lost River suckers—1. Adult and larval sampling in the Lower Williamson River, April-August 1999. Annual report: 1999. Oregon State University, Department of Fisheries and Wildlife, Corvallis, Oregon.

Marr, J.C. 1943. Age, length, and weight studies of three species of Columbia River salmon (*Oncorhynchus keta, O. gorbuscha and O. kisutch*). Stanford Ichthyological Bulletin 2:157-197.

Marshall, D.B. 1988. Status of the marbled murrelet in North America: with special emphasis on populations in California, Oregon and Washington. Audubon Society of Portland. 42 pages.

Matthews, G.M., and R.S. Waples. 1991. Status review for Snake River spring and summerChinook salmon. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-200. 75 p.

Mattson, C.R. 1948. Spawning ground studies of Willamette River spring Chinook salmon. Fish Commission of Oregon Research Briefs 1(2):21-32.

MBTSG (Montana Bull Trout Scientific Group). 1995a. Upper Clark Fork River drainage bull trout status report (including Rock Creek). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1995b. Bitterroot River drainage bull trout status report. Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1995c. Blackfoot River drainage bull trout status report. Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1995d. Flathead River drainage bull trout status report (including Flathead Lake, the North and Middle forks of the Flathead River and the Stillwater and Whitefish River). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1995e. South Fork Flathead River drainage bull trout status report (upstream of Hungry Horse Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1996a. Swan River drainage bull trout status report (including Swan Lake). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1996b. Lower Clark Fork River drainage bull trout status report (Cabinet Gorge Dam to Thompson Falls). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1996c. Middle Clark Fork River drainage bull trout status report (from Thompson Falls to Milltown, including the lower Flathead River to Kerr Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1996d. Lower Kootenai River drainage bull trout status report (below Kootenai Falls). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1996e. Middle Kootenai River drainage bull trout status report (between Kootenai Falls and Libby Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1996f. Upper Kootenai River drainage bull trout status report (including Lake Koocanusa, upstream of Libby Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1998. The relationship between land management activities and habitat requirements of bull trout. Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

McClure, M., B. Sanderson, E. Holmes, C. Jordan, P. Kareiva, and P. Levin. 2000.

Revised Appendix B of standardized quantitative analysis of the risks faced by salmonids in the Columbia River basin. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves, and L.A. Brown. 1994. Management history of eastside ecosystems: Changes in fish habitat over 50 years, 1935 to 1992. U.S. Forest Service, Pacific Northwest Research Station, General Technical Report. PNW-GTR 321.

McKernan, D.L., and C.R. Mattson. 1950. Observations on pulp and paper effluents and the probable effects of this pollutant on the fisheries resources of the Willamette River in Oregon. Fish Commission of Oregon, Fish Commission Research Briefs 3(1):14-21.

McPhail, J.D., and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Department of Zoology, University of British Columbia. Fisheries Management Report No. 104. Vancouver, British Columbia, Canada.

Meehan, W.R. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19.

Meekins, D.J., and T.E. Hamer. 1998. Use of radar to monitor marbled murrelets at inland sites in the North Cascades of Washington: Preliminary Report. USDA Forest Service. 16 pages.

Meffe, G.K., and C.R. Carroll. 1994. Principles of conservation biology. Sinauer Associate, Inc. Sunderland, Massachusetts.

Meyer, C. B., S. L. Miller, and C. J. Ralph. 2002. Multi-scale landscape and seascape patterns associated with marbled murrelet nesting areas on the U.S. west coast. Landscape Ecology 17:95-115.

Meyer, J.S., L.L. Irwin, and M.S. Boyce. 1998. Influence of habitat abundance and fragmentation on northern spotted owls in western Oregon. Wildlife Monographs 139:1-51.

Miller, P.S. and R.C. Lacy. 1999. VORTEX: a stochastic simulation of the extinction process. Version 8 user's manual. Conservation breeding specialists group (SSC/IUCN), Apple Valley, MN.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. NMFS-NWFSC-35. U.S. Dept. Commer., NOAA Technical Memorandum. 443 p.

National Research Council. 1996. Upstream–Salmon and Society in the Pacific Northwest. National Academy Press, Washington, D.C.

Nehlsen, W., J. Williams, and J. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16(02):4-21.

Nelson, S.K. and T.E. Hamer. 1995. Nest success and the effects of predation on marbled murrelet. *In* Ralph, C.J., G.L. Hunt, M.G. Raphael, J.F. Piatt, *Tech. Editors.* 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 420 p.

Nelson, S.K. and A.K. Wilson. 2002. Marbled murrelet habitat characteristics on state lands in western Oregon. Corvallis, OR: Oregon Cooperative Fish and Wildlife Research Unit, OSU, Department of Fisheries and Wildlife. 151 pages.

Newton, J.A., and S. Pribyl. 1994. Bull trout population summary: Lower Deschutes River subbasin. Oregon Department of Fish and Wildlife, The Dalles, Oregon. Oregon administrative rules, proposed amendments to OAR 340-41-685 and OAR 340-41-026. January 11, 1996.

North, M., G. Steger, R. Denton, G. Eberlein, T. Munton, and K. Johnson. 2000. Association of weather and nest-site structure with reproductive success in California spotted owls. Journal of Wildlife Management 64(3):797-807.

Nickelson, T.E., J.D. Rodgers, S.L. Johnson, and M.F. Solazzi. 1992. Seasonal changes in habitat use by juvenile coho salmon (*Oncorhynchus kisutch*) in Oregon coastal streams. Canadian J. Fish. Aquat. Sci. 49:783-789.

NMFS (National Marine Fisheries Service). 1992. Final recovery plan for steller sea lions (*Eumetopias jubatus*). NOAA, Recovery Plan.

NMFS (National Marine Fisheries Service). 1995. And Addendum: Juvenile Fish Screening Criteria for Pump Intakes (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.html).

NMFS (National Marine Fisheries Service). 1998. Letter from Steve Morris, National Marine Fisheries Service, to W.B. Paynter, Portland District, U.S. Army Corps of Engineers (December 9, 1998) (transmitting a document titled *Position Document for the Treated Wood in Areas within Oregon Occupied by Endangered Species Act Proposed and Listed Anadromous Fish Species*, National Marine Fisheries Service, December, 1998).

NOAA Fisheries (NOAA's National Marine Fisheries Service). 1995. Proposed recovery plan for Snake River salmon. Protected Resources Division, Portland, Oregon.

NOAA Fisheries (National Marine Fisheries Service). 2000. Biological Opinion on Reinitiation of Consultation on Operation of the Federal Columbia River Power System, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin. NMFS, Hydro Division, Portland, Oregon.

NOAA Fisheries (National Marine Fisheries Service). 2000a. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. Protected Resources Division, Portland, Oregon.

NOAA Fisheries (NOAA's National Marine Fisheries Service). 2000b. Biological Opinion. Reinitiation of Consultation on Operation of the Federal Columbia River

Power System, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin. National Marine Fisheries Service, Northwest Region, Seattle, WA.

NOAA Fisheries (National Marine Fisheries Service). 2003a. Endangered Species Act Section 7 consultation programmatic biological opinion and Magnuson-Stevens fishery management and conservation act essential fish habitat consultation for statewide drilling, surveying and hydraulic engineering activities. National Oceanic and Atmospheric Administration National Marine Fishery Service.

NOAA Fisheries (National Marine Fisheries Service). 2003b. Endangered Species Act Section 7 formal consultation and Magnuson-Stevens Fishery conservation and management act essential fish habitat consultation for the Hood Canal bridge retrofit and east half replacement project.

NOAA Fisheries (National Marine Fisheries Service). 2003c. Endangered Species Act section 7 programmatic formal consultation and Magnuson-Stevens fishery conservation and managment act essential fish habitat consultation for the oil spill response activities conducted under the Northwest Area Contingency Plan (NWACP). National Marine Fisheries Service, Seattle, Washington.

NOAA Fisheries (National Marine Fisheries Service). 2004. Northwest region seal and sea lion (Pinniped) managment map of seal and sea lion trouble spots. National Marine Fisheries Service, Seattle, Washington.

North, M. P., J. F. Franklin, A. B. Carey, E. D. Forsman, and T. Hamer. 1999. Forest stand structure of the northern spotted owl's foraging habitat. Forest Science 45: 520-527.

Noss, R.F., E.T. LaRoe and J.M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. U.W. National Biological Service, Biological Report 28.

ODFW (Oregon Department of Fish and Wildlife). 1995. A Guide to placing Large Wood in Streams. (http://www.odf.state.or.us/FP/RefLibrary/RefsList.htm).

ODFW (Oregon Department of Fish and Wildlife). 1998a. Briefing paper–Lower Columbia RiverChinook ESU. ODFW, Portland. October 13.

ODOT (Oregon Department of Transportation). 2002a. Standard specifications for highway construction. ODOT, Salem, Oregon.

ODOT (Oregon Department of Transportation). 2002b. Programmatic Biological Assessment (PBA) Statewide Drilling, Survey, and Stormwater and Engineering Programs: Effects on Federally Listed Fish Species in Regions 1, 2, 3, 4 & 5

ODFW (Oregon Department of Fish and Wildlife). 2003a. Coastal salmonid inventory project: coho abundance–stratified random sampling estimates for coastal river basins 1990-2002. (http://oregonstate.edu/Dept/ODFW/spawn/coho.htm).

ODFW (Oregon Department of Fish and Wildlife). 2003b. Oregon pinniped haul-out location by lat/lon for the harbor seal (*Phoca vitulina*), northern sea lion (*Zalophus californianus*), stellar sea lion (*Eumetopias jubatus*), northern elephant seal (*Mirounga angustirostris*). Unpublished report. Oregon Department of Fish and Wildlife.

ODOT (Oregon Department of Transportation). 2003c. OTIA III economic and bridge options report, Oregon Department of Transportation. Available: http://www.odot.state.or.us/comm/bridge_options/index.htm. (Accessed 2003).

ODOT (Oregon Department of Transportation). 2004a. Programmatic Biological Assessment (PBA) ODOT OTIA III Statewide Bridge Delivery Program

ODOT (Oregon Department of Transportation). 2004b. Comprehensive Mitigation/conservation Strategy (CMCS) Draft Program Manual.

ODSL (Oregon Division of State Lands). 1989. Heads of tide for coastal streams in Oregon.Unpublished report. Oregon Division of State Lands, Engineering Section, Salem, Oregon.

Oregon Coastal Salmon Restoration Initiative. 1997. State of Oregon, Salem, Oregon. March 10.

Oregon Department of Administrative Services. 1999. Oregon Economic and Revenue Forecast.Vol. XIX. No. 2. Office of Economic Analysis, Salem.

Oregon Department of Environmental Quality. 1998. Oregon's final water quality limited streams - 303(d) list. Oregon Depart of Environmental Quality, Portland.

Oregon Department of Forestry (ODF). 2000. Forest Practices Administrative Rules and Forest Practices Act. Salem, OR.

Oregon. 1996. Oregon administrative rules, proposed amendments to OAR 340-41-685 and OAR 340-41-026. January 11, 1996.

Oregon. 1997. Coastal Salmon Restoration Initiative. The Oregon Plan. State of Oregon.

Ott Engineering. 1990. Link River dam fishway conceptual design study. Prepared for PacifiCorp. Portland, Oregon.

OWEB (Oregon Watershed Assessment Manual). 2001. Watershed Professionals Network 2001. Appendix A *in* Oregon watershed assessment manual, May, 2001. Govenor's Watershed Enhancement Board, Salem, Oregon. Available: http:/www.oweb/state.or.us/publications/wa_manual99.shtml.

PacifiCorp. 1997. Final report of fish trapping activities at the Klamath hydroelectric project. Prepared by PacifiCorp Environmental Services. June 1997.

Paton, P.W.C., C.J. Ralph, and R.A. Erickson. 1992. Use of an inland site in northwestern California by marbled murrelets. Proceedings of the Western Foundation of Vertebrate Zoology 5:109-116.

Pearson, R.R., and K.B. Livezey. *In Press*. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. Draft manuscript on file at the Western Washington Fish and Wildlife Office, Lacey, WA.

Pearsons, T.N. 1989. Ecology and decline of a rare western minnow: the Oregon chub (*Oregonichthys crameri*). Masterof Science Thesis. Oregon State University, Corvallis, Oregon.

Perkins, D.L. 1996. Lost River and Shortnose suckers of Upper Klamath Lake. Report 96-1. California Science Center, Reno Field Station.

Perkins, D.L. 1997. Spawning migration and status of adult Lost River and shortnose suckers in Upper Klamath Lake, February-May 1997. National Biological Service, Reno Field Station, Study Bulletin 97-1.

Perkins, D.L., J. Kann, and G.G. Scoppettone. 2000. The role of poor water quality and fish kills in the decline of endangered Lost River and Shortnose suckers in Upper Klamath Lake. Final report. U.S. Geological Survey, Biological Resources Division, Western Fisheries Research Center, Reno Field Station, Reno, Nevada.

PFMC (Pacific Fishery Management Council), 1998a. Final Environmental Assessment/ Regulatory Review for Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan. October 1998.

PFMC (Pacific Fishery Management Council), 1998b. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. Portland, Oregon.

PFMC. 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.

Phelps, S.R., L.L. LeClair, S. Young, and H.L. Blankenship. 1994. Genetic diversity patterns of chum salmon in the Pacific Northwest. Canadian J. Fish. Aquat. Sci. 51 (Suppl. 1):65-83. population. Animal Conservation 1:70-72.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 *in* P.J. Howell, and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River. Draft report. Prepared for the Washington Water Power Company, Spokane, Washington.

Quigley, T.M. and S.J. Arbelbide, technical editors. 1997. An assessment of ecosystem components in the interior Columbian basin and portions of the Klamath and Great Basins. Volume 2. U.S. Forest Service General Technical Report PNW-GTR-405.

Ralph, C.J. and S.L. Miller. 1995. Offshore population estimates of marbled murrelets at sea in Oregon during the summers of 1992 and 1993. *In* Ralph, C.J., G.L. Hunt, M.G. Raphael, J.F. Piatt, *Tech. Editors.* 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 420 p.

Ralph, C.J., G.L. Hunt, M.G. Raphael, J.F. Piatt, *Tech. Editors.* 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 420 p.

Raphael, M.G., D. Evans-Mack, and B.A. Cooper. 2002. Landscape-scale relationships between abundance of marbled murrelets and distribution of nesting habitat. Condor 104(2):331-342.

REO (Regional Ecosystem Office). 2003. REO Geographic Information Systems Range of the Northern Spotted Owl and Northwest Forest Plan Boundary, (FEMAT 1993).(http://www.reo.gov/gis/data/gisdata/index.htm).

Rhodes, J.J., D.A. McCullough, and F.A. Espinosa, Jr. 1994. A coarse screening process for potential application in ESA consultations. Columbia River Intertribal Fish Commission. Prepared under NMFS/BIA Inter-Agency Agreement 40ABNF3. December. http://www.critfc.org/tech/94-4report.htmL.

Rich, C.F., Jr. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

Rich, W.H. 1942. The salmon runs of the Columbia River in 1938. Fisheries Bulletin 50:103-147.

Rieman, B.E., and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21:756-764.

Rieman, B.E., and J.B. Dunham. 2000. Metapopulations and salmonids: a synthesis of life history patterns and empirical observations. Ecology of Freshwater Fish 9:1-2.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah.

Rieman, B.E., and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124(3):285-296.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River basins. North American Journal of Fisheries Management. 17:1111-1125.

Risser, P.G. 2000. Oregon State of the Environment Report. Oregon Progress Board.

Rodway M.S., and H.M. Regehr. 2002. Inland activity and forest structural characteristics as indicators of marbled murrelet nesting habitat in Clayoquot Sound. Pages 57-87 *in* A. E. Burger and T. A. Chatwin, editors. Multi-scale studies of populations, distribution and habitat associations of marbled murrelets in Clayoquot Sound, British Columbia. Ministry of Water, Land and Air Protection, Victoria, British Columbia, Canada.

Rodway, M.S., H.M. Regehr, and J.P.L. Savard. 1993. Activity patterns of marbled murrelets in old-growth forest in the Queen-Charlotte-Islands, British Columbia. Condor 95:831-848.

Roni, P., L.A. Weitkamp and J. Scordino. 1999. Identification of essential fish habitat for salmon in the Pacific Northwest: initial efforts, information needs, and future direction. Pages 39-107 in Bemala. American Fisheries Society, Symposium 22, Bethesda, Maryland.

Salo, E.O. 1991. Life history of chum salmon, *Oncorhynchus keta*. P. 231-309 in: C. Groot and L. Margolis, eds. Pacific salmon life histories. University of British Columbia Press, Vancouver, B.C.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: A review. Conservation Biology 5:18-32.

Scheerer, P.D and P.J. McDonald. 2000. Oregon Chub Research: Middle Fork Willamette and Santiam River Drainages. Contract #W66QKZ93345985. Oregon Department of Fish and Wildlife. Corvallis, Oregon.

Scheerer, P., and G.D. Apke. 1998. Oregon Chub Research. Middle Fork Willamette and Santiam River Drainages. Annual Progress Report. E96970022.

Scheerer, P., and K. Jones. 1997. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. EF-96 VII-1.

Scheerer, P., C. Shafer, K. Jones. 1992. Oregon Chub Investigations. Oregon Department of Fish and Wildlife, Fish Research Project EF-91 VII-1.

Scheerer, P., P.S. Kavanagh, and K. Jones. 2003. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. Project Number E-2-33.

Scheerer, P., T.J. Cornwell, and K. Jones. 1998. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. Project Number E-2.

Scheerer, P.D., P.S. Kavanagh, K.K. Jones. 2002. Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project E-2-32. Annual Progress Report. Oregon Department of Fish and Wildlife, Corvallis, Oregon.

Schill, D.J. 1992. River and stream investigations. Job Performance Report, Project F-73-R-13. Idaho Department of Fish and Game, Boise, Idaho.

Schreck, C.B., H.W. Li, R.C. Jhort, and C.S. Sharpe. 1986. Stock identification of Columbia RiverChinook salmon and steelhead trout. Final report to Bonneville Power Administration, Portland, Oregon (Project 83-451).

Schultz, C.B. 1994. Status of the Fender's blue butterfly (*Icaricia icarioides fenderi*) in Eugene, Oregon: A species at risk. Unpublished report to the Oregon Natural Heritage Department and the U.S. Fish and Wildlife Service, Portland, OR.

Schultz, C.B. and K. Dlugosch. 1999. Effects of Declining food resources on populations of the Fender's blue butterfly (*Icaricia icarioides fenderi*). Submitted to Journal of Biological Conservation.

Scoppettone, G. 1986. Upper Klamath Lake, Oregon, catostomid research. U.S. Fish and Wildlife Service Report, Reno, Nevada.

Scoppettone, G.C., and C.L. Vinyard 1991. Life history and management of four lacustrine suckers. Pages 369-387 *in* Minckley, W.L. and J.E. Deacon. Battle against extinction - native fish management in the American west. The University of Arizona Press, Tucson, Arizona.

Sedell, J. R. and J. L. Froggatt. 1984. Importance of streamside forests to large rivers: The isolation of the Willamette River, Oregon, U.S.A., from its floodplain by snagging and streamside forest removal. Verh. Internat. Verein. Limnol. 22:1828-1834.

Sedell, J., F. Reeves, F. Hauer, J. Stanford, and C. Hawkins. 1990. Role of refugia in recovery from disturbances: Modern fragmented and disconnected river systems. Environ. Mgmt. 14(5)711-724.

Sedell, J.R., and F.H. Everest. 1991. Historic changes in pool habitat for Columbia River Basin salmon under study for TES listing. Draft U.S. Department of Agriculture Report, Pacific Northwest Research Station, Corvallis, Oregon.

Sexauer, H.M., and P.W. James. 1997. Microhabitat use by juvenile trout in four streams located in the eastern Cascades, Washington. Pages 361-370 *in* W.C. Mackay, M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.

Shively, R.S. 2002. Size distribution of suckers collected in Clear Lake and Gerber Reservoir, in 2000. U.S. Geological Survey. Unpublished data.

Shultz, C.B. 1997. Dispersal behavior and its implications for reserve design in a rare Oregon butterfly. *Conservation Biology*. 12:284-292.

Shultz, C.B. and E.E.Crone. 1998. Burning prairie to restore butterfly habitat: modeling approach to management tradeoffs for the Fender's blue butterfly. *Restoration Ecology*. 6(3):244-252.

Simenstad, C.A. 1983. The ecology of estuarine channels of the Pacific Northwest coast: a community profile. U.S. Fish and Wildlife Services. FWS/OBS-83/05.

Simon, D.C. 2002. Preliminary data analysis: Annual survey of abundance and distribution of age 0 shortnose and Lost River suckers in Upper Klamath Lake. Annual report: 2002. Oregon Cooperative Research Unit, Department of Fisheries and Wildlife, Corvallis.

Simon, D.C. and D.F. Markle. 2001. Ecology of Upper Klamath Lake shortnose and Lost River suckers. Annual survey of abundance and distribution of age 0 shortnose and Lost River suckers in Upper Klamath Lake. Annual report: 2000. Oregon Cooperative Research Unit. Department of Fisheries and Wildlife. Corvallis.

