Endangered Species Act Section 7(a)(2) Consultation
Biological Opinion & Magnuson-Stevens Fishery Conservation & Management Act Essential Fish Habitat Consultation

Consultation on the "Willamette River Basin Flood Control Project"

Action Agencies:	U.S. Army Corps of Engineers Bonneville Power Administration U.S. Bureau of Reclamation
Consultation Conducted by:	NOAA's National Marine Fisheries Service (NMFS) Northwest Region
NOAA Fisheries Log Number:	F/NWR/2000/02117
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Issued by:	D. Robert Lohn Regional Administrator

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4 ENVIRONMENTAL BASELINE

ACRONYMS & ABBREVIATIONS

Action Agencies	USACE, BPA, and Reclamation
AM	annual milestones
AFS	American Fisheries Society
APA	Administrative Procedure Act
BA	Biological Assessment submitted by the Action Agencies to NMFS and USFWS on April 26, 2000
BIA	Bureau of Indian Affairs
BKD	bacterial kidney disease
BLM	U.S. Bureau of Land Management
BMP	best management practice
BPA	Bonneville Power Administration
BRT	Biological Review Team
CAP	Continuing Authorities Program
CBFWA	Columbia River Basin Fish & Wildlife Authority
cfs	cubic feet per second
CHARTS	Critical Habitat Analytical Review Teams
COP	configuration/operation planning
CPEC	Construction Projects Environmental Coordinating Committee
CR	Columbia River
CRFM	Columbia River Fish Mitigation
CRHRP	Columbia River Hatchery Reform Project
CRITFC	Columbia River Inter-Tribal Fish Commission
CSOs	combined sewer overflows
CTGR	Confederated Tribes of the Grand Ronde Community of Oregon
CTSI	Confederated Tribes of the Siletz Indians
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CTWS	Confederated Tribes of the Warm Springs Reservation
CWA	Clean Water Act
CWC	Calapooia Watershed Council
CWTs	Coded wire tags
DC	direct current
DDR	detailed design report
Defendants	NMFS, USFWS, USACE, and Reclamation
DEQ	Oregon Department of Environmental Quality
DO	Dissolved Oxygen
DPS	distinct population segment

DQA	Data Quality Act
ECC	Environmental Coordinating Committee
EFH	essential fish habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
EWEB	Eugene Water & Electric Board
FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
FL	fork length
FM	Flow Management Committee
FMEP	Fisheries Management & Evaluation Plan
FPHM	Fish Passage and Hatchery Management Committee
FPMP	Fish Passage and Management Plan
fps	feet per second
GBT	gas bubble trauma
GI	General investigations
gpm	gallons per minute
HD	House Document
HGMP	Hatchery Genetic Management Plan
HSRG	Hatchery Scientific Review Group
HUC	Hydrologic Unit Code
HUC5	Hydrological Unit Code (at the fifth field scale, for example)
ICTRT	Interior Columbia TRT
IHN	Infectious Hematopoietic Necrosis
IHOT	Integrated Hatchery Operations Team
IM	interim milestones
ISAB	Independent Science Advisory Board
IT	incidental take
ITS	Incidental take statement
LCFRB	Lower Columbia Fish Recovery Board
LCR	Lower Columbia River
LGMSC	Lower Granite Migration Study Steering Committee
LTWC	Long Tom Watershed Council
LWD	large woody debris
MAF	millions of acre feet
MCR	Middle Columbia River
MHHW	mean higher high waters
MM	major milestone

MPG	major population groups
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MW	megawatts
NCBC	North Coast British Columbia
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NTP	natural thermal potential
NTU	Nephelometric Turbidity Units
O&M	operations and maintenance
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OFC	Ocean Fish Commission
Opinion	this Biological Opinion
OPRD	Oregon Parks & Recreation Department
OWQI	Oregon Water Quality Index
OWRD	Oregon Water Resources Department
PA	Proposed Action
PAC	post-authorization change
PAH	Polynuclear aromatic hydrocarbons
PAS	Planning Assistance to States
PCE	primary constituent element
PDO	Pacific decadal oscillation
PFMC	Pacific Fishery Management Program
PGE	Portland General Electric Company
PIT-tag	Passive integrated transponder – tag
Plaintiffs	Willamette Riverkeepers and Northwest Environmental Defense Center
PNERC	Pacific Northwest Ecosystem Research Consortium
PNI	proportion of natural influence
PST	Pacific Salmon Treaty
RCC	USACE Northwest Division's Reservoir Control Center
Reclamation	U.S. Bureau of Reclamation
RER	Rebuilding Exploitation Rate