Simon, D.C., M. Terwilliger, and D.F. Markle. 2000b. Ecology of Upper Klamath Lake shortnose and Lost River suckers—3. Annual survey of abundance and distribution of age 0 shortnose and Lost River suckers in Upper Klamath Lake. Annual report: 1999. Oregon Cooperative Research Unit, Department of Fisheries and Wildlife, Corvallis.

Simon, D.C., M.R. Terwilliger, P. Murtaugh, and D.F. Markle. 2000a. Larval and juvenile ecology of Upper Klamath Lake suckers: 1995-1998. Final report. Oregon State University. Department of Fisheries and Wildlife, Corvallis.

Singer, S.W., D.L. Suddjian, and S.A. Singer. 1995. Fledging behavior, flight patterns, and forest characteristics at marbled murrelet tree nests in California. Northwestern Naturalist 76:54-62.

Snyder, J. 1908. The fishes of the coastal streams of Oregon and northern California. Bulletin of the U.S. Bureau of Fisheries 27:153-189.

SOER (Science Panel). 2000. Oregon State of the Environment Report 2000, SOER, Report, Salem, Oregon.

Solis, D.M. And R.J. Gutierrez. 1990. Summer habitat ecology of northern spotted owls in northwestern California. The Condor 92:739-748.

Soulé, M.E. 1987. Viable Populations for Conservation. Cambridge University Press, Cambridge, UK.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR.

Spiech, S.M. and T.R. Wahl. 1995. Marbled murrelet populations of Washington – Marine habitat preferences and variability of occurrence. *In* Ralph, C.J., G.L. Hunt, M.G. Raphael, J.F. Piatt, *Tech. Editors.* 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 420 p.

Spindor, J. 1996. Yulalona. Unpublished report.

Spruell, P., and F. Allendorf. 1997. Nuclear DNA analysis of Oregon bull trout. Final report to the Oregon Department of Fish and Wildlife. Division of Biological Sciences, University of Montana.

Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of bull trout populations. Ecology of Freshwater Fish 8:114-121.

Spruell, P., A.R. Hemmingsen, P.J. Howell, N. Kanda, and F.W. Allendorf. 2003. Conservation genetics of bull trout: Geographic distribution of variation at microsatellite loci. Conservation Genetics 4:17-29.

Stalmaster, M.B. 1987. The Bald Eagle. Universe Books. New York, New York.

Stern, T. 1966. The Klamath Tribe. University of Washington Press, Seattle.

Strong, C.S. 2003. Marbled murrelet abundance and reproductive indices in Oregon during 2002. Oregon Department of Fish and Wildlife, Wildlife Diversity Program. 14 pages.

Strong, C.S., and T.M. Carten. 2000. Marbled murrelets at sea in Oregon: Status of abundance and reproduction during 1999 – Final Report. Oregon Department of Fish and Wildlife, Portland, Oregon. 17 pages.

Taylor, A.L., and E.D. Forsman. 1976. Recent range extension of the barred owl in western North America, including the first records for Oregon. Condor 78:560-561.

Taylor, B.E., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecular Ecology 8:1155-1170.

Thomas, G. 1992. Status of bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.

Thomas, J.W. and M.G. Raphael (eds.) 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team (FEMAT). July 1993. Portland, OR: USDA Forest Service and the USDI Bureau of Land Management.

Thomas, J.W., E.D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Unpublished interagency document.

Thomas, J.W., M. G. Raphael, R. G. Anthony, E. D. Forsman, A. G. Gunderson, R. S. Holthausen, B. G. Marcot, G. H. Reeves, J. R. Sedell, and D. M. Solis. 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific northwest. USDA Forest Service, Portland, Oregon.

USACE (U.S. Army Corps of Engineers). 2000. Biological Assessment of the effects of the Willamette River Basin flood control project on species listed under the Endangered Species Act. Final; April 2000. USACE Portland District. 800 p.

USACE (U.S. Army Corps of Engineers). 2002. Mitigation Regulatory Guidance Letter (RGL) 02-2.

USBR. 1996. Klamath Project sucker salvage report – 1995. Unpublished report. U.S. Bureau of Reclamation, Klamath Basin Area Office, Klamath Falls, Oregon.

USBR. 1998. Lost River and shortnose sucker spawning in lower Lost River, Oregon. U.S. Bureau of Reclamation. Klamath Basin Area Office, Klamath Falls, Oregon.

USBR. 2000. Klamath Irrigation project sucker salvage and Langell Valley fish survey report – 1999. Unpublished report. U.S. Bureau of Reclamation, Klamath Basin Area Office, Klamath Falls, Oregon.

USDA (U.S. Department of Agriculture), and USDI (U.S. Department of the Interior). 1995. Decision Notice/Decision Record Finding of No Significant Impact, Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon, and Washington, Idaho, and portions of California (PACFISH).

USDA (U.S. Department of Agriculture), and USDI (U.S. Department of the Interior). 1996. Status of the Interior Columbia Basin, Summary of Scientific Findings.

USDA (U.S. Department of Agriculture), and USDI (U.S. Department of the Interior). 1997. Interior Columbia River Basin Ecosystem Management Project, Upper Columbia River Basin Draft Environmental Impact Statement. Vol I., Vol II, Vol III.

USDA (U.S. Department of Agriculture). 1995. Inland Native Fish Strategy Environmental Assessment. Forest Service; Intermountain, Northern, and Pacific Northwest Regions.

USDA Forest Service, and USDI Bureau of Land Management. 1994a. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon.

USDA Forest Service, and USDI Bureau of Land Management. 1994b. 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. Portland, Oregon. 2 vols. and appendices.

USFWS (U.S. Fish and Wildlife Service). 1986. Recovery Plan for the Pacific Bald Eagle. U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service)and NMFS (National Marine Fisheries Service). 1998. Final Consultation Handbook--Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.

USFWS (U.S. Fish and Wildlife Service). 1987. The northern spotted owl status review. U.S. Fish and Wildlife Service, Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 1989. The northern spotted owl; a status review supplement. U.S. Fish and Wildlife Service, Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 1990. 1990 status review: northern spotted owl: Strix occidentalis caurina. Report to the U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1992. Draft final recovery plan for the northern spotted owl. U.S. Fish and Wildlfie Service. 2 Volumes. Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 1993. Lost River and Shortnose Sucker Recovery Plan. Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological Opinion for the Preferred Alternative (9) of the Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-Growth Forest Within the Range of the Northern Spotted Owl.

USFWS (U.S. Fish and Wildlife Service). 1994b. Biological opinion on effects of Long-Term Operation of the Klamath Project, with special emphasis on Clear Lake Operations. Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1998. Oregon Chub (*Oregonichthys crameri*) Recovery Plan. U.S. Fish and Wildlife Service. Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1999. Oregon water quality standards ESA consultation. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Oregon State Office, Portland, OR. July 1, 1999.

USFWS (U.S. Fish and Wildlife Service). 2002. Biological opinion on the 10-year Operation Plan for the Klamath Project. Klamath Falls, OR.

USFWS (U.S. Fish and Wildlife Service). 2003a. Five year review for the marbled murrelet. Unpublished Report.

USFWS (U.S. Fish and Wildlife Service). Formal and informal consultation on activities that may affect listed species in the Rogue River Basin for fiscal year 2004 through fiscal year (FY) 2008 (log # 1-15-03-F-511), USFWS Roseburg, Oregon

USFWS (U.S. Fish and Wildlife Service). 2003c. Biological opinion on the effects to Oregon chub from ongoing activities in the Willamette Basin. Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 2003d. Biological opinion and letter of concurrence for effects to bald eagles, marbled murrelets, northern spotted owls, bull trout, and designated critical for marbled murrelets and northern spotted owls from Olympic National Forest program of activities for August 5, 2003, to December 31, 2008.

Waples, R.S. 2002. Definition and estimation of effective population size in the conservation of endangered species. Pages 147-168 *in* S.R. Beissinger and D.R. McCullough, editors. Population Viability Analysis. The University of Chicago Press, Chicago, IL.

Ward, J. W. Jr. 1990. Spotted owl reproduction, diet and prey abundance in northwest California. M.S. thesis. Humboldt State Univ., Arcata.

Waterhouse, F.L., R. Bradley, J. Markila, F. Cooke, and L. Lougheed. 2002. Use of airphotos to identify, describe, and manage forest structure of marbled murrelet nesting habitat at a coastal British Columbia site. British Columbia Forest Service, Nanaimo, Canada. 19 pages.

Waters, T.F. 1995. Sediment in streams; sources, biological effects, and control. American Fisheries Society Monograph 7.

Watershed Professionals Network. 2001. Appendix A *in* Oregon watershed assessment manual, May, 2001. Govenor's Watershed Enhancement Board, Salem, Oregon. Available: http:/www.oweb/state.or.us/publications/wa_manual99.shtml.

Watson, G., and T.W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: An investigation at hierarchical scales. North American Journal of Fisheries Management 17:237-252.

WDE (Washington Department of Ecology). 2001. Stormwater Management Manual for Western Washington, Appendix I-B-1 (August 2001).

WDF (Washington Department of Fisheries), WDW (Washington Department of Wildlife), and WWTIT (Western Washington Treaty Indian Tribes). 1993. Washington state salmon and steelhead stock inventory (SASSI), 1992. WDF, WDW, and WWTIT, Olympia.

WDFW (Washington Department of Fish and Wildlife). 2000. Chum salmon: Columbia River chum salmon. Washington Department of Fish and Wildlife, Olympia, WA. Available online at: (http://www.wa.gov/wdfw/fish/chum/chum-7.htm).

WDFW, WDOT, and WDE (Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology). 2003. Integrated Streambank Protection Guidelines, various pagination (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.html).

Weathers, W.W., P.J. Hodum, and J.A. Blakesley. 2001. Thermal ecology and ecological energetics of California spotted owls. Condor 103:678-690.

Weddell, B.J., K.L. Gray and J.D. Foster. 1998. History and ecology of Lower Klamath, Tule Lake, Upper Klamath, and Klamath Forest National Wildlife Refuges, Oregon and California. Draft report for U.S. Fish and Wildlife Service.

Weddell, B.J. 2000. Relationship between flows in the Klamath River and Lower Klamath Lake prior to 1910. Report for: U.S. Department of the Interior, U.S. Fish and Wildlife Service, Klamath Basin Refuges.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-24. National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division, Seattle, WA.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. Ecological health of river basins in forested regions of eastern Washington and Oregon. Gen. Tech. Rep. PNW-GTR-326. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon. 65 p. http://www.fs.fed.us/pnw/publications/popularpubs.shtml

Whiteley, A.R., P. Spruell, and F.W. Allendorf. 2003. Population genetics of Boise Basin bull trout (*Salvelinus confluentus*). Final report to Rocky Mountain Research Station, Contract:RMRS # 00-JV-1122014-561.

Willamette Basin Task Force. 1969. Willamette Basin comprehensive study: Water and related land resources: Appendix D fish and wildlife. Pacific Northwest River Basins Commission, Vancouver, Washington.

Williams, R. N., R. P. Evans, and D. J. Shiozawa. 1997. Mitochondrial DNA diversity in bull trout from the Columbia River basin. Pages 283-297 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.

Wissmar, R. C., J. E. Smith, B. A. McIntosh, H. W. Li, G. H. Reeves, and J. R. Sedell. 1994. A history of resource use and disturbance in riverine basins of eastern Oregon and Washington (early 1800s-1990s). Northwest Science 68:1-35.

Wright, S. 1931. Evolution of Mendelian populations. Genetics 16:97-159.

Zabel, C.J., K.M. McKelvey, and J.P. Ward, Jr. 1995. Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls (Strix occidentalis caurina). Canadian Journal of Zoology 73:433-439.

Zharikov, Y., D.B. Lank, F. Huettmann, R.W. Bradley, N.R. Parker, P.P.W. Yen, L.M. Tranquilla, and F. Cooke. Submitted. Nest site selection and breeding success in marbled murrelets in relation to distances to edges and forest patch size, at Desolation Sound and Clayoquot Sound, British Columbia, Canada. Auk.

Ziller, J.S. 1992. Distribution and relative abundance of bull trout in the Sprague River subbasin, Oregon. Pages 18-29 *in* P.J. Howell, and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Zobel, D.B., L.F. Roth and G.M. Hawk. 1985. Ecology, pathology and management of Port-Orford cedar (*Chamaecyparis lawsoniana*). U.S. Forest Service General Technical Report PNW-184.

***In litt.* References**

Gilpin, M., University of California. 1997. Bull trout connectivity on the Clark Fork River, letter to Shelly Spalding, Montana Department of Fish, Wildlife and Parks, Helena, Montana. 5 pp.

IDFG (Idaho Department of Fish and Game). 1995. List of streams compiled by IDFG where bull trout have been extirpated, fax from Bill Horton, IDFG.

Werdon, S. USFWS. 2001. Email message concerning bull trout observed in Dave Creek, jarbidge River basin, during temperature monitoring survey conducted in 1999.

Personal Communications

Clark, A., 2004. Wildlife Biologist. U.S. Fish and Wildlife Service, Julia Butler Hansen Columbia White-tailed Deer Refuge.

Castro J. 2003. Fluvial Geomorphologist. U.S. Fish and Wildlife Service, Oregon Fish and Wildlife Office,

Werdon, S. 1998. Personal communication on August 5, 1998, between Selena Werdon, U.S. Fish and Wildlife Service, Reno, Nevada, and Sam Lohr, U.S. Fish and Wildlife Service, Boise, Idaho, concerning bull trout observed by survey teams during the Salvelinus confluentus Curiosity Society meeting august 4-6.

APPENDIX A Program bridge locations and associated information.

Record[1] No.	Bridge[2] No.	Highway[3]	MP[4]	HUC[5]	Feature Crossed[6]
1	09184	IS005	10.34	171003080104	NEIL CREEK ROAD
2	08743	IS005	14.77	171003080105	EAST MAIN STREET OVERPASS
3	08742N	IS005	14.96	171003080105	BEAR CREEK
4	08742S	IS005	14.96	171003080105	BEAR CREEK
5	08738N	IS005	17.29	171003080105	EAGLE MILL ROAD
6	08738S	IS005	17.29	171003080105	EAGLE MILL ROAD
7	08693	IS005	19.17	171003080107	VALLEY VIEW ROAD CONNECTOR #1 OVER INTERSTATE 5
8	08681	IS005	21.21	171003080107	VALLEY VIEW ROAD CONNECTOR #2 OVER INTERSTATE 5
9	08682	IS005	24.40	171003080109	FERN VALLEY ROAD CONNECTOR #2 OVER INTERSTATE 5
10	08543	IS005	31.30	171003080110	BEAR CREEK AND TABLE ROCK ROAD
11	08542	IS005	32.75	171003080110	CENTRAL POINT ROAD CONNECTOR #2 (EAST PINE STREET)
12	08540A	IS005	33.85	171003080110	UPTON ROAD OVERPASS
13	07777	IS005	36.09	171003080112	CENTRAL OREGON RAILROAD (SEVEN OAKS)
14	07777B	IS005	36.09	171003080112	CENTRAL OREGON RAILROAD (SEVEN OAKS)
15	07773A	IS005	38.73	171003080204	FOLEY LANE FRONTAGE ROAD
16	08383N	IS005	45.47	171003080205	OREGON STATE ROUTE 99
17	08383S	IS005	45.47	171003080205	OREGON STATE ROUTE 99
18	08381N	IS005	45.61	171003080205	ROGUE RIVER (HOMESTEAD)
19	08381S	IS005	45.61	171003080205	ROGUE RIVER (HOMESTEAD)
20	08375	IS005	49.46	171003080401	CREED AND COUNTY ROADS AND CENTRAL OREGON & PACIFIC RAILROAD
21	08335N	IS005	54.10	171003080401	FOOTHILL BLVD
22	08335S	IS005	54.10	171003080401	FOOTHILL BLVD
23	08333	IS005	55.40	171003080401	FOOTHILL BLVD
24	08341	IS005	55.78	171003080402	US ROUTE 199
25	08339	IS005	57.06	171003080402	BEACON DR
26	08501	IS005	58.06	171003080402	US ROUTE 199 AND OREGON STATE ROUTE 99
27	08500	IS005	58.18	171003080402	SCOVILLE ROAD
28	08018N	IS005	61.45	171003100203	LOUSE CREEK AND FRONTAGE ROAD
29	08018S	IS005	61.45	171003100203	LOUSE CREEK AND FRONTAGE ROAD
30	08094N	IS005	65.74	171003100202	JUMPOFF JOE CREEK
31	08094S	IS005	65.74	171003100202	JUMPOFF JOE CREEK

32	09439	IS005	71.39	171003100303	SUNNY VALLEY ROAD
33	09439A	IS005	71.39	171003100303	SUNNY VALLEY ROAD
34	06493A	IS005	71.72	171003100303	GRAVE CREEK
35	09440	IS005	71.93	171003100303	LELAND ROAD
36	09440A	IS005	71.93	171003100303	LELAND ROAD
37	09339	IS005	76.03	171003100304	SOUTH WOLF CREEK CONNECTOR
38	09352A	IS005	80.80	171003020703	GLENDALE INTERCHANGE
39	07364A	IS005	98.28	171003020507	5TH ST (CANYONVILLE)
40	08028N	IS005	99.53	171003020508	IRWIN ACCESS
41	08028S	IS005	99.53	171003020508	IRWIN ACCESS
42	08024	IS005	104.05	171003021001	RIDDLE ROAD (PRUNER ROAD) OVERPASS
43	07931N	IS005	105.41	171003021001	SOUTH UMPQUA RIVER (MISOURI BOTTOM)
44	07931S	IS005	105.41	171003021001	SOUTH UMPQUA RIVER (MISOURI BOTTOM)
45	07952A	IS005	107.52	171003021001	CENTRAL OREGON RAILROAD (WEAVER)
46	18613	IS005	107.52	171003021001	CENTRAL OREGON RAILROAD (WEAVER)
47	07950	IS005	108.31	171003021002	MYRTLE CREEK INTERCHANGE
48	07900A	IS005	110.35	171003021002	BOOMER HILL ROAD
49	07839	IS005	113.44	171003021002	CLARKS BRANCH ROAD
50	07835	IS005	117.74	171003021303	ROBERTS CREEK ROAD
51	07835A	IS005	117.74	171003021303	ROBERTS CREEK ROAD
52	07804N	IS005	120.03	171003021303	SPEEDWAY ROAD
53	07713A	IS005	120.57	171003021305	SOUTH UMPQUA RIVER (SHADY BRIDGE) AND CENTRAL OREGON & PACIFIC RAILROAD
54	07711A	IS005	121.69	171003021305	MCLAIN RD (GARBAGE DUMP ROAD)
55	07670A	IS005	123.01	171003021305	PORTLAND AVE (FAIRGROUND INTERCHANGE)
56	07404	IS005	124.54	171003021305	SOUTH UMPQUA RIVER (VETS BRIDGE)
57	07667	IS005	125.08	171003021305	GARDEN VALLEY ROAD OVERPASS
58	07663C	IS005	128.92	171003011205	NORTH UMPQUA RIVER, SOUTHERN PACIFIC RAILROAD, UNNAMED CREEK, AND COUNTY ROAD (WINCHESTER)
59	07663A	IS005	128.92	171003011205	NORTH UMPQUA RIVER, SPRR, UNNAMED CREEK, AND COUNTY ROAD (WINCHESTER)
60	07632	IS005	129.22	171003011205	DEL RIO ROAD OVERPASS (WINCHESTER)
61	07631	IS005	130.46	171003011205	SOUTHERN PACIFIC RAILROAD AND COUNTY ROAD
62	07631A	IS005	130.46	171003011205	SOUTHERN PACIFIC RAILROAD AND COUNTY ROAD
63	07627B	IS005	133.25	171003011204	ROGERS ROAD CONNECTOR
64	07627A	IS005	133.25	171003011204	ROGERS ROAD CONNECTOR