RM	River mile
RM&E	research, monitoring, and evaluation
RO	regulating outlet
RPA	reasonable and prudent alternative
RPM	reasonable and prudent measure
RSW	removable spillway weirs
SCAB	Steelhead and Chinook above Barriers Committee
SEAK	Southeast Alaska
Services	NMFS and USFWS, collectively
SIWG	Species Interaction Work Group
SLOPES	Standard Local Operating Procedures for Endangered Species
SOI	Southern Oscillation Index
SOP	standard operating procedure
SR	Snake River
SRP	Sustainable Rivers Project
STEP	Salmon and Trout Enhancement Project
Supplemental BA	Supplemental Biological Assessment submitted by the Action Agencies to NMFS and USFWS on May 31, 2007
SWCD	Santiam Water Control District
T&C	terms and conditions
TDG	total dissolved gas
TL	total length
TMDL	total maximum daily load
TNC	The Nature Conservancy
TRT	technical recovery team
TU	temperature unit
UCR	Upper Columbia River
UNREG	unregulated conditions
USACE	U.S. Army Corps of Engineers
USBR	US Bureau of Reclamation
USDA	US Department of Agriculture
USDI	US Department of Interior
USEPA	US Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWR	Upper Willamette River
VSP	viable salmonid populations
WLCTRT	Willamette/Lower Columbia Technical Recovery Team

WATER	Willamette Action Team for Ecosystem Restoration
WCP	Willamette Conservation Plan
WCSBRT	West Coast Salmon Biological Review Team
WFOP	Willamette Fish Operations Plan
WNF LRD	Willamette National Forest Lowell Ranger District
WNF	Willamette National Forest
WQMP	Water Quality Management Plan
WQTC	Water Quality and Temperature Control Committee
WRDA	Water Resources Development Act of 1950
WRI	Willamette Restoration Initiative
WTC	water temperature control
Yakama	Yakama Indian Nation

Chapter 1
Introduction

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1 INTRODUCTION

1.1 OBJECTIVES

This Biological Opinion (Opinion) is the result of an interagency consultation under Section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the configuration, operations, and maintenance of the Willamette Valley Project (Willamette Project) on 13 listed species of Pacific salmon and steelhead, North American green sturgeon of the Southern DPS, and Southern Resident killer whale DPS. There are three Federal Action Agencies in this consultation because each plays a role in the Willamette Project. The U.S. Army Corps of Engineers (USACE) operates and maintains the 13 multipurpose dams and maintains about 43 miles of revetments in the upper Willamette basin; Bonneville Power Administration (BPA) markets power generated at some of the Willamette Project dams; and the U.S. Bureau of Reclamation (Reclamation) sells a portion of the water stored in Project reservoirs for irrigation purposes.

The National Marine Fisheries Service (NMFS) is responsible for administration of the ESA with respect to anadromous salmonids, green sturgeon, and killer whales. Section 7(a)(2) of the ESA requires Federal agencies to ensure that their actions do not jeopardize the continued existence of listed species or adversely modify designated critical habitat. To "jeopardize the continued existence of" means to engage in an action that reasonably is expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild, by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

The Action Agencies submitted a Biological Assessment (BA) (USACE 2000) to NMFS and U.S. Fish and Wildlife Service (USFWS, and collectively with NMFS, the Services) on April 26, 2000, and a Supplemental Biological Assessment (Supplemental BA) (USACE 2007a) on May 31, 2007, requesting consultation on the effects of the Willamette Project on species listed as threatened or endangered under the ESA, and on their critical habitat. The Action Agencies' Proposed Action consists of the continued operation and maintenance of the Willamette Project, which provides flood control, hydropower generation, water quality, water for irrigation, and other project purposes, including fisheries conservation and recreation. As part of the Proposed Action, the Action Agencies propose to reduce adverse effects on ESA-listed species by releasing minimum flows and reducing Project ramping in tributaries below dams; maintaining minimum flows in the mainstem Willamette River; constructing, operating, and maintaining fish collection and passage facilities at priority sites above and below Project dams; operating, improving, and maintaining Project hatcheries; and carrying out a series of research, monitoring, and evaluation actions to assess the effectiveness of the mitigation measures. The Proposed Action is described in more detail in Section 2 of this document and in the Action Agencies' BA (USACE 2000) and Supplemental BA (USACE 2007a), which are incorporated herein by reference as the complete version of the proposed action for this consultation.