65	07563A	IS005	138.71	171003030205	CALAPOOYA CREEK
66	07644A	IS005	148.21	171003030303	RICE HILL FRONTAGE ROAD
67	07642	IS005	150.36	171003030303	YONCALLA JUNCTION
68	07640	IS005	150.76	171003030303	CENTRAL OREGON RAILROAD
69	07640A	IS005	150.79	171003030303	CENTRAL OREGON RAILROAD
70	07636A	IS005	154.54	171003030302	ELKHEAD ROAD
71	07567B	IS005	156.03	171003030302	ELK CREEK
72	07572A	IS005	156.49	171003030302	CURTIS CREEK
73	07569A	IS005	162.06	171003030304	BUCK CREEK ROAD
74	07469B	IS005	163.43	171003030304	BEAR CREEK
75	07584A	IS005	164.45	171003030304	COMSTOCK CEMETERY ROAD
76	07861B	IS005	169.58	170900020305	MARTIN CREEK
77	07810A	IS005	171.56	170900020305	LATHAM ROAD
78	07810B	IS005	171.56	170900020305	LATHAM ROAD
79	07809A	IS005	171.62	170900020305	COAST FORK WILLAMETTE RIVER
80	07809B	IS005	171.62	170900020305	COAST FORK WILLAMETTE RIVER
81	07860	IS005	172.24	170900020306	LONDON ROAD OVERPASS
82	07865A	IS005	173.40	170900020306	TAYLOR AVENUE
83	07864A	IS005	173.84	170900020306	16TH STREET (LANDESS ROAD)
84	07863	IS005	174.24	170900020306	ROW RIVER ROAD
85	07863A	IS005	174.24	170900020306	ROW RIVER ROAD
86	07830	IS005	174.41	170900020105	ABANDONED RAILROAD
87	07833A	IS005	174.74	170900020105	ROW RIVER ROAD
88	07833B	IS005	174.74	170900020105	ROW RIVER ROAD
89	07832	IS005	174.75	170900020105	CENTRAL OREGON & PACIFIC RAILROAD
90	07829A	IS005	175.40	170900020105	ROW RIVER
91	07871A	IS005	175.60	170900020105	ROW RIVER OVERFLOW
92	07871B	IS005	175.60	170900020105	ROW RIVER OVERFLOW
93	07828B	IS005	175.84	170900020105	UNAMED CREEK
94	07825	IS005	176.76	170900020501	SIGINAW ROAD OVERPASS
95	07793A	IS005	177.89	170900020501	BROWN CREEK
96	07793B	IS005	177.89	170900020501	BROWN CREEK
97	07757A	IS005	178.40	170900020501	GETTINGS CREEK
98	07757B	IS005	178.40	170900020501	GETTINGS CREEK
99	07756A	IS005	179.64	170900020504	COAST FORK RELIEF OPENING
100	07745A	IS005	179.99	170900020504	COAST FK WILLAMETTE RIVER
101	07743A	IS005	180.49	170900020504	TUNNEL MILL RACE
102	07740A	IS005	182.63	170900020504	HILL CREEK
103	07740C	IS005	182.63	170900020504	HILL CREEK
104	07739A	IS005	182.83	170900020504	INTERSTATE 5 OVERPASS (CRESWELL)
105	07736A	IS005	185.46	170900020503	CAMAS SWALE
106	07736C	IS005	185.46	170900020503	CAMAS SWALE
107	07732B	IS005	188.34	170900020505	OREGON STATE ROUTE 58 (GOSHEN GRADE)
108	07732A	IS005	188.34	170900020505	OREGON STATE ROUTE 58
109	06836A	IS005	188.91	170900020505	FRANKLIN BOULEVARD AND

					UNION PACIFIC RAILROAD
110	08445	IS005	190.50	170900030201	OREGON STATE ROUTE 58 OVERPASS
111	08870	IS005	190.76	170900030201	MCVAY ACCESS
112	08329	IS005	192.75	170900030201	WILLAMETTE RIVER, HWY015, SOUTHERN PACIFIC RAILROAD
113	08182N	IS005	195.78	170900030201	GAME FARM ROAD
114	08182S	IS005	195.80	170900030201	GAME FARM ROAD
115	08180N	IS005	196.19	170900030201	MCKENZIE OVERFLOW
116	08180S	IS005	196.19	170900030201	MCKENZIE OVERFLOW
117	08178N	IS005	196.69	170900040706	MCKENZIE OVERFLOW
118	08178S	IS005	196.69	170900040706	MCKENZIE OVERFLOW
119	08175N	IS005	197.38	170900040706	MCKENZIE RIVER AND FRONTAGE ROAD
120	08175S	IS005	197.38	170900040706	MCKENZIE RIVER & FRONTAGE ROAD
121	08171N	IS005	200.50	170900030206	MUDDY CREEK OVERFLOW
122	08171S	IS005	200.50	170900030206	MUDDY CREEK
123	08241N	IS005	216.97	170900030307	COURTNEY CREEK
124	08241S	IS005	216.97	170900030307	COURTNEY CREEK
125	08239N	IS005	217.39	170900030307	SODOM DITCH OVERFLOW
126	08239S	IS005	217.39	170900030307	SODOM DITCH OVERFLOW
127	08236N	IS005	218.79	170900030307	CALAPOOIA RIVER
128	08236S	IS005	218.79	170900030307	CALAPOOIA RIVER
129	08235N	IS005	220.04	170900030305	CALAPOOIA CREEK
130	08235S	IS005	220.06	170900030305	CALAPOOIA CREEK
131	08233N	IS005	221.13	170900030305	SODOM SLOUGH
132	08233S	IS005	221.13	170900030305	SODOM SLOUGH
133	08232N	IS005	222.42	170900030306	BUTTE CREEK
134	08232S	IS005	222.42	170900030306	BUTTE CREEK
135	08227N	IS005	230.45	170900030402	OAK CREEK
136	08227S	IS005	230.48	170900030402	OAK CREEK
137	08226N	IS005	230.83	170900030402	AREC RAILROAD (TALLMAN BRANCH)
138	08226S	IS005	230.86	170900030402	AREC RAILROAD (TALLMAN BRANCH)
139	08222N	IS005	233.65	170900030404	COX CREEK
140	08222S	IS005	233.65	170900030404	COX CREEK
141	08221B	IS005	234.16	170900030404	OREGON STATE ROUTE 99E (NORTH ALBANY INTERCHANGE)
142	08221D	IS005	234.16	170900030404	OREGON STATE ROUTE 99E (NORTH ALBANY INTERCHANGE)
143	08221A	IS005	234.23	170900030404	KNOX BUTTE ROAD (NORTH ALBANY INTERCHANGE)
144	08221C	IS005	234.23	170900030404	KNOX BUTTE ROAD (NORTH ALBANY INTERCHANGE)
145	08218A	IS005	235.67	170900030404	MURDER CREEK ROAD
146	08218B	IS005	235.67	170900030404	MURDER CREEK ROAD
147	08217	IS005	235.71	170900030404	MURDER CREEK
148	08124	IS005	240.42	170900050604	SANTIAM RIVER OVERFLOW NO

					4
149	08122	IS005	241.12	170900050604	SANTIAM RIVER OVERFLOW NO 3
150	08121	IS005	241.35	170900050604	SANTIAM RIVER OVERFLOW NO 2
151	07524B	IS005	249.38	170900070103	SOUTH EAST COMMERCIAL STREET
152	07538A	IS005	251.34	170900070301	SOUTH EAST BOONE ROAD
153	07441A	IS005	251.79	170900070301	MARIETTA STREET
154	07440A	IS005	252.13	170900070301	UNION PACIFIC RAILROAD
155	07522A	IS005	252.22	170900070301	SOUTH EAST TURNER ROAD
156	07439	IS005	252.54	170900070104	MILL CREEK
157	07439A	IS005	252.57	170900070104	MILL CREEK
158	07855E	IS005	259.49	170900070302	SALEM PARKWAY AND NORTH EAST CHEMAWA ROAD CONNECTOR
159	07794A	IS005	282.25	170900070402	OREGON STATE ROUTE 51
160	07794B	IS005	282.28	170900070402	OREGON STATE ROUTE 51
161	09870	IS005	282.43	170900070402	OREGON STATE ROUTE 51
162	08203B	IS005	296.04	170900120104	SOUTH WEST 26TH AVE
163	08197	IS005	298.24	170900120302	SOUTH WEST IOWA STREET VIADUCT
164	08195	IS005	299.23	170900120302	OREGON STATE ROUTE 43 (SOUTH WEST HOOD AVENUE)
165	04516A	IS005	307.70	170900120301	JANTZEN PEDESTRIAN TUNNEL
166	07333	IS005	308.38	170800010901	CLOUMBIA RIVER AND NORTH HAYDEN ISLAND DRIVE
167	08588B	IS084	0.52	170900120302	THE BANFIELD INTERCHANGE
168	02163A	IS084	6.73	170900120301	NORTH EAST 102ND AVENUE
169	13514E	IS084	7.65	170900120301	FRONTAGE ROAD CONNECTORS AND NORTH EAST 102ND AVENUE
170	06875	IS084	17.68	170800010803	SANDY RIVER
171	06875A	IS084	17.68	170800010803	SANDY RIVER
172	06945	IS084	17.82	170800010803	CONNECTOR 2 JORDAN ROAD
173	06945A	IS084	17.82	170800010803	CONNECTOR 2 JORDAN ROAD
174	02176A	IS084	35.12	170800010702	HISTORIC US ROUTE 30 AND UNION PACIFIC RAILROAD
175	00338A	IS084	36.47	170800030202	TIDE CREEK
176	02194A	IS084	38.98	170800010701	MOFFETT CREEK
177	02194B	IS084	38.98	170800010701	MOFFETT CREEK
178	02062A	IS084	40.14	170800010701	TANNER CREEK
179	02062B	IS084	40.14	170800010701	TANNER CREEK
180	08610	IS084	43.93	170701051304	MOODY STREET (CASCADE LOCKS)
181	08610 W	IS084	43.93	170701051304	MOODY STREET (CASCADE LOCKS)
182	08605	IS084	45.05	170701051304	HISTORIC US ROUTE 30
183	08605 W	IS084	45.05	170701051304	HISTORIC US ROUTE 30
184	07403A	IS084	46.10	170701051301	HERMAN CREEK
185	08623	IS084	47.31	170701051304	CONN HERMAN CREEK

186	09591	IS084	48.36	170800030204	FRONTAGE ROAD (LEWIS AND CLARK BRIDGE CONNECTOR)
187	08604	IS084	50.99	170701051203	WYETH INTERCHANGE CONNECTOR
188	07722	IS084	55.29	170800030206	LOST CREEK
189	08534	IS084	56.04	170701051203	VIENTO INTERCHANGE CONNECTOR
190	07715	IS084	60.82	170800030305	SWEDETOWN COUNTY ROAD
191	07519	IS084	61.21	170800030305	CLATSKANIE RIVER
192	07496A	IS084	63.02	170701051203	JAYMAR ROAD
193	08662	IS084	63.41	170701050803	UNION PACIFIC RAILROAD
194	07458	IS084	63.98	170701050803	UNION PACIFIC RAILROAD
195	07398	IS084	64.44	170701051202	FRONTAGE ROAD OVERPASS CONNECTOR
196	07392	IS084	69.62	170701050502	ROCK CREEK
197	07626A	IS084	69.65	170701050503	MOSIER WEST BOUND CONNECTOR
198	07397	IS084	69.85	170701050502	UNION PACIFIC RAILROAD
199	07393	IS084	70.10	170701050503	MOSIER CREEK
200	08276	IS084	82.62	170701050406	HOSTELLER WAY
201	00308A	IS084	88.04	170701050206	FIFTEEN MILE CREEK
202	07771	IS084	88.83	170701050404	THE DALLES DAM ACCESS
203	08931E	IS084	167.95	170701010604	IRRIGON JUNCTION INTERCHANGE
204	16453	IS084	179.43	170701031306	INTERSTATE 82 OVERPASS
205	16454	IS084	179.45	170701031306	INTERSTATE 82 OVERPASS
206	08498E	IS084	237.95	170701030201	UNION PACIFIC RAILROAD & MEACHAM CREEK
207	08498 W	IS084	237.95	170701030201	UNION PACIFIC RAILROAD & MEACHAM CREEK
208	00449A	IS084	248.55	170601040401	EMIGRANT HILL, UNION PACIFIC RAILROAD & FRONTAGE ROAD (GLOVER)
209	07292B	IS084	285.84	170502030505	UNION PACIFIC RAILROAD (NORTH POWDER
210	08302E	IS084	313.65	170502030204	ENCINA INTERCHANGE
211	08302 W	IS084	313.65	170502030204	ENCINA INTERCHANGE
212	08423E	IS084	315.29	170502020701	ALDER CREEK ROAD
213	08423 W	IS084	315.29	170502020701	ALDER CREEK ROAD
214	07987	IS084	325.31	170502020705	UNION PACIFIC RAILROAD AND PRITCHARD CREEK
215	07987A	IS084	325.34	170502020705	UNION PACIFIC RAILROAD AND PRITCHARD CREEK
216	01786A	IS084	340.58	170502020808	BURNT RIVER (DIXIE CREEK)
217	09354	IS084	342.91	170502020808	LIME INTERCHANGE
218	07970	IS084	371.45	170501150201	STAYTON BOULEVARD OVERPASS
219	07971	IS084	372.18	170501150201	DOMAN ROAD
220	08397E	IS084	375.80	170501150104	UNION PACIFIC RAILROAD
221	08397 W	IS084	375.80	170501150104	UNION PACIFIC RAILROAD

222	08107E	IS084	378.01	170501150104	SNAKE R (FREEWAY BRIDGE) EAST
223	08107 W	IS084	378.01	170501150104	SNAKE R (FREEWAY BRIDGE) WEST
224	01868	OR006	5.78	171002030508	WILSON RIVER (MILLS BRIDGE)
225	01869A	OR006	11.80	171002030508	WILSON RIV
226	01872A	OR006	18.04	171002030505	JORDON CREEK
227	02472	OR006	32.05	171002030501	DEVILS LAKE FORK OF THE WILSON RIVER
228	07316	OR007	41.19	170502030202	POWDER RIVER (RANCHERIA)
229	07431	OR007	42.31	170502030202	POWDER RIVER (SALBURY)
230	13491	OR018	0.04	171002040803	US ROUTE 101
231	04192	OR018	6.23	171002040802	SALMON RIVER
232	04573	OR018	18.78	170900080103	ROGUE RIVER
233	01612A	OR018	21.55	170900080105	SOUTH YAMHILL RIVER
234	00745	OR018	23.77	170900080106	SOUTH YAMHILL RIVER
235	02235	OR019	79.03	170702040201	MULE SHOE CREEK
236	02236A	OR019	80.92	170702040201	ALDER CREEK
237	04979A	OR019	81.85	170702040109	JUNIPER CREEK
238	04981A	OR019	84.53	170702040109	MATHAS CREEK
239	02233A	OR019	85.17	170702040109	HARPER CREEK
240	02655	OR019	119.56	170702011502	JOHN DAY R. (GOOSE ROCK)
241	02734A	OR019	124.12	170702011403	ROCK CREEK. (PICTURE GORGE)
242	07696	OR019	155.75	170702011002	JOHN DAY RIVER (COLES BRIDGE)
243	02463	OR019	170.49	170702010806	INDIAN CREEK
244	02466	OR019	174.96	170702010802	DIXIE CREEK-PRARIE CITY
245	02585A	OR019	265.33	170501190602	KERN CREEK
246	02586A	OR019	266.39	170501190602	LANCASTER CREEK
247	02081	OR022	0.03	170900080106	SOUTH YAMHILL RIVER
248	02015	OR022	3.97	170900080302	GOOSENECK CREEK
249	08071	OR022	4.03	170900090108	DEER PARK ROAD
250	01756A	OR022	4.71	170900080302	MILL CREEK
251	08073	OR022	5.44	170900090108	SOUTH EAST JOSEPH STREET
252	02001	OR022	8.38	170900080501	SALT CREEK
253	08076	OR022	8.88	170900070102	BEAVER CREEK
254	08069	OR022	13.23	170900070101	CASCADE HIGHWAY SOUTH EAST
255	08070	OR022	13.58	170900070101	MILL CREEK
256	07347	OR022	23.28	170900050506	LITTLE NORTH FORK SANTIAM RIVER
257	08889	OR022	24.30	170900070301	OREGON STATE ROUTE 221 OVERPASS
258	07366	OR022	25.62	170900070301	OREGON STATE ROUTE 221 OVERPASS
259	07253R	OR022	25.85	170900070301	WILLAMETTE RIVER
260	00123K	OR022	25.88	170900070301	WILLAMETTE RIVER
261	07253B	OR022	25.91	170900070301	WILLAMETTE RIVER
262	07964	OR022	40.33	170900050304	PARTIAL VIADUCT
263	07295	OR022	47.69	170900050303	TUMBLE CREEK
264	07017	OR022	49.84	170900050303	BREITENBUSH RIVER

265	05978	OR022	54.09	170900050107	BOULDER CREEK
266	06806	OR022	65.48	170900050104	MINTO CREEK
267	08281	OR042	0.07	171003040402	US 101
268	03172A	OR042	4.14	171003040402	CENTRAL OREGON RAILROAD
269	03173A	OR042	5.37	171003050603	BEAVER CREEK
270	03173B	OR042	5.37	171003050603	BEAVER CREEK
271	08842	OR042	23.37	171003050210	COQUILLE RIVER
272	08843	OR042	23.48	171003050210	HIGHWAY 242
273	08830	OR042	24.32	171003050210	COQUILLE RIVER
274	08875	OR042	25.52	171003050210	COQUILLE RIVER
275	08876	OR042	25.67	171003050210	COQUILLE RIVER
276	03212A	OR042	26.72	171003050210	ENDICOT CREEK
277	08936	OR042	30.10	171003050210	COQUILLE RIVER
278	08935	OR042	30.59	171003050210	COQUILLE RIVER
279	00559B	OR042	53.17	171003050201	MIDDLE FORK COQUILLE RIVER
280	00588C	OR042	63.97	171003021204	TENMILE CREEK
281	00587C	OR042	67.61	171003021206	OLALLA CREEK
282	00805C	OR042	72.52	171003021206	LOWER LOOKING GLASS CREEK
283	01923	OR042	74.47	171003021305	SOUTH UMPQUA RIVER (WINSTON)
284	07806	OR042	119.99	171003021303	INTERSTATE 5
285	05285A	OR058	1.96	170900020505	WILLAMETTE RIVER RELIEF OPENING
286	05286	OR058	2.46	170900020505	COAST FORK WILLAMETTE RIVER
287	05287B	OR058	2.71	170900020505	WILLAMETTE RIVER RELIEF OPENING
288	07110	OR058	8.08	170900011002	UNION PACIFIC RAILROAD
289	06768	OR058	9.51	170900010702	LOST CREEK
290	07894	OR058	33.24	170900010505	WILLAMETTE RIVER
291	07171	OR058	37.09	170900010505	PRIVATE LOGGING ROAD
292	07188	OR058	55.98	170900010302	HALF VIADUCT
293	01826	OR058	67.95	170703010202	ODELL CREEK
294	01825	OR058	73.40	170703020206	CRESCENT CREEK
295	07984	OR058	86.30	170703020503	US 97
296	08745	OR066	14.17	171003080104	INTERSTATE 5
297	03522A	OR078	0.69	171200020803	SILVIES SLOUGH (1ST BRIDGE)
298	04821A	OR082	2.64	170601040405	GRANDE RONDE RIVER (LAND COURT)
299	08780	OR082	17.88	170601040906	GRANDE RONDE RIVER AND UNION PACIFIC RAILROAD
300	00800A	OR082	19.20	170601040906	GRANDE RONDE RIVER (SOUTH ELGIN)
301	01996	OR082	20.62	170601041103	GRANDE RONDE R(NORTH EEAST ELGIN)
302	05192	OR082	31.15	170601050507	MINAM VIADUCT
303	01038A	OR082	33.65	170601050507	WALLOWA RIVER-MINAM BRIDGE
304	02184	OR082	45.83	170601050603	WALLOWA RIVER(BEAR CREEK BRIDGE)
305	07573	OR082	54.11	170601050204	LOSTINE RIVER
306	08749	OR099	11.89	171003080104	SOUTH ASLAND INTERCHANGE

307	01697	OR099	28.28	171003030401	PARADISE CREEK
308	08539	OR099	35.62	171003080112	INTERSTATE 5 (SEVEN OAKS INTERCHANGE)
309	01614	OR099	36.39	171003030310	ELK CREEK 1ST XING
310	01601	OR099	38.76	171003030310	ELK CREEK 2ND XING
311	01465	OR099	39.64	171003030310	ELK CREEK 3RD XING
312	01406	OR099	39.97	171003030310	ELK CREEK 4TH XING
313	07601B	OR099	40.83	171003080204	INTERSTATE 5 (SOUTH GOLD HILL)
314	08382	OR099	43.77	171003080205	INTERSTATE 5 (ROCKY POINT)
315	01424	OR099	47.50	171003030307	HARDSCRABBLE CREEK
316	08221E	OR099E	234.23	170900030404	KNOX BUTTE ROAD (NORTH ALBANY INTERCHANGE)
317	07941	OR099E	244.68	170900070205	INTERSTATE 5 OVERPASS
318	08205R	OR099W	6.21	170900120104	SOUTH BOUND CONNECTOR RAMP TO INTERSTATE 5
319	02262	OR126	0.60	170900030103	CENTRAL OREGON RAILROAD (OAK HILL)
320	08370	OR126	18.47	171002060802	KNOWLES CREEK
321	02201	OR126	19.40	170703050404	OCHOCO CREEK
322	08446	OR126	26.48	171002060108	SIUSLAW RIVER
323	08554	OR126	27.66	171002060302	WILDCAT CREEK
324	02553	OR126	34.10	170703050204	MARKS CREEK
325	07649	OR126	37.44	170703050204	MARKS CREEK
326	07372	OR126	62.54	170702040303	BRIDGE CREEK
327	07490	OR126	65.63	170702040303	BRIDGE CREEK
328	07491	OR126	65.85	170702040303	BRIDGE CREEK
329	09587	OR126	195.45	170900030201	OREGON STATE ROUTE 213 OVERCROSSING
330	01516	OR126B	13.06	170900040706	EUGENE WATER BOARD CANAL (WALTERVILLE)
331	01324A	OR126B	26.52	170900040701	GATE CREEK (VIDA)
332	01323A	OR126B	40.70	170900040502	BLUE RIVER BRIDGE
333	02496	OR138	17.95	171003011202	NORTH UMPQUA RIVER (LONE ROCK)
334	07904	OR138	22.30	171003011003	ROCK CREEK
335	16861	OR138	56.83	171003010305	ROUGH CREEK (PENSTOCK)
336	03913	OR140	102.40	171200060404	CATTLEPASS
337	03915	OR140	126.92	171200060301	CROOKED CREEK
338	08431	OR203	259.35	170601040404	GRANDE RONDE RIVER
339	08431A	OR203	259.35	170601040404	GRANDE RONDE RIVER
340	07867	OR213	5.20	170900110607	UNION PACIFIC RAILROAD
341	01439A	OR213	8.13	170900110607	ROCK CREEK
342	08252	OR228	216.57	170900030307	INTERSTATE 5
343	03461	OR230	5.16	171003070105	ROGUE RIVER
344	04841A	OR244	46.75	170601040307	GRANDE RONDE RIVER (HILGARD)
345	08502	OR244	253.0	170601040307	HILGARD INTERCHANGE
346	07530	US020	3.23	171002040302	BEAVER CREEK
347	07532	US020	4.19	171002040302	BEAVER CREEK
348	07533	US020	4.47	171002040302	BEAVER CREEK

349	07534	US020	5.36	171002040302	LITTLE BEAVER CREEK
350	12205B	US020	5.51	170900030403	CALAPOOIA RIVER
351	09413	US020	5.85	170900030403	CALAPOOIA OVERFLOW
352	09414	US020	5.91	170900030403	CALAPOOIA OVERFLOW
353	00654	US020	21.01	171002040104	HAYES CREEK
354	00683	US020	23.38	171002040102	YAQUINA RIVER
355	00866B	US020	39.34	170900030501	WESTERN PACIFIC RAILROAD AND MARYS RIVER
356	01205A	US020	45.68	170900030503	WESTERN PACIFIC RAILROAD AND HARRI ROAD
357	01075A	US020	48.88	170900030504	MARYS RIVER
358	01706	US020	52.44	170900060603	SODA FORK
359	08617	US020	55.73	170900030511	WESTERN PACIFIC RAILROAD
360	08616	US020	55.86	170900030511	WESTERN PACIFIC RAILROAD
361	03506A	US020	105.62	171200040305	MILLER CREEK
362	01961A	US020	167.64	170501160405	STINKINGWATER CREEK
363	01962A	US020	174.57	170501160701	MIDDLE FORK MALHEUR RIVER
364	08223	US020	233.23	170900030404	INTERSTATE 5 AND CONNECTORS
365	03091A	US026	2.24	171002010103	VOLMER CREEK
366	03092A	US026	3.26	171002010102	JOHNSON CREEK
367	02601	US026	4.40	171002010102	NECANICUM RIVER
368	01831	US026	16.28	171002020306	WEST HUMBUG CREEK
369	01832	US026	17.37	171002020306	EAST FORK HUMBUG CREEK
370	02165	US026	21.73	171002020305	NEHALEM RIVER AND OREGON STATE ROUTE 47
371	02164	US026	24.23	171002020305	NORTH FORK QUARTZ CREEK
372	00665B	US026	33.24	170800010402	ALDER CREEK
373	00689B	US026	34.09	170800010401	WILDCAT CREEK
374	02027A	US026	34.93	171002020102	NORTH FORK WOLF CREEK
375	02029	US026	37.38	171002020102	WOLF CREEK
376	02364A	US026	37.88	171002020101	NEHALEM RIVER
377	02672	US026	45.31	170900100101	WEST FORK DAIRY CREEK
378	03026A	US026	46.04	170800010202	ZIG ZAG RIVER
379	02673	US026	46.30	170900100101	WEST FORK DAIRY CREEK
380	02362A	US026	50.22	170900100102	WEST FORK DAIRY CREEK
381	02366	US026	54.55	170900100105	EAST FORK DAIRY CREEK
382	02367	US026	55.73	170900100105	WESTERN PACIFIC RAILROAD (VIDA)
383	02365	US026	57.85	170900100107	MCKAY CREEK
384	02285	US026	70.83	170900100503	OREGON STATE ROUTE 47 (SOUTH WEST CANYON ROAD)
385	09254D	US026	73.94	170900120302	CONECCTOR TO MARKET STREET AND I-405
386	02269	US026	116.57	170703060205	OREGON TRUNK RAILROAD
387	00921	US030	77.25	170800060204	GNAT CREEK
388	07417	US030	82.52	170800060201	BIG CREEK
389	05225A	US095	10.98	170501080602	COW CREEK
390	08893	US097	2.37	170701050101	SPANISH HOLLOW CREEK
391	08894	US097	2.48	170701050101	SPANISH HOLLOW CREEK
392	00815A	US097	75.04	170703070502	TROUT CREEK

393	08600	US097	90.11	170703060205	IRRIGATION CANAL
394	00971A	US097	92.11	170703060205	WILLOW CREEK
395	07768	US097	113.94	170703051101	OREGON TRUNK RAILROAD (TERREBONE)
396	01675B	US097	129.72	170703010702	PILOT BUTTE CANAL
397	08888	US097	136.46	170703010702	NORTH UNIT CANAL BRIDGE AND SWALLEY CANAL
398	07454	US097	183.16	170703020106	GILCRIST TIMBER ROAD
399	07929	US097	202.09	170703020501	UNION PACIFIC RAILROAD
400	06884	US097	243.98	180102010502	SPRING CREEK
401	06886	US097	247.54	180102010504	OREGON STATE ROUTE 78 (CHILOQUIN)
402	07302	US097	263.11	180102030207	BARKLEY SPRINGS IRRIGATION CANAL
403	07301	US097	265.65	180102030207	ALGOMA LOG POND
404	08352	US097	272.99	180102030207	UNION PACIFIC RAILROAD AND PELICAN CITY ROAD
405	08510	US097	273.68	180102030207	US BUREAU OF RECLAMATION CANAL AND NEVADA AVENUE CONNECTOR
406	08345	US097	273.71	180102030207	US BUREAU OF RECLAMATION CANAL
407	08346	US097	274.73	180102041202	CALIFORNIA AVENUE
408	08347A	US097	275.38	180102041202	LINK RIVER
409	09692	US097	275.75	180102041202	GREEN SPRINGS DRIVE OLD ALIGNMENT AND BERLINGTON NORTHERN RAILROAD
410	00922A	US101	114.88	171002040804	DEVILS LAKE OUTLET (D RIVER)
411	00924A	US101	118.17	171002040708	SCHOONER CREEK
412	00925A	US101	119.27	171002040707	DRIFT CREEK
413	01950	US101	234.76	171003040405	CENTRAL OREGON RAILROAD (NORTH BEND)
414	01108A	US199	32.10	171003110405	WEST FORK ILLINOIS RIVER
415	01107A	US199	34.28	171003110404	ROUGH & READY CREEK
416	01074A	US199	40.24	171003110402	ELK CREEK
417	08050	US395	5.77	170701030508	MCKAY CREEK
418	03558A	US395	7.25	170702010704	CANYON CREEK
419	02561	US395	15.27	170701030603	EEAST FORK BIRCH CREEK (PILOT ROCK)
420	03596	US395	42.95	171200020308	TROUT CREEK OVERFLOW
421	04728	US395	60.93	170702020609	CAMAS CREEK
422	04729	US395	63.81	170702020703	NORTH FORK JOHN DAY RIVER (DALE)
423	06204	US395	98.31	170702020901	SMITH CREEK
424	06205	US395	99.13	170702020901	FOX CREEK
425	03553A	US395	110.20	170702010903	BEECH CREEK (6TH XING)
426	09314	US395	188.84	170701030706	STANFIELD JUNCTION INTERCHANGE
427	09636	US395	207.47	170701030307	US ROUTE 30 OVERPASS (WEST PENDLETON INTERCHANGE)
428	04041		6.60	170900030109	BEAR CREEK
429	04056		29.78	170900030101	HAYES CREEK

430	04062		40.43	171002060101	SOUTH FORK SIUSLAW RIVER

[1] Program bridge record number
[2] ODOT bridge identification number
[3] Interstate Route (Interstate), U.S. route (US), or Oregon Route (OR)
[4] Milepost where bridge is located
[5] Sixth-field Hydrologic Unit Code
[5] Description of feature that the bridge is crossing and ODOT highway designation

APPENDIX B Preferred in-water work periods.

WATERWAY	PREFERRED WORK PERIOD[64]
Northwest Region	
North Coast Watershed	
Pacific	
Columbia	
Columbia River Estuary (Mouth to Tongue Pt.)	November 1 - February 28 *(MAR,SHL,CHF,CHS,SS,CO,STW,STS CT*)*
Youngs River	July 15 - September 30 *(CO,STW *)*
Young's Bay Tributaries	July 1 – September 15 (*CO,CT,STW*)
Wallooskee River	June 1 - September 30 *(CO,CT*)*
Other Columbia R. Est. Tribs. (Mouth to Tongue Pt.)	July 1 - September 15 *(CHF,STW*)*
Necanicum	
Necanicum River & tributaries	July 1 - September 15 *(CO,CHF,STW*)*
Necanicum and Neawanna Estuary	November 1-February 15 (*MAR,SHL,CO,CHF,STW*)
Ecola Creek and Tributaries	July 1-September 15 (*CO,CT,STW*)
Nehalem	
Nehalem Bay	November 1 - February 15 *(MAR,SHL,CHS,CHF,CO,STW,*)*
Lower Nehalem River (below Hwy 26)	July 1 - September 15 *(CHF*)*
N. Fk. Nehalem River	July 1 - September 15 *(CHF,STW*)*
Cook Creek	July 1 - September 15 *(CHF,STW*)*
Salmonberry River	August 15 - September 15 *(CHS,STW*)*
Other Lower Nehalem River Tributaries	July 1 - September 15 *(CHF,CO,STW*)*
Upper Nehalem River (above Hwy 26)	July 1 - August 31 *(CHS,STW*)*
Other North Coastal tributaries (Columbia R. to Nehalem)	July 1 – September 15 *(CO,CT*)*
Coastal Lakes	October 1-February 15 (*CT*)
Coastal Lake Tributaries	July 1- September 15 (*CT*)
Pacific	
Tillamook	
Tillamook Bay	November 1 - February 15 *(MAR,SHL,CHF,CHS,STW,CO,CS*)*
Miami,Kilchis,Wilson,Trask,Tillamook Rivers & Tribs.	July 1 - September 15 *(CHF,CHS,STW,CO,CS*)*
Other Tillamook Bay Tributaries	July 1 – September 15 (*CO,CT*)
Netarts Bay	November 1 - February 15 *(MAR,SHL,CHF,STW,CO,CS*)*

[64] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.

Sand Lake	November 1 - February 15 *(MAR,SHL,CHF,STW,CO,CS*)*
Nestucca	
Nestucca Bay	November 1 - February 15 *(MAR,SHL,CHF,CHS,STW,CO,CS*)*
Nestucca River & Tributaries	July 1 - September 15 *(CO,CHS,CHF,CS,STW*)*
Little Nestucca River & Tributaries	July 1 – September 15 (*CO,CHS,CHF,CS,STW*)
Neskowin Creek and Tributaries	July 1 - September 15 *(CO,CS,STW*)*
Other North Coastal Tributaries (Nehalem to Neskowin Cr.)	July 1 – September 15 (*CO,CT*)
Coastal Lakes	October 1 – February 15 (*CT*)
Coastal Lake Tributaries	July 1 – September 15 (*CT*)
Pacific	
Salmon	
Salmon River Estuary	November 1 - February 15 *(MAR,SHL*)*
Salmon River	July 1 - September 15 *(CHF,CO,CS,STW,CT*)*
Siletz	
Siletz Bay	November 1 - February 15 *(MAR,SHL*)*
Siletz River	July 1 - August 31 *(CHF,CHS,CO,CS,STW,STS,CT*)*
Yaquina	
Yaquina Bay	November 1 - February 15 *(MAR,SHL*)*
Yaquina River	July 1 - September 15 *(CHF,CO,STW,CT*)*
Alsea	
Alsea Bay	November 1 - February 15 *(MAR,SHL*)*
Alsea River	July 1 - August 31 *(CHF,CHS,CO,STW,CT*)*
Yachats River	July 1 - September 15 *(CHF,CO,STW,CT*)*
Siuslaw	
Siuslaw Bay	November 1 - February 15 *(MAR,SHL,CHF,CO,STW,CT*)*
Siuslaw River	July 1 - September 15 *(CHF,CO,STW,CT*)*
Other Coastal Tributaries	July 1 - September 15 *(CO,STW,CT*)*
Coastal Lakes	October 1 – February 15 (*STW,CO,CT*)
Coastal Lake Tributaries	July 1 – September 15 (STW,CO,CT)
North Willamette Watershed	
Columbia	
Columbia River (Big Creek to Bonneville Dam)	November 1 - February 28

	(CHF,CHS,CHR,SS,CO,CS,STW,STS, CTS)*
Columbia River (Within District above Bonneville Dam)	November 15 - March 15 *(CHF,CHS,CHR,SS,CO,CS,STW,STS, CTS*)*
Columbia R. Tribs. (Big Creek to St. Helens)	July 1 - September 15 *(CHF,STW*)*
Clatskanie River	July 15 - September 15 *(CHF,STW*)*
Willamette	
Multnomah Channel (including Scappoose Bay)	July 1 - October 31 & December 1 - January 31 *(CHF,CHS,CO,STW,STS,CT,WW *)*
Milton Cr. & Scappoose Cr.	July 15 - August 31 *(CO,STW,JUV,WW*)*
Willamette River (mouth to Willamette Falls)	July 1 - October 31 & December 1 - January 31 *(CHF,CHS,CO,STW,STS,CT,WW *)*
Columbia Slough	June 15 - September 15 *(JUV,WW)*
Johnson	
Johnson Creek (below Gresham)	June 1 - August 31 *(STW,CO,CT,CHF*)*
Johnson Creek (above Gresham)	July 15 - August 31 *(STW,CO,CT,CHF*)*
Johnson Cr. Tribs.	July 15 - August 31 *(CT,STW,CO*)*
Kellogg Creek	July 1 - September 30 *(STW,CO,CT*)*
Tryon Creek	July 15 - September 30 *(STW,CO,CT*)*
Clackamas River	July 15 - August 31 *(CHF,CHS,STW,CO,STS,CT*)*
Abernethy Creek	July 15 - September 30 *(CO,STW,CT*)*
Other Willamette River tribs	. July 1 – October 15 (*CT**)
Willamette River (Will. Falls to Newberg)	June 1 - October 31 & December 1 - January 31 *(CHS,STW*)*
Tualatin	
Tualatin River (below Scoggins Cr.)	June 1 - September 30 *(CO,STW,CT,WW*)*
Tualatin River (above Scoggins Cr.)	July 1 - September 30 *(CO,STW,CT,WW*)*
Tributaries	July 1 - September 30 *(CO,STW,CT,WW*)*
Beaver Creek	July 1 - September 30 *(CT*)*
Molalla/Pudding River	
Molalla River (below Molalla)	June 1 – September 30 *(STW,CT*)*
Other Molalla R. Tribs (below Molalla)	June 1 - September 30 *(CT*)*
Molalla River (above Molalla)	July 15 - August 31 *(CHS,STW,CT,RB*)*
N. Fk & M. Fk Molalla	July 15 - August 31 *(CHS,STW,CT,RB*)*
Other Molalla R. Tribs (above Molalla)	July 15 - September 30 *(STW,CT*)*
Pudding River	June 1 - September 15 *(CHS,STW,CT*)*

Butte Creek	July 15 - September 30 *(STW,CT*)*
Abiqua Creek	July 15 - August 31 *(CHS,STW,CT,RB*)*
Silver Creek	July 15 - September 30 *(STW,CT*)*
Other Pudding River Tributaries	June 1 - September 30 *(STW,CT,RB*)*
Other Willamette River tribs.	July 1 – October 15 *(CT*)*
Willamette River (Newberg to Yamhill River)	June 1 – September 30 *(CHS,STW,CT,RB*)*
Chehalem Creek	July 1 - October 15 *(CT*)*
Yamhill River	July 1 - October 15 *(STW,CT*)*
Other Willamette River tribs.	July 1 – October 15 *(CT*)*
Fairview Cr., Arata Cr., Salmon Cr.	June 15 - September 15 *(CT,WW*)*
Sandy River	July 15 - August 31 *(CHS,CHF,CO,STW*)*
Tanner Creek	July 15 - August 15 *(CHF,CHS,CO,STW*)*
Columbia River Tributaries (St. Helens to Sandy River)	July 15 - August 31 *(CHF,CO,STW,CT *)*
Columbia River Tributaries (Sandy River to Herman Cr.)	July 15 - August 31 *(CO,STW,STS,CT *)*
South Willamette Watershed	
Willamette	
Willamette River (Yamhill River to McKenzie River)	June 1 – September 30 *(CHS,STW,CT,RB*)*
Spring Valley Creek	July 1 - September 30 *(CT*)*
Glenn Creek	July 1 - September 30 *(CT*)*
Mill Creek	June 1 – September 30 *(STW,CT,RB*)*
Rickreall Creek	July 1 – September 30 *(STW,CT*)*
Luckiamute River	July 1 - September 30 *(STW,CT*)*
Santiam	
Santiam River	June 1 – September 30 *(STW,CT*)*
North Santiam River (below Big Cliff Dam)	July 15 - August 31 *(CHS,STW,CT,RB*)*
Stout Cr., Rock Cr., & Mad Cr.	July 15 - September 30 *(STW,CT,RB*)*
Lt. N. Fk. Santiam River	July 15 - August 31 *(CHS,STW,CT,RB*)*
Sinker, Elkhorn Cedar Creeks & tribs	July 15 - September 30 *(STW,CT,RB*)*
Other Tributaries	June 1 - September 30 *(CT*)*
Other Santiam River Tribs (below Big Cliff Dam)	June 1 - September 30 *(CT*)*
North Santiam River (above Detroit Dam)	June 1 - September 30 *(K,CT,RB*)*
Breitenbush River	June 1 - September 30 *(K,CT,RB*)*
South Santiam River (below Foster Dam)	June 1 - August 31 *(CHS,CT,RB*)*
Crabtree Cr., & Thomas Cr.	July 15 - August 31 *(CHS,STW,CT,RB*)*
McDowell Cr., Wiley Cr.	July 15 - September 30 *(STW,CT*)*
Other South Santiam R Tribs (below Foster Dam)	June 1 - September 30 *(CT*)*

WATERWAY	PREFERRED WORK PERIOD[65]
South Santiam River (above Foster Dam)	July 15 - August 31 *(CHS,STW,CT,RB*)*
Middle Santiam River & Quartzville Creek	June 1 - September 30 *(K,CT,RB*)*
Marys River	July 1 - September 30 *(CT*)*
Long Tom River	July 1 - September 30 *(CT*)*
Other West Bnk Will. R Tribs (Will Falls to McKenzie R)	July 1 - September 30 *(CT*)*
Calapooia	
Calapooia River (below Holley)	June 1 - September 30 *(CHS,STW,CT*)*
Calapooia River (above Holley)	July 15 - August 31 *(CHS,STW,CT,RB*)*
Other East Bank Will. R. Tribs. (Will. Falls to Harrisburg)	June 1 - September 30 *(CT*)*
Willamette	
Willamette River (above McKenzie River)	June 1 - October 31 *(CHS,RB*)*
McKenzie	
McKenzie River (below Blue River)	July 1 - August 31 *(CHS,STW,CT,RB*)*
Tribs. McKenzie River (below Blue River)	July 1 - October 15 *(CT,RB*)*
McKenzie River (above Blue River)	July 1 - August 15 *(CHS,BUT,CT,RB*)*
Middle Fork Willamette	
Middle Fork Willamette River (to Rattlesnake Cr)	July 1 - August 31 *(CHS,STW,CT,RB*)*
Middle Fork Willamette R. (Rattlesnake to Hills Cr. Res.)	By specific arrangement *(CHS,STW,CT,RB,OC*)*
Fall Creek	July 1 - August 31 *(CHS,STW,CT,RB*)*
Middle Fork Willamette River tributaries	July 1 - October 15 *(CT,RB*)*
Middle Fork Willamette River (above Hills Cr Reservoir)	July 1 - August 15 *(CHS,BUT,CT,RB*)*
Coast Fork Willamette	
Coast Fork Willamette River	June 1 - October 31 *(CHS,RB*)*
Row River (below Dorena Res.)	June 1 - October 31 *(CHS,RB*)*
Row River (above Dorena Res.)	July 1 - October 15 *(CT,RB*)*
Southwest Region	
Umpqua Watershed	
Pacific	
Umpqua River	
Umpqua Bay & Smith Est.	November 1 - January 31 *(MAR,SHL,CHS,CHF,CO,STW,STS,C T*)*
Umpqua River (Scottsburg and above)	July 1 - August 31 *(CHS,CHF,CO,STW,STS,CT*)*
Umpqua River Tribs.	July 1 - September 15 *(CHF,CO,STW,CT*)*

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North Umpqua	
North Umpqua River (below Soda Springs Dam)	By specific arrangement *(CHF,CHS,CO,STW,STS,CT*)*
Tribs. North Umpqua (below Soda Springs)	July 1 - September 15 *(CHS,CO,STW,STS,CT*)*
North Umpqua River *(*above Soda Springs Dam)	June 15 - October 15 *(RB,BT,BR*)*
South Umpqua	
South Umpqua River	July 1 - August 31*(CHF,CHS,CO,STW,CT*)*
South Umpqua Tribs.	July 1 - September 15 *(CHF,CO,STW,CT*)*
Pacific	
Coos	
Coos Bay and River (to Millicoma R./S. Coos R. confluence)	October 1 - February 15 *(MAR,SHL,JUV,CHF,CO,STW,CT *)*
Millicoma River, S. Coos R. and tribs.	July 1 – September 15 *(CHF,CO,STW,CT,MD*)*
Coquille	
Coquille River Estuary (Mouth to Bear Creek)	October 1 - February 15 *(MAR,SHL,JUV,CHF,CO,STW,CT *)*
Coquille River and tribs. (Bear Creek and above)	July 1 - September 15 *(CHF,CO,STW,CT*)*
Other Coastal Tributaries	July 1 – September 15 *(CHF,CO,STW,CT*)*
Coastal Lakes	October 1 – February 15 *(CO,STW,CT*)*
Coastal Lake Tributaries	July 1 - September 15 *(CO,STW,CT*)*
Rogue Watershed	
Pacific	
Sixes/Coastal Tributaries	
Estuaries (Floras Cr., Sixes R., below 101 bridge)	October 1 - May 31 *(JUV CHF*)*
Floras Creek	July 15 - September 30 *(CHF,CO,STW,CT*)*
Sixes River	July 15 - September 30 *(CHF,CO,STW,CT*)*
Elk	
Elk River Estuary (below 101 bridge)	October 1 - May 31 *(JUV CHF*)*
Elk River	July 15 - September 30 *(CHF,CO,STW,CT*)*
Euchre/Coastal Tributaries	
Euchre Creek Estuary	October 1 - May 31 *(JUV CHF*)*
Euchre Creek	July 15 - September 30 *(CHF,CO,STW,CT*)*
Hubbard Cr., Brush Cr., Mussel Cr.	July 15 - October 31 *(STW,CT*)*
Rogue River	
Rogue River Estuary	October 1 - May 31 *(JUV CHF*)*

Rogue River (below Marial)	May 1 - September 30 *(CHF*)*
Rogue River Tributaries (below Marial)	July 15 - September 30 *(CHF,STW,CT*)*
Hunter	
Hunter Creek Estuary	October 1 - May 31 *(JUV CHF*)*
Hunter Creek	July 15 - September 30 *(CHF,STW,CT*)*
Pistol/Coastal Tributaries	
Pistol River Estuary	October 1 - May 31 *(JUV CHF*)*
Pistol River	July 15 - September 30 *(CHF,STW,CT*)*
Chetco/Coastal Tributaries	
Chetco River Estuary	October 1 - May 31 *(JUV CHF*)*
Chetco River	July 15 - September 30*(CHF,STW,CT*)*
Meyers Cr., Thomas Cr., & Whalehead Cr.	July 15 - October 31 *(STW,CT*)*
Winchuck	
Winchuck River Estuary	October 1 - May 31 *(JUV CHF*)*
Winchuck River	July 15 - September 30 *(CHF,STW,CT*)*
Other Coastal Tributaries	July 15 - October 31 *(CT*)*
Rogue	
Rogue River (above Marial)	June 15 - August 31 *(CHS,STW*)*
Illinois River	June 15 - September 15 *(CHF,STW*)*
Applegate River	July 1 - September 15 *(CHF,STW*)*
Other Rogue River Tributaries (above Marial).	June 15 - September 15 *(CHS,STW*)*
Rogue River (above Lost Cr.)	June 15 - September 15 *(BT,CT*)*
High Desert Region	
Deschutes Watershed	
Columbia	
Columbia River (Within District Bonneville to John Day Dam)	November 15 - March 15 *(CHF,CHS,SS,CO,STW,STS*)*
Columbia River Tributaries	July 1 - September 30 *(STW,CO,RB*)*
Fifteenmile Creek	July 1 - October 31 *(STW,RB*)*
Hood River	
Hood River	July 15 - August 31 *(CHF,CHS,CO,STS,STW*)*
East Fork Hood River & Tribs.	July 15 – August 31 *(CHF,CO,STS,STW*)*
Middle Fork Hood River & Tribs.	July 15 – August 15 *(STW,CHS,BUT*)*
West Fork Hood River & Tribs.	July 15 – August 15 *(CHS,STS,STW*)*
Deschutes	
Deschutes River (below Pelton Dam)	February 1 - March 15 *(CHF,STS,RB*)*
White River	July 1 - October 31 *(RB*)*
Buckhollow Cr.	July 1 - October 31 *(STS,RB*)*
Bakeoven Cr.	July 1 - October 31 *(STS,RB*)*
Trout Cr.	July 1 - October 31 *(STS,RB*)*
Deschutes	
Metolius	
Metolius River	by specific arrangement *(K,RB,BR,BUT*)*
Spring Creek	July 1 - September 30 *(K,RB*)*

Lake Creek	July 1 - September 30 *(K,RB,BR*)*
Deschutes River (Pelton Dam through Lake Billy Chinook)	July 1 - September 30 *(RB,BR*)*
Crooked River	
Crooked River (below Prineville Dam)	July 1 - October 31 *(RT*)*
Prineville Reservoir	July 1 - October 31 *(RT*)*
Crooked River (above Prineville Dam)	July 1 - October 31 *(RT*)*
N.Fk. Crooked River (above Big Summit Prairie)	July 1 - September 30 *(RT*)*
Deschutes River (Lake Billy Chinook to Bend)	July 1 - September 30 *(RB,BR,BUT,K*)*
Squaw Creek	July 1 - October 15 *(RB,BR,BUT*)*
Tumalo	July 1 - October 15 *(RB,BR*)*
Deschutes River (Bend-North Canal Dam to Benham Falls)	July 1 - October 15 *(RB,BR*)*
Deschutes River (Benham Falls to Wickiup Dam)	July 1 - October 15 *(RB,BR*)*
Little Deschutes River	July 1 - October 15 *(RB,BR*)*
Fall River	July 1 - October 15 *(RB,BR*)*
Deschutes River (Wickiup Reservoir to Crane Prairie Dam)	July 1 - August 31 *(RB,BR,K *)*
Deschutes River (Crane Prairie Reservoir to Little Lava Lake)	July 1 - August 31 *(RB,BT,K*)*
Klamath Watershed	
Klamath	
Klamath River (below Keno)	July 1 - March 31 *(RB*)*
Cottonwood Creek	June 15 – September 15 (*STW**)
Jenny Creek	July 1 – January 31 (*SCRT,JCS**)
Klamath River (above Keno)	July 1 – February 1 *(SNS,BCHUB,RB*)*
Lost River above Bonanza	July 1 – February 1 (*RT,SNS*)
Lost River below Bonanza	July 1 - March 31 *(RT*)*
Williamson River	August 1 - September 30 *(RB,BT,BR,RT,SNS,LRS,KLS*)*
Sprague River	August 1 - September 30 *(BUT,LRS,SNS,RB,BT,BR *)*
Sycan River	August 1 - September 30 *(RB,BT,BR,BUT,LRS,SNS*)*
Wood River	August 1 - September 30 *(RB,BR,BUT,SNS*)*
Sevenmile Creek	August 1 - September 30 *(RB,BR*)*
Klamath Lake and Agency Lake	July 1 - January 31 *(RB,LRS,SNS,BCHUB*)*
Silver Lake tributaries	July 1 - September 15 *(RT,BT*)*
Summer Lake	July 1 - September 15 *(*)*
Chewaucan River	July 1 - September 15 *(RT*)*
Goose Lake tributaries	July 1 - September 15

	(GRT,GLAM,GSUC,GCB,PRCH,PSCL)*
Warner Valley tributaries	July 1 - September 15 *(WSUC,FD*)*
Malheur Watershed	
Columbia	
Snake	
Snake River (Malhuer County)	Open
Malheur	
Malheur River (below Namorf Dam)	Open
Willow Cr. (below Brogan Cyn.)	Open
Willow Cr. (above Brogan Cyn)	October 1 - March 31 *(RB,RT*)*
Cottonwood, Cr., Squaw Cr.	October 1 - March 31 *(RB,RT*)*
Other Tributaries	October 1 - March 31 *(RB,RT*)*
Malheur River (Namorf Dam to Dreswsey Valley)	November 1 - March 31 *(RT*)*
North Fork Malheur (mouth to Beulah Res.)	November 1 - March 31 *(RT,RB*)*
North Fork Malheur (above Beulah Res.)	July 1 - August 31 *(BUT,RT,BT*)*
South Fork Malheur	October 1 - March 31 *(RT*)*
Malheur River (above Drewsey Valley)	July 1 - August 31 *(BUT,RT,BT*)*
Owyhee River	
Owyhee River (below dam)	November 1 - March 31 *(RB,BT*)*
Owyhee River (above dam)	October 1 - March 31 *(RB,RT*)*
Succor Creek	October 1 - March 31 *(RT*)*
Silvies River (above 5mi dam)	October 1 - March 31 *(RT,*)*
Silver Creek (above Hwy 45)	October 1 - March 31 *(RT*)*
Donner Blitzen River (Steen Mtns)	October 1 - March 31 *(RT*)*
Alvord Basin	October 1 - March 31 *(LCT,AC*)*
Catlow Valley tributaries	October 1 - March 31 *(LCT,CTC,RT*)*
Trout Creek Mountains streams	October 1 - March 31 *(LCT,AC,RB,CT*)*
Quinn River	October 1 - March 31 *(LCT,RB,CT*)*
Northeast Region	
John Day Watershed	
Columbia River	
Lower John Day	
John Day River (below John Day)	July 15 - August 31 *(STS,RT*)*
Rock Creek	
Rock Creek (Gilliam Co.)	July 15 - September 30 *(STS,RT*)*
North Fork John Day	
North Fork John Day River (below U.S. 395)	July 15 - August 31 *(STS,RT*)*
Middle Fork John Day	
Middle Fork John Day River (below US 395)	July 15 - August 31 *(STS,RT*)*
Middle Fork John Day River (above US	July 15 - August 15 *(CHS,STS,RT,BUT*)*

395)	
North Fork John Day River (above U.S. 395)	July 15 - August 15 *(CHS,STS,BUT*)*
Upper John Day	
South Fork John Day River	
South Fork John Day River	July 15 - August 31 *(STS,RT*)*
John Day River (above John Day)	July 15 - August 15 *(CHS,STS,BUT,RT,CT*)*
Canyon Creek	July 15 - August 31 *(STS,RB,CT*)*
Columbia	
Columbia River (John Day Dam upstream)	December 1 - March 31 *(CHF,CHS,SS,CO,STS*)*
Willow Creek	July 1 - December 31 *(RT*)*
Umatilla	
Umatilla River (below Pendleton)	July 15 - October 15 *(CHF,CHS,CO,STS*)*
Butter Creek July 1 - December 31 *(RT*)*	
Umatilla River (above Pendleton)	July 1 - August 15 *(CHS,CHF,STS,RT*)*
Birch Creek	July 1 - October 31 *(STS,RT*)*
McKay Creek	
McKay Creek (below reservoir)	November 1 - March 31 *(CHF,CHS,CO,STS*)*
McKay Creek (above reservoir)	July 1 - December 31 *(RT*)*
Wildhorse Creek	July 1 - October 31 *(CHF,CHS,CO,STS,RT*)*
Meacham Creek	July 1 - August 15 *(CHS,STS,RT,BUT*)*
Walla Walla	
Walla Walla River (below Harris Park)	July 1 - October 31 *(STS,RT,BUT*)*
Mill Creek	July 1 - October 31 *(STS,RT,BUT*)*
Walla Walla River (above Harris Park)	July 1 - August 15 *(STS,RT,BUT*)*
Grande Ronde Watershed	
Columbia	
Snake River (state line to Hells Canyon Dam)	July 1 - October 15 *(CHF,CHS,SS,STS*)*
Grande Ronde	
Grande Ronde River (below Wallowa River)	July 1 - September 15 *(CHF,STS*)*
Wenaha River	July 1 - August 15 *(CHS,STS,BUT*)*
Joseph Creek	July 1 - March 31 *(STS*)*
Wallowa River	July 15 - August 15 *(CHS,STS,RB,BT,BUT *)*
Imnaha River (above Big Sheep Creek)	July 15 - August 15 *(CHS,STS,BUT*)*
Imnaha River (below Big Sheep Creek)	July 1 – October 15 *(CHF,STS*)*
Columbia	
Snake	
Grande Ronde	
Grande Ronde River (Wallowa River to Hwy 244 Br.)	July 1 - October 15 *(CHS,STS,RB,BUT*)*

Minam River	July 1 – August 15 (*CHS,STS,RB,BUT**)
Lookingglass Creek	July 1 - August 15 *(CHS,STS,RB,BUT*)*
Catherine Creek	
Catherine Cr. (to and including Little Cr.)	July 1 - October 15 *(CHS,STS,RB,BUT*)*
Catherine Creek (above Little Creek)	July 1 – August 15 *(CHS,STS,RB,BUT*)*
Grande Ronde River (above highway 244 bridge)	July 1 - July 31 *(CHS,STS,RB,BUT*)*
Snake River Reservoir	July 1 - November 30 *(WW*)*
Snake River Reservoir Tributaries	July 1 - October 31 *(RB*)*
Burnt River	July 1 - October 31 *(RB,BT*)*
Pine Creek	July 1 – August 31 *(RB,BUT *)*
Powder River (mouth to Phillips Reservoir)	July 1 - October 31 *(RB*)*
Anthony Creek	July 1 – August 31 (*RB,BUT**)
North Powder R. (above Dutch Flat Cr.)	July 1 – August 31 (*RB,BUT**)
Wolf Creek (above Wolf Creek Res.)	July 1 – August 31 (*RB,BUT**)
Big Muddy Creek (above Foothill Rd.)	July 1 – August 31 (*RB,BUT**)
Pine Creek (above North Fork Pine Cr.)	July 1 – August 31 (*RB,BUT**)
Salmon Creek (above Pocahontas Road)	July 1 – August 31 (*RB,BUT**)
Powder River (above Phillips Reservoir)	July 1 – August 31 (*RB,BUT**)
Deer Creek (above Phillips Reservoir)	July 1 – August 31 (*RB,BUT**)

*Coded fish species defined below provide the primary basis for timing guidelines. The species list should be considered general information and is not necessarily comprehensive nor accurate.

AC - Alford chub	K - kokanee
BCHUB – blue chub	KLS – Klamath largescale sucker
BR - brown trout	LCT - Lahontan cutthroat trout
BT - brook trout	LRS – Lost River sucker
BUT - bull trout	MAR - various marine species of fish
CR - Crappie	MD – Millicoma Dace
CHF - chinook salmon, fall	MMS - Malheur mottled sculpin
CHR - chinook salmon, summer	PRCH - pit roach
CHS - chinook salmon, spring	PSCL - pit sculpin
CO - coho salmon	RB - rainbow trout

CS - chum salmon	RT - red band trout
CT - cutthroat trout (includes sea run)	SHL - various marine shell fish
CTC - Catlow tui chub	SNS shortnose sucker
GCB - goose lake chub	SS - sockeye salmon
GLAM - goose lake lamprey	STS - steelhead summer
GSUC - goose lake sucker	STW - steelhead winter
JCRT – Jenny Creek red band trout	WW - various warm water game fish
JCS – Jenny Creek sucker	
JUV - juvenile salmonids	

APPENDIX C Environmental baseline supporting documentation.

Ecoregion Context
Oregon comprises ten ecoregions, each of which contains multiple habitat types. Ecoregions are relatively uniform geographic areas that respond in a similar manner to physical activities (i.e., rainfall, fire, human land use activities, etc.) (SOER 2000). These ecoregions are based on similarity of important environmental variables such as climate, geology, physiography, vegetation, soils, land use, wildlife, and hydrology. The ecoregion descriptions provide an overview to the current conditions of the regional environment.

The ecoregions used in this analysis were the EPA Level III ecoregion descriptions used by the State of the Environment Report (SOER) Science Panel in the Oregon State of the Environment Report (SOER 2000), the EPA Level IV ecoregion descriptions used in the Oregon Watershed Enhancement Board's Oregon Watershed Assessment Manual (Watershed Professionals Network 2001), and the ODFW and Oregon Natural Resources Heritage Program Level III ecoregion characterizations of patterns within a watershed (Bryce and Woods 2000). Because watersheds within an ecoregion have common attributes, the ecoregion descriptions assist with the effects analysis. Table 1 provides the acreage of the various habitat types within each ecoregion.

<u>Basin & Range.</u> The Basin and Range ecoregion includes a large portion of southeastern Oregon and is the least populated area of the State (SOER 2000). This ecoregion is Oregon's high desert, and contains numerous flat basins separated by isolated, generally north-south mountain ranges. Malheur Lake is the major drainage basin in this arid ecoregion (Watershed Professionals Network 2001). Runoff from precipitation and mountain snowpacks and basins often flows into flat, alkaline playas, where it forms seasonal shallow lakes and marshes (Bryce and Woods 2000). In addition, the terrestrial landscape is open and treeless, plants are widely spaced, and soils are exposed to the elements. The Basin and Range ecoregion contains many diverse habitats.

The most significant are the sagebrush (*Artemisia* spp.) steppe types, salt desert scrub (Bryce and Woods 2000), and riparian and wetland types, as well as mountain mahogany (*Cercocarpus* spp.) and aspen (Populus spp.) woodlands (SOER 2000).

Many of the major wetland complexes within this arid ecoregion are managed for waterfowl production by State, Federal, or private agencies, although most wetlands are privately owned (SOER 2000). The large wildlife refuges here support some of the largest populations of pronghorn antelope, white pelicans, and sage waterfowl, and are well known for their wildlife diversity (Bryce and Woods 2000). Flooding and drying now occur sooner in the year than they did historically. Historically, playa lakes were wet during winter and spring, and then dried as summer approached. Some playa lakes have been altered for livestock watering, and in drier years water is concentrated in deep pools, thus affecting a smaller area (SOER 2000).

Water is the limiting factor in this ecoregion. Declines in riparian condition and water quality occurred during the heavy grazing early in the 20th century. Stream water quality here is the lowest in the State, generally measured as poor or very poor. The trend in water quality shows no improvement, although in some areas, primarily fenced enclosures, riparian conditions have dramatically improved. Surface water is fully allocated. Much of the water is dammed, and releases from dams keep instream flows close to the required minimums (SOER 2000).

Many of the region's historical wetlands and riparian areas have been converted to agriculture or have been degraded through water diversions and grazing. The region has been heavily affected by grazing pressure, which affects different parts of the landscape in different ways. Improper grazing is particularly destructive in wetland and riparian areas. More than 145 species depend on tall sagebrush-bunchgrass communities. In other places, fire suppression has increased the relative density of sagebrush while diminishing bunchgrasses, which has negatively affected many native species. An additional threat to ecological integrity in upland areas as well as in wetland and riparian areas is the encroachment of invasive plant species (SOER 2000).

Blue Mountains. The Blue Mountains ecoregion occupies most of northeastern Oregon and encompasses three major ranges: the Ochoco, Blue, and Wallowa Mountains. Deep, rock-walled canyons, glacially cut gorges, dissected plateaus, and broad alluvial river valleys characterize the landscape. Extreme changes in elevation across the ecoregion result in a broad range of temperature and precipitation, supporting habitat diversity second only to the Klamath Mountains ecoregion (SOER 2000).

Vegetation in the lowland areas consists of bunchgrasses, sagebrush, and juniper (*Juniperus* spp.) (Bryce and Woods 2000). Ponderosa pine (*Pinus ponderosa*) and juniper woodlands are characteristic of mid-elevation areas, with mixed coniferous forests dominating higher altitudes and north- facing slopes at mid-elevations. Extensive grasslands occur in and north of the Wallowa Mountains (SOER 2000).

Table 1. Total acreage of Johnson and O'Neil habitat type within each ecoregion.

Habitat Type	Acreage of Habitat Type within Each Ecoregion									
	Basin and Range	**Blue Mountains**	**Coast Range**	**Columbia Basin**	**East Cascades Slopes and Foothills**	**Klamath Mountains**	**High Lava Plains**	**Owyhee Uplands**	**West Cascade Mountains**	**Willamette Valley**
Agriculture, Pasture, and Mixed Environments	250,430	550,910	164,950	1,740,960	459,780	609,980	299,810	250,250	83,900	1,779,280
Alpine Grasslands and Shrublands	1,180	214,120	0	0	8,920	960	0	0	66,250	0
Bays and Estuaries	0	0	22,450	0	0	0	0	0	860	8,940
Ceanothus-Manzanita Shrublands	0	0	0	0	2,970	48,530	0	0	590	0
Coastal Dunes & Beaches	0	0	42,710	0	0	0	0	0	0	0
Coastal Headlands & Islets	0	0	8,460	0	0	0	0	0	0	0
Desert Playa & Salt Scrub	707,880	0	0	0	90	0	0	11,370	0	0
Dwarf Shrub-steppe	408,120	110	0	0	61,090	0	21,700	22,760	0	0
Eastside (Interior) Canyon Shrublands	0	0	0	239,970	0	0	7570	110,600	0	0
Eastside (Interior) Grasslands	0	1,366,980	12,180	497,510	45,090	0	5,530	0	0	0

Table 1. (continued)

Habitat Type	Acreage of Habitat Type within Each Ecoregion									
	Basin and Range	Blue Mountains	Coast Range	Columbia Basin	East Cascades Slopes and Foothills	Klamath Mountains	High Lava Plains	Owyhee Uplands	West Cascade Mountains	Willamette Valley
Eastside (Interior) Mixed Conifer Forest	3,630	3,038,490	0	4,990	905,830	0	42,280	0	131,220	0
Eastside (Interior) Riparian-Wetlands	21,280	560	0	4,410	200	0	870	3,550	0	0
Herbaceous Wetlands	397,240	1,273,780	59,040	4,980	329,230	4,860	36,030	50,650	9,270	10,780
Lakes, Rivers, Ponds, & Reservoirs	322,520	25,050	24,800	13,540	158,690	16,080	14,540	36,280	76,550	44,050
Lodgepole Pine Forest and Woodlands	20	2,260	0	0	507,590	0	0	0	22,340	0
Marine Nearshore	0	0	3,610	0	0	0	0	0	0	0
Montane Coniferous Wetlands	0	5,400	0	0	41,350	90	130	0	8,930	190
Montane Mixed Conifer Forest	280	485,720	0	0	190,740	39,710	0	0	2,234,840	0
Ponderosa Pine and Eastside White Oak Forest and Woodlands	13,790	2,890,730	0	37,820	2,919,020	79,220	213,630	10	72,420	0
Shrub-steppe	7,093,000	1,986,120	0	1,641,770	457,950	0	1,327,670	4,911,800	0	0

Table 1. (continued)

Habitat Type	Acreage of Habitat Type within Each Ecoregion									
	Basin and Range	Blue Mountains	Coast Range	Columbia Basin	East Cascades Slopes and Foothills	Klamath Mountains	High Lava Plains	Owyhee Uplands	West Cascade Mountains	Willamette Valley
Southwest Oregon Mixed Conifer-Hardwood Forest	0	0	369,470	0	3,580	2,649,320	0	0	989,560	8,240
Subalpine Parklands	4600	0	0	0	7,380	5,650	0	0	66,570	0
Upland Aspen Forest	19,480	210	0	0	0	0	0	0	0	0
Urban and Mixed Environments	3,190	16,270	57,810	29,340	22,570	42,170	20,560	6,030	5,960	366,010
Western Juniper and Mountain Mahogany Woodlands	555,940	471,600	0	72,190	642,080	0	2,178,37 0	116,900	110	0
Westside Lowland Conifer-Hardwood Forest	0	0	4,961,680	0	10,720	256,560	0	0	3,324,250	785,870
Westside Oak and Dry Douglas-fir Forest and Woodlands	0	0	1,430	0	5,890	106,060	0	0	46,290	273,150
Westside Riparian - Wetlands	0	0	29,070	0	0	6,270	0	0	2,470	120,290
Total Acreage in Ecoregion	9,802,580	11,181,910	5,757,660	4,287,480	6,780,760	3,865,460	4,168,.69 0	5,520,200	7,142,380	3,396,800

Riparian areas in valley bottoms are important for aquatic and terrestrial organisms in arid landscapes where streamside vegetation provides shade and refuge. Riparian areas are among the most diverse natural communities in the region, largely concentrated in intermountain basins (SOER 2000). These seasonally flooded wet meadows provide important habitat; the largest remaining blocks of these wetlands, almost all on private lands, are found at Big Summit Prairie, along the upper Silvies River, and in Logan Valley (Watershed Professionals Network 2001).

The diversity of the Blue Mountains landscape provides goods and services long valued by the people of the region. Most of the uplands in the region are federally owned forest and rangeland. Private land generally follows valleys and water courses, where most of the region's agriculture occurs; however, several parcels of privately-owned timber in uplands are present (SOER 2000).

The large, central valleys of the Grande Ronde and Powder Rivers historically contained native riparian forests, wetlands, and grasslands that have been primarily converted to agriculture. Most stream reaches have been simplified by channelization and straightening. Riparian conditions are degraded throughout the region, particularly in the middle and lower reaches of large river valleys such as the Grande Ronde and Umatilla (SOER 2000, OWEB 2001).

Four activities have had profound effects on the landscape of the region: timber harvest, fire suppression, grazing, and agriculture. Fire suppression, in concert with timber harvest, has changed the structure and function of the region's forests; it has also allowed a dense build-up of young trees, creating more biomass than can be supported through times of drought. These dense, over-stocked forests are far more vulnerable to fire and insects (SOER 2000).

Virtually all of the Grande Ronde Valley's historical wetlands have been drained and converted to agriculture. Many wetland sites have been affected, at least temporarily, by water flow alterations as well as by increased sediment and nutrients from agricultural and other activities (SOER 2000). Much of the ecoregion is within a complex of aquatic diversity areas identified by the American Fisheries Society. Much of this complex lies in Federal wilderness areas (SOER 2000, OWEB 2001).

In coordination with regional planning efforts, complex plans for total maximum daily loads of non-point sources of pollution are being developed for stream segments with limited water quality, as identified by the Clean Water Act 303(d) list. Many of the low-lying streams in this ecoregion are listed, primarily as a result of high stream temperatures during the summer. Upland water is of relatively high quality and the conditions of upstream fish habitats are improving (SOER 2000).

Coast Range. The Coast Range ecoregion extends the entire length of the Oregon coastline as a narrow, jumbled mountain range from the edge of the Pacific Ocean to the Willamette Valley and Klamath Mountains. Along the north coast, cliffs and grassy headlands are separated by stretches of flat coastal plain and estuaries. A broad coastal terrace characterizes much of the south coast, punctuated by steep headlands, inland lakes, and rocky offshore islands (SOER 2000). The region's marine climate causes the wettest habitats in the State, including temperate rainforests, which are some of the most productive forests in the world (SOER 2000).

Much of the commercial and residential development in the region is clustered along 101 and around the larger estuaries and streamside riparian areas. The coastal economies are distinctly different from north to south. The northern counties are evolving from a dependence on fishing and timber to a reliance on tourism and retirement. To the south, the coastal economy has been more dependent on the forest products industry (SOER 2000).

Oregon's 22 estuaries are ecological transition zones, integrating features of the watersheds they drain with those of the marine environment. Although protection currently exists, most Oregon estuaries are dramatically smaller than they were historically—mostly, as a result of the conversion of tidal wetlands to diked and drained pastures in the early 1900s, followed by the filling of bayfront lands for urban and port development. In addition, the construction of jetties has disrupted the natural movement of sand along the coast, burying some areas and eroding others. Further inland, residential development has significantly reduced riparian vegetation along streams (SOER 2000).

Streams in the Coast Range are relatively free-flowing, are heavily relied upon by the fishing industry and summer tourism, and are important sources of drinking water. Coastal streams have been disrupted by logging practices. The density of streams in the Coast Range is among the highest in the State; therefore, a high percentage of the landscape falls within riparian buffers. As a result, timber harvests throughout the region have had adverse effects on aquatic organisms such as coho salmon. Removal of large conifers and erosion from logging are the most significant past human effects on riparian areas in the Coast Range (SOER 2000).

Past logging patterns led to dense forests with a high percentage of early successional stages consisting of young trees (less than 40 years old). However, modern logging and silvicultural practices (under the guidance and implementation of new Forest Practice Rules) have greatly minimized effects from recent logging operations. Historically, large fires left a complex matrix of large trees, snags, and downed wood, which provided a diversity of habitats for fish and wildlife. Modern commercial forest management encourages diversity, though not to the same extent as wildfires in unmanaged landscapes.

Almost 40 percent of the ecoregion is publicly owned, primarily as State and Federal forests. Much of the balance is private timberland, interspersed with the public forest. Timber harvest in the late 1990s was about two-thirds of the levels of the late 1980s, due to a major reduction of harvest on Federal lands. About half of Oregon's future timber harvest is projected to come from this ecoregion (SOER 2000).

The lowland rivers and wetlands have been altered by agriculture and development more than the forested portions of the ecoregion have. Acquisition of coastal wetlands by private land conservancies and State and Federal fish and wildlife agencies have protected some high quality wetlands and restored many acres of degraded wetlands (SOER 2000).

Columbia Basin. The Columbia Basin ecoregion is semi-arid, with cold winters and hot summers. Farther from the Columbia River, annual precipitation decreases and soil changes from sandy deposits to windblown silts. Most of the ecoregion receives less than 15 inches (38 centimeter) of precipitation per year, mostly in the form of snow.

Much of the ecoregion's natural vegetation is native bunchgrass prairie. Sandy deposits along the big bend of the Columbia River have created open dunes and areas of shrub-steppe and western juniper. The rivers were once lined with intermountain riparian vegetation, such as black cottonwood (*Populus trichocarpa*), willows, chokecherry (*Prunus* spp.), and aspen, and wetlands were located throughout the plateau. Fire was a natural component of this ecoregion, though the fire recurrence interval is not as clear as in other ecoregions.

The ecoregion has undergone extensive changes over the last 150 years; it is second only to the Willamette Valley in the extent of landscape change. It consists largely of privately-owned agricultural and range land, with over 85 percent of the former sagebrush steppe, grassland, and riparian communities converted to dry land wheat or irrigated agriculture. Only marginal lands that cannot be farmed, such as the steep canyon grasslands and scablands, retain a semblance of native vegetation. Protected areas and publicly owned lands are very limited in this region.

In the conversion to farmland, much of the natural function of the landscape has been lost. Bottomland forests and wetlands have been replaced by irrigated agriculture and rural residential development. Changes in the upland have occurred as sagebrush steppe has been reduced by over 85 percent. Invasive plant species are a major threat to native habitats as well as to the productivity of farmlands and pastures.

Dam construction and subsequent inundation has degraded riparian resource conditions along the Columbia River and confluences. Lake habitats have largely replaced riparian and floodplain wetlands. Large rivers such as the Umatilla River have decreased riparian function and water quality.

East Cascades Slope and Foothills Ecoregion. The East Cascades ecoregion is geologically young, with lava flows, volcanic vents, and a mantle of pumice soil. Ponderosa pine forests predominate, with extensive stands of lodgepole pine (*Pinus contorta*) on deep Mazama ash. The ecoregion is a transition zone that extends from below the crest of the Cascade Range east to where the pine forests intersect with sagebrush-juniper steppe. The northern two-thirds of the East Cascades ecoregion is drained by the Deschutes River system, which includes a series of large lakes and reservoirs near its headwaters high in the Cascade Mountains. The southern third is drained by the Klamath River, which rises from a vast interior wetland before it flows south and west into California. Forests, mostly federally owned, cover most of the region's uplands, with privately-owned agricultural land in the valleys.

The Deschutes River watershed spreads across several ecoregions, with headwaters to the east in the Blue Mountains and to the west in the high Cascades. Several dams have been constructed on the Deschutes River. This has affected flow and sediment, which have influenced the establishment and natural succession of riparian vegetation throughout the downstream river course. Riparian areas have been further altered by dredging, dikes, and flood control activities. Today, all major river systems in the region are dammed, and many of these dams provide no fish passage. Agricultural practices and related water delivery systems remain a significant threat to the recovery of aquatic health in the southern part of the region.

The contrasts of this ecoregion are reflected in its water quality. Clean, cold water flows from perennial springs along the east slope into streams such as the Metolius River and the Little Deschutes, which have some of the highest quality water in the State. The low-lying Klamath Basin, in contrast, has sites such as Klamath Strait and Lost River with some of the poorest water quality in the State. Several of these streams have been placed on the 303(d) list as a result of high temperatures in summer, total dissolved gas, habitat modification, flow modification, pH, sedimentation, turbidity, bacteria, and dissolved oxygen.

Enormous efforts were made in the 1900s to drain vast acreage of wetlands in the Klamath Basin. As a result, the great shallow lake and marsh systems of the upper Klamath Basin have been reduced by an estimated 75 percent. Reductions in riparian vegetation and associated wetlands have contributed to nutrient loading in the rivers and lakes of the region by decreasing the potential for nutrient filtration and uptake in streamside areas. Similarly, riparian areas throughout the Klamath basin have been highly altered and in many cases eliminated by agricultural activities.

Activities affecting key resource systems in this region include changes in the fire regime, alterations of rivers, streams, and wetlands, and rapid urban development.

Klamath Mountains. Douglas-fir forests, oak woodlands, and ponderosa pine woodlands. Many of these plant communities have changed significantly since fire suppression was widely instituted in the early 20th century, although the plant communities of the Klamath Mountains continue to be among the most diverse in the world. There are pockets of plant communities that occur nowhere else, endemic to a particular condition of the climate or soil type. Of the 4,000 kinds of native plants found in Oregon, about half are found in this ecoregion, and about a quarter of these are found only here.

Nearly a century of fire suppression has dramatically altered the ecology of the forests, savannas, and shrublands in this region. The steep terrain makes the Klamath Mountain ecoregion particularly susceptible to landslides and debris flows, especially in extensively logged basins. Relatively few large conifers remain in the active flood plain, although historic evidence shows that conifers were once abundant in low gradient valley bottoms and were selectively logged in the 1950s and 1960s.

Today the rate of population growth in this region is second only to the Willamette Valley. Most of the population is concentrated in the valleys along Interstate 5, but rapid population growth in the southern and eastern parts of the ecoregion has brought new pressures to the landscape, particularly to the rural areas along rivers such as the Rogue, Umpqua, and Applegate, which were already affected by past development activities. Industrial and rural residential developments are the major threats to ecological health.

High Lava Plains. The High Lava Plains ecoregion is located in the dry foothills that surround the western perimeter of the Blue Mountains, and separates the north-central Blue Mountains from the southern Blue Mountains and Ochoco Mountains. The drainage basins in this ecoregion are the John Day, the Goose and Summer Lakes, the Malheur Lakes, and the Deschutes. The land use in this ecoregion is primarily irrigated pasture, grazing, and recreation.

The geology here is ash beds and the eroded remnants of a mountain chain. The erosion rate is high in ash-dominated areas; most erosion occurs during high intensity runoff events during snow melt periods or during thunderstorms. This ecoregion consists of highly dissected hills, palisades, and ash beds. The steep-sided canyons of the John Day and Crooked Rivers cut deeply through the surrounding terrain. Streams have low to moderate gradient, and the main rivers originate within surrounding ecoregions that have more rain and snow.

This ecoregion has a continental climate with low precipitation (mean annual precipitation is 10 to 20 in [25 to 50 cm]) and wide temperature extremes. This climate is moderated by a marine influence spreading southward from the Columbia River Gorge and eastward through the low passes of the Cascade Mountain range. The marine influence brings more moisture into the region and causes less extreme temperature fluctuations than in other parts of the Blue Mountains. Precipitation falls primarily as rain during the spring and fall months and as light snow in the winter months; most precipitation occurs in the winter months of November, December, and January. Shallow snowpacks can accumulate at higher elevations.

The most frequent natural disturbance in this ecoregion is fire. Fire suppression and grazing have caused an increase in juniper abundance and a decline in grass abundance. The native upland vegetation includes juniper, bluebunch wheatgrass (*Pseudoroegnria spicata*), and Idaho fescue (*Festuca idahoensis*), and the native riparian vegetation includes hardwoods (cottonwood and alder) and shrubs (willows, Douglas spirea [*Spirea douglasii*] and common snowberry [*Symphoricarpos albus*]). Ponderosa pine and juniper are found infrequently in the riparian areas.

Owyhee Uplands. The Owyhee Uplands ecoregion is located in the southeastern section of Oregon. This ecoregion is similar to the adjacent Basin and Range ecoregion in vegetation; however, it differs markedly in terrain, as the landscape is basically a broad, undulating plateau cut by deep riverine canyons. The Owyhee River and the lower basin of the Malheur River generally drain north through these canyons and to the Snake River Basin located at the border of Oregon and Idaho (Bryce and Woods 2000).

An extreme climate characterizes the ecoregion. Moist springs and cold winters bring precipitation primarily in the form of snow, while summers are hot and dry. Vegetative types are consistent with the high deserts of the Intermountain west, with sagebrush steppe communities being the most dominant. Within this ecoregion less extensive vegetative communities include herbaceous wetland and riparian habitats, mountain mahogany woodlands, and a few examples of salt desert scrub (Bryce and Woods 2000).

Like the adjacent Basin and Range ecoregion, presently, the population of the Owyhee Uplands is sparse, with most of the population centered along the major drainages near the towns of Vail and Ontario. These towns border the confluence of the Malheur and Owyhee Rivers with the Snake River. Irrigated agriculture in these fertile lowlands is the foundation of the local economy (Bryce and Woods 2000). In contrast, the remainder of this ecoregion relies almost entirely on local ranching as their source economy (Bryce and Woods 2000). Decades of livestock grazing has degraded the habitat.

West Cascade Mountains. The West Cascade Mountains ecoregion is a mountainous spine of volcanic peaks and dense forests. Relatively few people live in the area, which is geologically composed of two parts. The older western Cascade Mountains feature long ridges with steep sides and wide, glaciated valleys—remnants of long-extinct volcanoes. The younger high Cascades to the east include more than a dozen major peaks formed from more recent volcanic activity. Most of the rivers draining the northern two-thirds of the ecoregion flow into the Willamette Valley and then to the Columbia River system; the southern third drains to the Pacific Ocean through the Umpqua and Rogue River systems.

The drier southern half has a fire regime similar to that of the Klamath Mountains, with frequent, lightning-caused fires. In the northern half, the natural fire regime has historically produced less frequent but more severe fires.

Higher elevations receive heavy winter snows. Dense forests cloak the entire ecoregion. Douglas-fir/western hemlock forests dominate large areas up to elevations of about 3,300 feet. Pacific silver fir and mountain hemlock forests occur at higher elevations. Above 7,000 feet, the montane forests often open into alpine parklands with patches of forest interspersed with a variety of habitats, ranging from dwarf shrubs to wetlands and barren expanses of rock and ice.

The conifer forests of the Cascades have been the foundation of a timber-based economy in the ecoregion and in neighboring communities to the east and west; most of the population in the ecoregion is found in small towns where recreation use increasingly supplements this traditional timber-based economy. A continuous ribbon of national forests at middle and high elevations dominates this ecoregion, with private ownership (especially forest industry) at lower elevations. The USFS manages approximately two-thirds of the forest in this ecoregion. More than two-thirds of the Federal forest land in this ecoregion is managed for biological diversity—as late successional reserves, riparian reserves, and extensive wilderness areas.

The major factors that have influenced patterns of riparian condition in the western Cascades are: 1) Fire; 2) floods; 3) timber harvest and log transport; 4) road construction and residential development; and 5) flow regulation by dams (SOER 2000). In the absence of human activities, moist riparian forests were not as susceptible as surrounding uplands to disturbance by fire.

Cascade wetland types are highly variable and include snowmelt-fed slope wetland meadows, high elevation lakes with broad fringing wetlands, bogs, and riparian wetlands along streams. Although many of the high-elevation wetlands along the crest of the Cascades are largely intact, some lower-elevation wetlands have been altered by road construction, timber harvest, and the construction of reservoirs as well as by the offsite changes that result from regulated flows. For the most part, these activities have altered, rather than eliminated, the region's wetlands.

The high proportion of streams with good to excellent water quality is a strong indicator of the health of water resources in this region; this area consistently has the highest water quality in the State. Extensive public ownership of the landscape has protected these upstream reaches from some of the disruptions common farther downstream.

Willamette Valley. The Willamette Valley ecoregion is defined by the Willamette River and Oregon's largest river valley. The river's upper reaches and much of its watershed lie in the Cascade Mountains and Coast Range beyond the ecoregion borders. The ecoregion itself is characterized by broad alluvial flats and low basalt hills, with soils of deep alluvial silts from river deposits, and dense heavy clays from fluvial deposits in the valley bottom's numerous oxbow lakes and ponds. This ecoregion has 70 percent of the State's population, the majority of its industry, and almost half of its farmland. The Willamette Valley ecoregion is largely in private ownership; agriculture, urban areas, and forestland dominate the landscape.

Over the past 150 years, the prairies have been largely converted to farmland, as have most of the riparian forests and wetlands. The rivers have been dammed and channelized to reduce flooding. Open oak savannas and oak-conifer woodlands have been logged to become closed-canopy forests. A growing urban population has replaced agriculture in many areas, and rural residential development continues to encroach on remaining woodlands. Due to the pattern of development, the Willamette Valley is the most altered ecoregion in Oregon, with the most significant natural processes, fire and flooding, almost entirely excluded.

Trends in riparian condition in the Willamette Valley have shown an 80 percent reduction in total riparian area since the 1850s. An estimated 72 percent of the original riparian and bottomland forest is gone, as well as an estimated 99 percent of wet prairies, 88 percent of upland prairies, and 87 percent of upland forests at the margins of the valley (SOER

2000). Much of the valley's agricultural development converted native wet prairie; less than one percent of the original wet prairie remains today and several wet prairie plants are rare or endangered.

Water development projects have reduced the frequency of extremely high and low flows, and have moderated the once dynamic hydrologic pattern of floods and dry spells. Flood control modifications have largely disconnected the Willamette River from its braided channels, oxbows and sloughs—wetland types that characterized much of the historical floodplain. This fundamental alteration to the valley's hydrologic regime has changed the character of the valley's wetlands and greatly altered their functions. Today, most of the mainstem Willamette River exceeds standards for bacteria, temperature, and toxics such as mercury.

The encroachment of invasive species has greatly altered the composition of riparian plant communities, with introduced plants increasing from 10 percent in the headwaters to more than 50 percent of the number of species in the mainstem Willamette.

Johnson and O'Neil Habitat Type Context

The Johnson and O'Neil habitat types (Johnson and O'Neil 2001) discussed in the above ecoregion sections are described below. Johnson and O'Neil (2001) provided the following information on the habitat types.

Urban and Mixed Environments. Urban habitat occurs throughout Oregon. Most urban development is located west of the Cascades, but urban growth is occurring in the majority of smaller municipalities throughout the Pacific Northwest.

This habitat type creates a physical setting unique to itself: temperatures are elevated and background lighting is increased; wind velocities are altered by the urban landscape, often reduced except around the tallest structures downtown, where high-velocity winds are funneled around the skyscrapers. Urban development often occurs in areas with little or no slope and frequently includes wetland habitats. Many of these wetlands have been filled and eliminated. Many artificial "wetland" impoundments are created for stormwater management.

The original habitat is altered in urban environments and is replaced by buildings, impermeable surfaces, bridges, dams, and non-native species, although remnant isolated blocks of native vegetation may be present. Urban habitat often replaces habitats that are valuable for wildlife. Often, urban areas are surrounded by agricultural and grazing lands.

Ice, wind, and firestorms can occur. Floods are often more frequent and more violent. Attempts to lessen flooding in urban areas often lead to the channelization, paving, or diking of waterways. Urban growth is predicted to continue to accelerate, and loss of native habitat can be anticipated, which will result in a loss of native habitat.

Agriculture, Pasture, and Mixed Environment. Agricultural habitat occurs within a matrix of other habitat types at low to middle elevations (less then 6,000 ft [1,830 m]), including Eastside grasslands, Shrub-steppe, Westside Lowlands Conifer-Deciduous Forest and other low- to mid-elevation forest and woodland habitats. This habitat often dominates the landscape in flat or gently rolling terrain, on well-developed soils, in broad river valleys, and in areas with access to abundant irrigation water. Unlike other habitat types, agricultural habitat is often characterized by regular landscape patterns, straight borders (because of ownership boundaries), and multiple crops within a region. Edges can be abrupt along the borders between agricultural and adjacent habitats.

The dominant characteristic of agricultural habitat is a regular pattern of management and vegetation disturbance. With the exception of the improved pasture-cover type, most areas classified as agricultural habitat receive regular inputs of fertilizer and herbicides and have some form of vegetation harvest and manipulation.

Natural fires are almost totally suppressed in this habitat, except in unimproved pastures and modified grasslands, where fire-return intervals can resemble those of native grassland habitats. Fires are generally less frequent today than in the past, primarily because of fire suppression, the construction of roads, and the conversion of grass and forests to cropland. Bottomland areas along streams and rivers are subject to periodic floods, which may remove or deposit large amounts of soil.

In the absence of fires or mowing, eastside agricultural habitats may convert to other habitats, primarily grassland and shrub from the surrounding native habitats. Abandoned westside pastures have increasing amounts of hawthorn (*Crataegus* spp*.),* snowberry (*Symphoricarpos albus*), rose (*Rosa* spp*.),* Himalayan blackberry (*Rubus discolor*), spirea, Scot's broom (*Cytisus scoparius*), and poison oak (*Toxicodendron diversilabum*). Douglas-fir (*Pseudotsuga menziesii*) or other trees can be primary invaders in some environments.

Eastside (Interior) Grasslands. In Oregon, this habitat is found primarily in the Columbia Basin at middle to low elevations, and on plateaus in the Blue Mountains, usually within the ponderosa pine zone.

Idaho fescue and bluebunch wheatgrass vegetative habitats are common throughout the Columbia Basin, both as modified native grasslands in deep canyons and the dry Palouse, and as fire-induced representatives in the shrub-steppe. Similar grasslands appear on the High Lava Plains ecoregion, where they occur in a matrix with big sagebrush (*Artemisia tridentata*) or juniper woodlands. They are also found in burned shrub-steppe and canyons in the Basin and Range and Owyhee Uplands. Sand dropseed (*Sporobolus cryptandrus*) and three-awn (*Aristida longiseta*) grassland habitats are restricted to river terraces in the Columbia Basin, Blue Mountains, and Owyhee Uplands of Oregon. The primary location of this habitat extends along the Snake River from Lewiston south to the Owyhee River.

This habitat develops in hot, dry climates in the Pacific Northwest where snow accumulation is low. Soils are variable and vegetation consists of upland vegetation, but may also include riparian bottomlands dominated by non-native grasses. This habitat is found from 500-6,000 feet in elevation.

Eastside grassland habitats can overlap with the Ponderosa Pine Forest and Woodlands or Western Juniper and Mountain Mahogany Woodlands habitat types. Bluebunch wheatgrass and Idaho fescue are the characteristic native bunchgrasses of this habitat and either or both can be dominant.

Large expanses of grasslands are currently used for livestock ranching. Deep soil Palouse sites are mostly converted to agriculture. Drier grasslands and canyon grasslands, as well as those with shallower soils, steeper topography, or hotter, drier environments, were more intensively grazed and for longer periods than were deep-soil grasslands.

Most of the Palouse prairie of Oregon has been converted to agriculture. Remnants still exist in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. The Palouse is one of the most endangered ecosystems in the U.S. with only one percent of the original habitat remaining; it is highly fragmented, with most sites being less than 10 acres (0.04 km2) (Noss et al. 1995).

Herbaceous Wetlands. Herbaceous wetlands are found throughout the world and are represented in Oregon wherever local hydrologic conditions promote their development. This habitat includes all wetlands except bogs and those within Subalpine Parkland and Alpine habitats.

Freshwater aquatic bed habitats are found throughout the Pacific Northwest, usually in isolated sites. They are more widespread in valley bottoms and high rainfall areas, but are present in montane and arid climates as well. Habitats are permanently flooded, semi-permanently flooded, or flooded seasonally, and may remain saturated through most of the growing season. This habitat is referred to as palustrine emergent wetlands (Cowardin et al. 1979) and occurs in both lotic and lentic systems. Elevation varies from sea level to 10,000 feet, although it is infrequently found above 6,000 feet.

The herbaceous wetland habitat is generally a mix of emergent herbaceous plants with a grass-like life form (graminoids). These meadows often occur with deep- or shallow-water habitats with floating or rooting aquatic forbs. Shrubs or trees are not a common part of this herbaceous habitat, although willow or other woody plants occasionally occur along margins, in patches, or along streams running through these meadows.

Nationally, herbaceous wetlands have declined; the Pacific Northwest is no exception. Herbaceous wetlands have been filled, drained, grazed, and farmed extensively in the lowlands of Oregon. Herbaceous wetlands have decreased as beavers' influence has diminished. Herbaceous wetlands are susceptible to exotic, noxious plant invasions (Quigley and Arbelbide 1997).

Ponderosa Pine Forest and Woodlands (includes Eastside Oak). In Oregon, this habitat occurs on the eastern slopes of the Cascades and in the Blue Mountains. This habitat generally occurs on the driest sites supporting conifers and is widespread and variable appearing on moderate to steep slopes in canyons, foothills, and on plateaus or plains near mountains. In Oregon, this habitat can be maintained by the dry pumice soils. Average annual precipitation ranges from approximately 14-30 inches in ponderosa pine sites in Oregon and Washington, often as snow. This habitat can be found at elevations of 100 feet in the Columbia River Gorge to dry, warm areas over 6,000 feet. Timber harvest, livestock grazing, and pockets of urban development are major land uses.

Ponderosa pine and Douglas-fir are the most common evergreen trees in this habitat type. Other common trees in this habitat type include western larch (*Larix occidentalis*), grand fir (*Abies grandis*), Oregon white oak (*Quercus garryanna*), mallowleaf ninebark (*Physocarpus malvaceus*), common snowberry, and white-leaf manzanita (*Arctostaphylos patula*). Undergrowth in this habitat is usually dominated by herbaceous species such as pinegrass (*Calamagrostis rubescens*), Greyer's sedge (*Carex geyeri*), and blue wildrye (*Elymus glaucus*).

Fire plays an important role in creating vegetation structure and composition in this habitat. Most of the habitat has experienced frequent low-severity fires that maintained woodland or savanna conditions. Soil drought plays a role in maintaining an open tree canopy in part of this dry woodland habitat.

Shrub-Steppe. In Oregon, Shrub-steppe habitats are common across the Columbia Plateau. They extend up into the cold, dry environments of surrounding mountains. Generally, this habitat is associated with hot, dry environments in the Pacific Northwest, although variants occur in cool, moist areas that have some snow accumulation in climatically dry mountains. The elevation range of the shrub-steppe is from 300-9,000 feet. The most common elevations are from 2,000-6,000 feet. Habitat occurs on deep alluvial, loess, silty or sandy-silty soils; and on stony flats, ridges, mountain slopes, and the slopes of lake beds with ash or pumice soils.

Shrub-steppe habitat defines a biogeographic region and is the dominant vegetation type in typical areas in the Columbia Plateau, usually below Ponderosa Pine Forest and Woodland, and Western Juniper and Mountain Mahogany Woodland habitats. Vegetation structure in this habitat is characteristically an open shrub layer over a moderately open to closed bunchgrass layer. The more northern or productive sites generally have a denser grass layer and sparser shrub layer than southern sites.

Predominant vegetation within the shrub-steppe habitat type includes basin sagebrush, Wyoming sagebrush (*Artemisia tridentate wyomingensis*), antelope bitterbrush (*Purshia tridentata*), silver sagebrush (*Artemisia cana*), and three-tip sagebrush (*Artemisia tripartite*). Many sandy areas are shrub-free or are open to patchy shrublands of bitterbrush and/or rabbitbrush (*Chrysothamnus* spp.*)*. Silver sagebrush is the dominant and characteristic shrub along the edges of stream courses, moist meadows, and ponds.

Shrub-steppe habitat still dominates most of southeastern Oregon, although half of its original area in the Columbia Basin has been converted to agriculture. The alteration of fire regimes, habitat fragmentation, livestock grazing, and the addition of more than 800 invasive plant species have changed the character of shrub-steppe habitat.

Western Juniper and Mountain Mahogany Woodlands. In Oregon, this dry woodland habitat appears primarily in the Owyhee Uplands, High Lava Plains, and northern Basin and Range ecoregions. Secondarily, it develops in the foothills of the Blue Mountains and East Cascades ecoregions, and seems to be expanding into the southern Columbia Basin ecoregion, where it was naturally found in outlier stands. The primary land use in this habitat type is livestock grazing.

This habitat is widespread and variable, occurring in basins and canyons and on slopes and valley margins in the southern Columbia Plateau, as well as on fire-protected sites in the northern Basin and Range province. It may be found on benches and foothills. Western juniper and/or mountain mahogany woodlands are often found on shallow soils on flats at middle to high elevations, usually on basalts. Other sites range from deep, loess soils and sandy slopes to very stony canyon slopes. At lower elevations, or in areas outside of shrub-steppe, this habitat occurs on slopes and in areas with shallow soils. Mountain mahogany can occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. Average annual precipitation ranges from approximately 10-13 inches, with most occurring as winter snow.

Western juniper and/or mountain mahogany dominate these woodlands, either with bunchgrass or shrub-steppe undergrowth. Western juniper is the most common dominant tree in these woodlands. Part of this habitat will have curl-leaf mountain mahogany (*Cercocarpus ledifolius*) as the only dominant tall shrub or small tree; mahogany may be co-dominant with western juniper. Ponderosa pine can grow in this habitat and in rare instances may be an important part of the canopy. Part of this woodland habitat lacks a shrub layer, as various native bunchgrasses dominate.

Over the past 150 years—with fire suppression, overgrazing, and changing climatic factors—western juniper has increased its range into adjacent shrub-steppe, grasslands, and savannas. The increased density of juniper and reduced fine fuels from an interaction of grazing and shading result in high severity fires that eliminate woody plants and promote herbaceous cover, primarily annual grasses.

This habitat is dominated by fire-sensitive species (e.g., mountain mahogany and western juniper), and therefore, the range of western juniper and mountain mahogany has expanded because of an interaction of livestock grazing and fire suppression. In the inland Pacific Northwest, Juniper Woodlands and Mountain Mahogany cover types now cover a significantly wider area than before 1900 (Quigley and Arbelbide 1997). However, this habitat is generally degraded as a result of an increase in exotic plants and a decrease in native bunchgrasses.

Bays and Estuaries. This diverse habitat consists of areas with significant mixing of salt and freshwater, including the lower reaches of rivers, intertidal sand and mud flats, saltwater and brackish marshes, and the open-water portions of associated bays. The habitat is distributed along the marine coast and shoreline of Oregon and is strongly influenced by the daily tides and currents.

Climate is moderated by the Pacific Ocean and is usually mild. Coastal zone topography is characterized by long stretches of sandy beaches broken by steep rocky cliffs, rocky headlands, and the mouths of bays and estuaries. Organics, silt, and sand are the primary substrate components of this habitat, and vary in composition and distribution (Jefferson).

Some of the major uses of bays and estuaries are recreation, tourism, the shellfish industry, and navigation. The terrestrial interface portions of this habitat have been extensively converted to agricultural crop production, livestock grazing, and residential and commercial development. Water channels of many areas have been dredged for ship navigation.

Natural disturbance perpetuates the dynamic, transitional nature of this habitat. Tides, seasonal riverine discharges, winds, storms, erosion, and accretion are the primary natural processes that shape this habitat. Although natural erosion and accretion processes continue, most habitat modification can be attributed to anthropogenic causes (Simenstad 1983). Because of historical diking for crop production and flood control, almost no areas of natural high marsh remain in Oregon (Jefferson 1975). These dikes, and other more recent barriers, prevent natural recovery and the re-establishment of this habitat. Remaining examples of the bay and estuarine habitat exist in various conditions, from the more natural areas and areas undergoing active restoration, to the more prevalent polluted, degraded, or overused areas. With increasing population pressures in coastal areas and the corresponding threats of habitat use and conversion, the future trend will likely be a continued degradation and reduction of remaining bay and estuarine areas.

Westside Lowlands Conifer-Hardwood Forest. This habitat type occurs on the western slopes of the Cascades, around the margins of the Willamette Valley, in the Coast Range, and along the outer coast.

The climate is relatively mild and moist to wet; snowfall ranges from rare to regular, but is transitory; summers are relatively dry, and summer fog is a major factor in the Sitka spruce zone on the outer coast. Elevation ranges from sea level to 3,500 feet in central Oregon (on the western slopes of the Cascades). Soils and geology are very diverse, and topography ranges from relatively flat glacial till plains to steep mountainous terrain.

This is the most extensive lowland habitat on the west side of the Cascades (except in southwestern Oregon), and forms the matrix within which other habitats occur as patches, especially Westside Riparian-Wetlands and, less commonly, Herbaceous Wetlands or Open Water. This habitat is forest, or, rarely, woodland, dominated by evergreen conifers, deciduous broadleaf trees, or both. Western hemlock (*Tsuga heterophylla*) and Douglas-fir are the most characteristic species and one or both are typically present. Most stands are dominated by one or more of the following: Douglas-fir, western hemlock, western red cedar (*Thuja plicata*), Sitka spruce (*Picea sitchensis*), red alder (*Alnus rubra*), and big leaf maple (*Acer macrophyllum*).

The natural disturbances most common to the Westside Lowlands Conifer-Hardwood Forest habitat type include fire and wind damage, as well as disease. Fire is the major natural disturbance in all but the wettest climatic area (the Sitka spruce zone), where wind becomes the major source of natural disturbance. Bark beetles and fungi are significant causes of mortality that typically operate on a small scale. Landslides are another natural disturbance that occurs in some areas.

Large areas of this habitat remain, but remaining habitat has been degraded by industrial forest practices at both the stand and landscape scale. Only a fraction of the original old-growth forest remains, mostly in national forests in the Cascade Mountains.

<u>Lodgepole Pine Forest and Woodland.</u> This habitat is found along the east side of the Cascade Range and in the Blue Mountains. Subalpine lodgepole pine habitat occurs on the broad plateau areas along the crest of the Cascade Range and the Blue Mountains. On pumice soils, this habitat is confined to the eastern slope of the Cascade Range from near Mt. Jefferson south to the vicinity of Crater Lake.

This habitat is located mostly at middle to higher elevations, where the environments can be cold and relatively dry, usually with persistent winter snowpack. A few of these forests occur in low-lying frost pockets, wet areas, or within specific soil types (usually pumice), and are relatively long-lasting features of the landscape. The well-drained, deep Mazama pumice in eastern Oregon encourages the dominance of lodgepole pine.

The lodgepole pine habitat is composed of open to closed evergreen conifer tree canopies, and typically reflects early successional forest vegetation that originated with fires. The tree layer of this habitat is dominated by lodgepole pine, but it is usually associated with other montane conifers (grand fir, western larch, ponderosa pine, Douglas-fir, white fir [*Abies concolor*], California red fir [*A. magnifica var. shastensis*], incense cedar [*Calocedrus decurrens*], sugar pine [*Pinus lambertiana*], and western white pine [*P. monticola*]). Subalpine fir (*Abies lasiocarpa*), mountain hemlock (*Tsuga mertensiana*), Engelmann spruce (*Picea engelmannii*), and whitebark pine (*Pinus albicaulis*), indicators of subalpine environments, are present in colder or higher sites. Quaking aspen (*Populus tremuloides*) may occur in small numbers.

The area of the lodgepole pine cover type in Oregon is the same as prior to 1900 and in some regions it may exceed its historical area (Quigley and Arbelbide 1997), but at a finer scale, these forests have been fragmented by roads and timber harvest, and influenced by periodic livestock grazing and altered fire regimes.

<u>Montane Coniferous Wetlands.</u> This habitat occurs in mountains throughout Oregon, except the Basin and Range of southeastern Oregon, the Klamath Mountains of

southwestern Oregon and the Coast Range of Oregon. This includes the Cascade Range, and the Blue and Wallowa Mountains.

This habitat comprises forested wetlands or floodplains with a persistent winter snowpack, ranging from moderately to very deep. Sites typical of the Montane Coniferous Wetland habitat type are seasonally or temporarily flooded. The climate varies from moderately cool and wet to moderately dry and very cold. The topography is generally mountainous, but can also contain nearly flat valley bottoms. Gleyed or mottled mineral soils, organic soils, or alluvial soils are typical. Subsurface water flow within the rooting zone is common on slopes with impermeable soil layers. The flooding regimes include saturated, seasonally flooded, and temporarily flooded. Seeps and springs are common in this habitat.

The habitat is a forest or woodland (greater than 30 percent tree canopy cover) dominated by evergreen conifer trees. Deciduous broadleaf trees are occasionally co-dominant. The understory is dominated by shrubs (usually deciduous and relatively tall), forbs, or graminoids. The forb layer is usually well developed, even where a shrub layer is dominant. This habitat contains nearly all of the wettest forests within the Pacific silver fir (*Abies amabilis*) and mountain hemlock zones of northwestern Oregon, and most of the wet forests in the western hemlock and subalpine fir zones of eastern Oregon.

The primary land uses here are forestry and watershed protection. The major natural disturbances include flooding, debris flow, fire, and wind. The habitat is naturally limited in its extent and has probably declined little in area over time, though portions have been degraded by the effects of logging, either directly on site or through geohydrologic modifications. This habitat type is probably relatively stable in extent and condition, although its condition may be locally declining because of logging and road building.

<u>Lakes, Rivers, Ponds, and Reservoirs.</u> Lakes in Oregon occur statewide and are found from near sea level to about 10,200 feet above sea level. There are 6,000 lakes, ponds, and reservoirs in Oregon, including almost 1,800 named lakes and over 3,800 named reservoirs, all amounting to 270,641 acres (109,571 ha). Streams and rivers are distributed state-wide, forming a continuous network that connects high mountain areas to lowlands and the Pacific coast. There are 12,000 named rivers and streams in Oregon, totaling 112,640 miles in length; they range from cold, fast moving high-elevation streams to warmer lowland valley rivers. Streams are here defined as flowing water greater than 6 feet wide; narrower water bodies are considered within their respective habitats.

Rivers and streams in southwestern Oregon are fed by rain and are located in an area composed of sheared bedrock, which is thus an unstable terrain. Streams in this area have high suspended-sediment loads. Beds composed of gravel and sand are easily shifted during floods. Floods occur every year from October through April; more than half of all floods occur during December and January. Floods are initiated by precipitation and snow melts, and thus are short-lived.

Sewage effluents have caused eutrophication. The removal of gravel results in a reduction of spawning areas for anadromous fish. Overgrazing and a loss of vegetation caused by logging increases water temperatures and siltation, harming the invertebrate communities. Flood control measures have contributed to a loss of oxbows, river meanders, and flood plains. Unauthorized or over-appropriated withdrawals of water from the natural drainages have also caused a loss of open water habitat that has been detrimental to fish and wildlife production, particularly in the summer. The construction of dams is associated with changes in water quality, fish passage, competition between species, loss of spawning areas, and declines in native fish populations.

Southwest Oregon Mixed Conifer-Hardwood Forest . This upland forest and woodland habitat occurs in southwestern Oregon. In southern Oregon, this habitat type is found at low and middle elevations in the Klamath Mountains, Cascades, Coast Range, and Eastern Cascade Slopes and Foothills ecoregions. Portions of Curry, Josephine, Jackson, Douglas, Lane, and Klamath counties are included in the range of this habitat. The predominant land use is forestry. Grazing occurs in some areas, especially at lower elevations.

The climate varies from relatively dry and very warm, to moderately moist and cool, to slightly warm and very moist. Snow is uncommon except at the highest elevations, where a winter snow pack occurs for a few months. Summers are hot and dry. Elevation ranges from near sea level to 6,000 feet. The topography is mostly mountainous, but also includes two fairly large valleys and a corresponding variety of terrains. Soils are diverse, as is the bedrock geology. Serpentine soils are common in portions of the Siskiyou Mountains, where they have a major effect on vegetation.

Conifer trees typically dominate this habitat. In some areas, a well developed subcanopy layer of smaller evergreen broadleaf trees is present. Occasionally, deciduous broadleaf trees are co-dominant. Dominant tree species include Douglas-fir, white fir, sugar pine, ponderosa pine, and incense cedar.

Fire is the predominant natural disturbance, although fire regimes vary depending on environmental conditions. This habitat covers most of southwestern Oregon and has declined little in areal extent. Conditions of most communities and stands have been degraded by forestry practices and by fire suppression. The low-elevation, driest communities have been altered by grazing and invasion of exotic species; specifically, Port Orford cedar (*Chamaecyparis lawsoniana*) has declined dramatically (Zobel et al. 1985). Fire suppression and logging-related effects continue to be threats.

Westside Oak and Dry Douglas-fir Forest and Woodlands. This habitat is primarily found in the Willamette Valley and Klamath Mountains ecoregions. In southwestern Oregon, it is now restricted mainly to the valleys of the Rogue and Umpqua Rivers. Minor occurrences can also be found in the western Cascades. Land use in this habitat includes forestry (generally small scale), livestock grazing, and low-density rural residential.

The habitat has several geographic variants: California black oak (*Quercus kelloggii*) and ponderosa pine are important only in southwestern Oregon and the southern Willamette Valley. Dry Douglas-fir forests (without oak or madrone) are found, rarely, in the west Cascades and Willamette Valley. Pacific madrone (*Arbutus menziesii*) and Douglas-fir/Pacific madrone stands without oak are limited to the southern Willamette Valley foothills. Mixed oak-madrone stands occur most often, especially in southwestern Oregon.

This habitat typically occupies dry sites west of the Cascades. Elevation ranges from sea level to about 3,500 feet in the Olympic Mountains, but is mainly below 1,500 feet. The topography ranges from nearly level to very steep slopes, where aspect tends to be southern or western. Soils on dry sites are typically shallow over bedrock, very stony, or very deep and excessively drained. Fire is the major natural disturbance in this habitat.

This habitat type is a forest or woodland dominated by evergreen conifers, deciduous broadleaf trees, evergreen broadleaf trees, or a mixture of conifers and broadleaf trees. Understories vary in structure: grasses, shrubs, ferns, or some combination thereof will typically dominate; deciduous broadleaf shrubs are perhaps most typical

The canopy is typically dominated by one or more of the following species: Douglas-fir, Oregon white oak, Pacific madrone, shore (lodgepole) pine, or California black oak. Ponderosa pine is important in southwestern Oregon and the southern Willamette Valley, as a subordinate or co-dominant with oak.

This habitat type is relatively limited in area and is declining in both extent and condition. With the cessation of regular burning 100-130 years ago, many grasslands and savannas were invaded by a greater density of trees and thus converted to a different habitat. In addition, large areas of this habitat have been converted to Urban or Agriculture habitats. Most of the remaining habitat has been considerably degraded by the invasion of exotic species or by logging and its consequent loss of structural diversity. Ongoing threats include residential development, the increase and spread of exotic species, and fire suppression effects (the latter especially in oak-dominated stands).

<u>Westside Riparian-Wetlands</u> . In Oregon, this habitat is patchily distributed in the lowlands throughout the area west of the Cascade Crest. It can occur less extensively at middle to higher elevations in the Cascade Mountains, where it is limited to more specific environments. The major land use in the forested portions of this habitat is timber harvest. Livestock grazing occurs in some areas, and peat mining occurs in some bogs.

This habitat is characterized by wetland hydrology or soils, periodic riverine flooding, or perennial flowing freshwater. The climate varies from very wet to moderately dry and from mild to cold. This habitat is found at elevations primarily below 3,000 feet, but can extend up to 6,500 feet. The topography is typically flat to gently sloping or undulating, but can include moderate to steep slopes in the mountains. The geology is extremely variable, and flooding regimes include permanently flooded (aquatic portions of small streams), seasonally flooded, saturated, and temporarily flooded.

Most often this habitat is a tall deciduous broadleaf shrubland, woodland, or forest, or some mosaic of these. Short to medium-tall evergreen shrubs or graminoids and mosses dominate portions of bogs. The dominant trees are evergreen conifers or deciduous broadleaf, or a mixture of both. Red alder is the most widespread tree species, but is absent from sphagnum bogs. Water is sometimes present on the surface for a portion of the year. Large woody material is abundant in late seral forests and adjacent stream channels. Small stream channels and small backwater channels on larger streams are included in this habitat. This habitat includes all palustrine, forested wetlands, and scrub-shrub wetlands at lower elevations on the west side as well as a small subset of persistent emergent wetlands, those within sphagnum bogs. They are associated with both lentic and lotic systems.

The primary natural disturbance is flooding, although beavers act as important disturbances by changing the hydrology of a stream system through dams. Grazing by native ungulates (e.g., elk) can have a major effect on vegetation. Intense logging disturbance in conifer or mixed riparian or wetland forests, except bogs, often results in the establishment of red alder, and its ensuing long-term dominance. Salmonberry responds similarly to this disturbance and tends to dominate the understory. Roads and other water diversion/retention structures change watershed hydrology with wide-ranging and diverse effects, including major vegetation changes (Furniss et al. 1991). Increases in nutrients and pollutants are other common anthropogenic effects, the former with particularly acute effects in bogs. Reed canarygrass (*Phalaris arundinacea*) is an abundant non-native species in low-elevation, disturbed settings dominated by shrubs or deciduous trees. Many other exotic species also occur.

This habitat occupies relatively small areas and has declined greatly in extent as a result of its conversion to urban development and agriculture. The remaining habitat is mostly in poor condition, having experienced anthropogenic effects that have degraded the functionality of these ecosystems: channeling, diking, dams, logging, road-building, the invasion of exotic species, changes in hydrology and nutrients, and livestock grazing. Current threats include all of the above as well as development.

Landuse Context
Populations of resident fish, wildlife, and anadromous salmonids are at risk or already extinct in many basins of Oregon, leading to the numerous ESA listings. These populations have declined due to a variety of human activities and natural events including hydropower development, overharvest, land management activities, artificial propagation, water pollution, disease, predator control, competition, timber harvest, predation from introduced species, and climatic variation leading to temporarily unfavorable ocean conditions (FEMAT 1993, Henjum *et al.* 1994, NOAA Fisheries 1995, National Research Council 1996, Spence *et al.* 1996, Oregon Coastal Salmon Restoration Initiative 1997, Lee *et al.* 1997).

Land Management

Land management activities that have degraded habitat of resident fish, wildlife, and anadromous salmonids include water withdrawals, unscreened water diversions, hydropower development, road construction, timber harvest, stream cleaning of large wood, splash dams, mining, farming, livestock grazing, outdoor recreation, and urbanization (FEMAT 1993, Botkin *et al.* 1995, National Research Council 1996, Spence *et al.* 1996, Lee *et al.* 1997). In many Oregon basins, land management activities have: (1) Reduced connectivity (*i.e.*, the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields, filling pools and reducing spawning and rearing habitat; (3) reduced instream and riparian large woody debris that traps sediment, stabilizes streambanks, and helps form pools and off channel habitat; (4) reduced or eliminated vegetative canopy that minimizes temperature fluctuations; (5) caused streams to become straighter, wider, and shallower, which has the tendency to reduce spawning and rearing habitat and increase temperature fluctuations; (6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; (7) altered floodplain function, water tables and base flows, resulting in riparian wetland and stream dewatering; (8) degraded water quality by adding heat, nutrients and toxicants; (9) and reduced the area of mature forest habitat; and (10) converted native habitat types to agriculture or urban areas (FEMAT 1993, Henjum *et al.* 1994, McIntosh *et al.* 1994, Rhodes *et al.* 1994, Wissmar *et al.* 1994, National Research Council 1996, Spence *et al.* 1996, Oregon Coastal Salmon Restoration Initiative 1997, Lee *et al.* 1997).

Beginning in the early 1800s, riparian areas in eastern and southern Oregon were extensively changed by trapping beaver, logging, mining, livestock grazing, agricultural activities, and associated water diversion projects. Very little of the once extensive riparian vegetation remains to maintain water quality and provide habitats for listed resident fish and anadromous salmonids. Dams have affected flow, sediment, and gravel patterns, which in turn have diminished regeneration and natural succession of riparian vegetation along downstream rivers. Introduced plant species pose a risk to some riparian habitat by dominating local habitats and reducing the diversity of native plant species. Improper grazing management in riparian areas is another significant threat (USFWS 1998, Risser 2000). Past timber harvest practices and associated road building have also degraded streams (FEMAT 1993).

In the Columbia River Basin, even before mainstem dams were built, habitat was lost or severely damaged in small tributaries by construction and operation of irrigation dams and diversions, inundation of spawning areas by impoundments, and siltation and pollution from sewage, farming, logging, and mining (Fulton 1968).

Human activities have had vast effects on the native resident and anadromous salmonid populations in the Willamette River basin. First, the Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat (*i.e.*, stream shoreline) by as much as 75 percent. In addition, the construction of 37 dams in the basin has blocked access to over 435 miles of stream and river spawning habitat. The dams also alter the temperature regime of the Willamette and its tributaries, affecting the timing of development of naturally-spawned eggs and fry. Dams regulate seasonal flows thus limiting off channel habitat. Water quality is also affected by development and other economic activities. Agricultural and urban land uses on the valley floor, as well as timber harvesting in the Cascade and Coast ranges, contribute to increased erosion and sediment load in Willamette River basin streams and rivers. Finally, since at least the 1920s, the lower Willamette River has suffered municipal and industrial pollution (Risser 2000).

In the western Cascades, Willamette Valley, Coast Range, and Klamath Mountains, riparian areas on privately-owned land are dominated by younger forests because of timber harvest, whereas riparian areas on public lands have more mature conifers. Old coniferous forests now comprise approximately 20 percent of the riparian forests in the Cascades, but only 3 percent in the Coast Range. Older forests historically occurred along most of the McKenzie River, but now account for less than 15 percent of its riparian forests. Along the mainstem of the upper Willamette River, channel complexity has been reduced by 80 percent and the total area of riparian forest has been reduced by more than 80 percent since the 1850s. Downstream portions of the Willamette River have experienced significant channel change, and more than 80 percent of the historical riparian forest has been lost (Risser 2000).

Depending on the species, salmon spend from a few days to one or two years in an estuary before migrating out to the ocean. However, alterations such as filling, dredging, the introduction of nonnative species, and excessive waste disposal have changed Oregon's estuaries, reducing their natural resiliency and functional capacity. The most significant historical changes in Oregon's estuaries are the diking, draining and filling of wetlands and the stabilization, dredging and maintenance of navigation channels. Between 1870 and 1970, approximately 50,000 acres, or 68 percent of the original tidal wetland areas in Oregon estuaries, were lost. Consumptive use of fresh water in the upper watersheds has reduced freshwater inflow to estuaries by as much as 60 to 80 percent, thus reducing the natural dilution and flushing of pollutants. Non-native species now comprise a significant portion of Oregon's estuarine flora and fauna. Some, such as the European green crab, pose serious threats to the native estuarine communities. Despite these significant historical wetland conversions and continuing degradation by pollutants, nuisance species, and navigational improvement, much of the original habitat that existed in the mid-1800s is still relatively intact. Hundreds of acres of former estuarine marshes are now being restored (Risser 2000).

Oregon contains approximately 114,500 miles of rivers and streams. No statewide measurements exist of the area of riparian vegetation, although some estimates have been made for more localized regions. Using the conservative estimate of a 100-yard riparian corridor on each side of the stream, the total area of riparian habitats for flowing water in Oregon may be 22,900 square miles. That is equal to approximately 15 percent of the total area of the state. With the exception of fall Chinook, which generally spawn and rear in the mainstem, most salmon and steelhead spawning and rearing habitat is found in tributaries where riparian areas are a major habitat component. Healthy riparian areas retain the structure and function of natural landscapes as they were before the intensive land use and land conversion that has occurred over the last 150 to 200 years. However, land use activities have reduced the numbers of large trees, the amount of closed-canopy forests, and the proportion of older forests in riparian areas. In western Oregon, riparian plan communities have been altered along almost all streams and rivers (Risser 2000).

Water Supply

Oregon's currently available water supplies are fully or over allocated during low flow months of summer and fall. In the Columbia Plateau ecoregion, less that 20 percent of instream water rights can expect to receive their full allocation nine months of the year. In the Willamette Valley and Cascades ecoregions, more than 80 percent of the instream water rights can expect to receive their full allocation in the winter, but only about 25 percent in the early fall. Increased demand for water is linked to the projected 34 percent increase in human population over the next 19 years in the state (ODAS 1999). Depletion and storage of natural flows have altered natural hydrological cycles in basins occupied by listed resident fish and salmonid ESUs. This may cause juvenile salmon mortality through migration delay resulting from insufficient flows or habitat blockages, loss of sufficient habitat due to dewatering and blockage, stranding of fish resulting from rapid flow fluctuations, entrainment of juveniles into poorly screened or unscreened diversions, and increased juvenile mortality resulting from increased water temperatures (Spence *et al.* 1996). Reduced flows also negatively affected fish habitats due to increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, encroachment of riparian and exotic vegetation into spawning and rearing areas and loss of off channel habitat. Further, some climate models predict 10 to 25 percent reductions in late spring-summer-early fall runoff amounts in the coming decades (Risser 2000, USFWS 1998).

Water Quality

The Oregon Water Quality Index is based on a combination of measurements of temperature, dissolved oxygen, biochemical oxygen demand, pH, ammonia and nitrate nitrogen, total phosphorus, total solids and fecal coliform (Risser 2000). Generally, water quality in Oregon, as shown by the Oregon Water Quality Index, is poor for salmon during low flow periods, except in mountainous areas. Areas with excellent or good water quality occur most often in forested uplands. Poor or very poor water quality occurs most often in non-forested lowlands where land has been converted to agricultural and urban uses. Most ecoregions include some rivers and streams with excellent water quality and other with very poor water quality. Only the Cascades ecoregion has excellent water quality overall. The Willamette Valley, Columbia Plateau, Northern Basin and Range, and southern end of the Eastern Cascade Slope ecoregions have poor water quality. The effects of pesticides and fertilizers, especially nitrates, on aquatic habitats are a significant concern (Risser 2000).

Water quality in Upper Klamath Lake consistently reaches levels known to be stressful to resident fish including listed suckers and periodically reaches lethal levels in August - September, resulting in catastrophic die-off events (Bienz and Ziller 1987, Buettner 1997, Foott 1997, Gilbert 1898, Holt 1997, Loftus 2001, Perkins et al. 2000, Scoppettone 1986, Scoppettone and Vinyard 1991, USBR 1996). Major fish die-offs have been recorded since the late 1800's but have increased in frequency in the last few decades Small, localized fish die-offs have been observed annually on Upper Klamath Lake since 1992.

Exotic Species

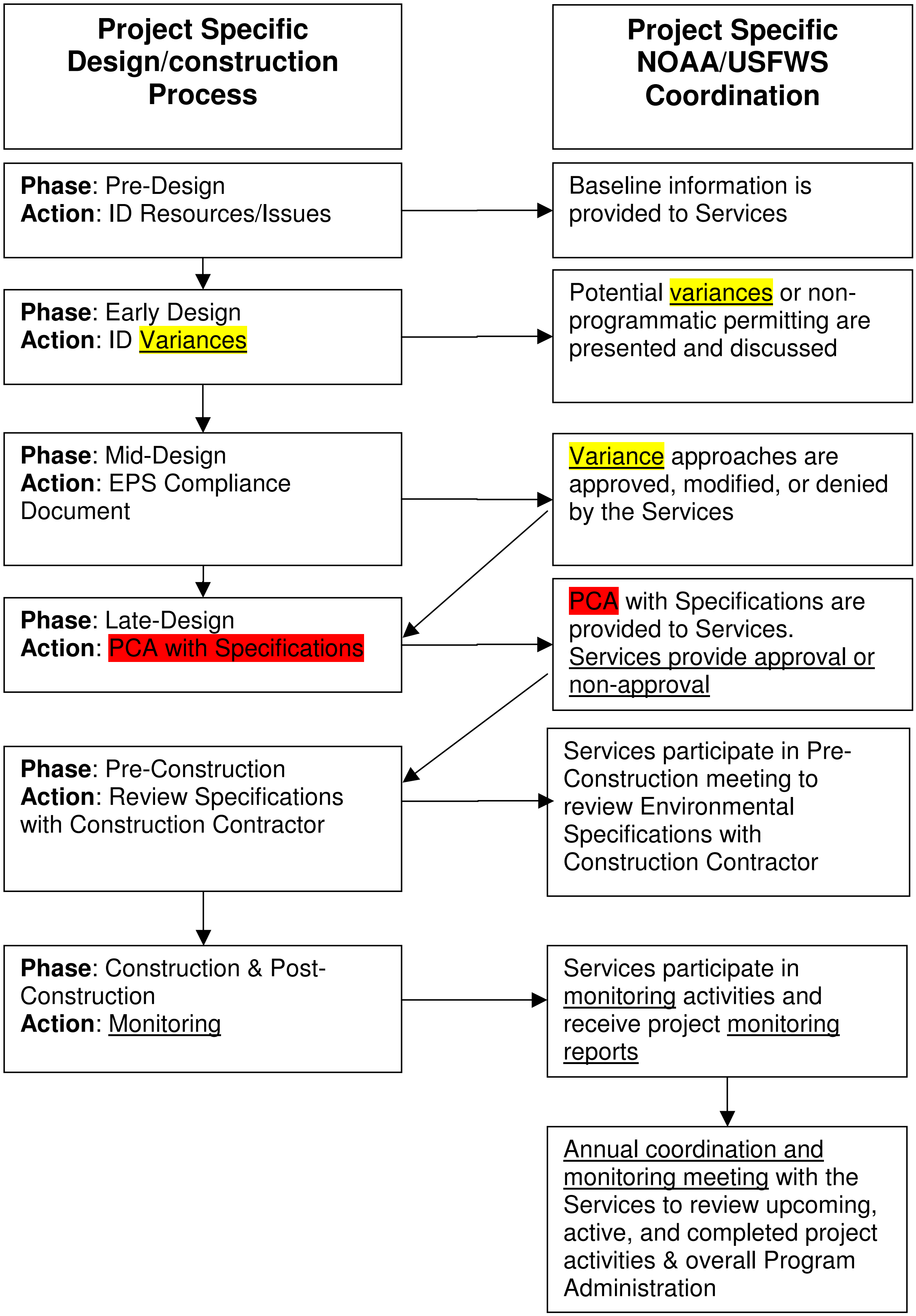
More than 32 species of freshwater fish have been introduced into Oregon, and are now self-sustaining, making up approximately one-third of Oregon's freshwater fish fauna. Introduced species are frequently predators on native species (USFWS 1998), compete for food resources, alter freshwater habitats, and may hybridize with native salmonids (Buchanan et al. 1997). In 1998, introduced species were found to comprise 5 percent of the number of species found in the upper Willamette River, but accounted for 60 percent of the observed species in the lower river near Portland (Risser 2000).

APPENDIX D Program coordination and communication protocol flow chart.

Variances. Variances will be requested for actions not clearly addressed in the environmental performance standards. The Services will respond with an approval, approval with additional conservation measures, or disapproval within 30 calendar days of receipt of the variance request.

Variances of the environmental performance standards that result in greater effects or greater take than provided in the biological opinion will not be granted and will require separate consultation.

Pre-Construction Assessment (PCA). The Services will **r**eview each individual bridge project to ensure that all effects are within the range considered in the biological opinion, quantify project level take estimates or extent of take per established metrics, verify program level exempted take is not likely to be exceeded, and that all appropriate environmental performance standards are being properly followed. Submit the PCA to the Services and the appropriate Regulatory Authorities at least 30 days prior to starting construction activities.


Project Specific Design/construction Process
Project Specific NOAA/USFWS Coordination
Phase: Pre-Design
Action: ID Resources/Issues
Baseline information is provided to Services
Phase: Early Design
Action: ID Variances
Potential variances or non-programmatic permitting are presented and discussed
Phase: Mid-Design
Action: EPS Compliance Document
Variance approaches are approved, modified, or denied by the Services
Phase: Late-Design
Action: PCA with Specifications
PCA with Specifications are provided to Services. Services provide approval or non-approval
Phase: Pre-Construction
Action: Review Specifications with Construction Contractor
Services participate in Pre-Construction meeting to review Environmental Specifications with Construction Contractor
Phase: Construction & Post-Construction
Action: Monitoring
Services participate in monitoring activities and receive project monitoring reports
Annual coordination and monitoring meeting with the Services to review upcoming, active, and completed project activities & overall Program Administration