The objectives of this Opinion are: (1) to determine the effects of the Proposed Action on 13 salmon evolutionarily significant units (ESUs) and steelhead distinct population segment (DPS), as well as the Southern DPS of North American green sturgeon (*Acipenser medirostris*), and Southern Resident killer whales (*Orcinus orca*), and (2) to determine if the Proposed Action is

likely to jeopardize the continued existence of these ESA-listed species under NMFS' jurisdiction, or adversely modify or destroy designated critical habitat for these species. Because there are multiple ESA-listed species are affected by the proposed action, and some of these are under USFWS jurisdiction, the Action Agencies consulted jointly with the Services. However, USFWS and NMFS wrote separate Biological Opinions.

This Opinion and the incidental take statement were prepared by NMFS in accordance with the ESA of 1973 (16 USC 1531 et seq.) and implementing regulations at 50 CFR 402. The analyses in this Opinion are based on NMFS' review of the best available scientific and commercial information. In this Opinion, NMFS concludes that the Proposed Action is likely to jeopardize the continued existence of Upper Willamette River (UWR) Chinook salmon and UWR steelhead, and to adversely modify or destroy designated critical habitat for these species. NMFS also concludes that the Proposed Action is likely to adversely affect, but not likely to jeopardize, the continued existence of the other 11 species of Interior and Lower Columbia Basin salmon and steelhead. Additionally, NMFS concludes that the Proposed Action is not likely to adversely modify or destroy designated critical habitat for the ten Interior and Lower Columbia Basin species for which it has been designated. Because the conclusion of this Opinion is that the Proposed Action jeopardizes two of the listed species of salmon and steelhead under NMFS' authority, NMFS developed and provides a reasonable and prudent alternative (RPA) to ensure their survival with an adequate potential for recovery. NMFS determines that the RPA and Proposed Action combined are not likely to adversely affect the Southern Resident killer whale DPS or the Southern DPS of North American green sturgeon, or to destroy or adversely modify critical habitat designated for the Southern Resident killer whale.

NMFS is also responsible for consultations conducted under Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) regarding essential fish habitat (EFH) consultation requirements. Section 305(b)(2) of the MSA requires Federal agencies to consult with NMFS if their actions may adversely affect EFH. Added to this Opinion is NMFS' assessment of whether the Proposed Action may result in adverse effects on EFH, and EFH conservation recommendations provided under Section 305(b)(4) of the MSA. NMFS prepared the EFH consultation in accordance with Section 305(b) of the MSA (16 USC 1855(b)) and implementing regulations at 50 CFR 600 subpart K.

The administrative records for both the ESA and MSA consultations are on file at NMFS' Northwest Regional Office in Portland, Oregon.

1.2 CONSULTATION PROCEDURAL HISTORY

1.2.1 ESA Consultation on Willamette Project Operations

Discussions between the USACE, USFWS, and NMFS on the ESA Section 7(a)(2) consultation requirements for the Willamette Project began in early 1999, shortly before UWR Chinook salmon *(Oncorhychus tshawytscha)* and UWR steelhead *(O. mykiss)* were listed (on March 24 and March 25, 1999, respectively [NMFS 1999a and 1999b]). A letter from USFWS to the USACE, dated February 9, 1999, outlined the issues that these two agencies had agreed should be covered in a single BA for a Section 7(a)(2) consultation. A letter from NMFS to the

USACE, dated February 25, 1999, provided additional guidance concerning the types of information to be included in the BA for UWR Chinook salmon and UWR steelhead.

On March 26, 1999, USACE sent a letter to NMFS requesting a species list for the Willamette Basin, which NMFS provided on March 30, 1999. Over the next year, the Services worked closely with USACE and its contractor to develop the BA for the Willamette Project. The Services and the USACE, in collaboration with the State of Oregon, also developed an approach to spring and early summer flow management that could be implemented while consultation was underway (ODFW 2000).

In April 2000, the USACE transmitted the 2000 BA (USACE 2000) to the Services and requested initiation of ESA Section 7 consultation on the impacts of the Willamette Project and maintenance of 43 miles of revetments on ESA-listed species. The proposed action contained in the 2000 BA was based on operation of the Willamette Project prior to the ESA-listing of UWR Chinook salmon and UWR steelhead in 1999. The 2000 BA concluded that the proposed action was "likely to adversely affect" several fish species and one plant species. On the basis of this finding, the USACE requested formal consultation with the Services. The BPA and Reclamation joined the USACE as Action Agencies for this Section 7 consultation at this time.

The Services provided a preliminary Federal review draft of a joint Biological Opinion to the Action Agencies on September 22, 2000. The analysis in the draft Opinion concluded that the continued operation of the Willamette Project was likely to jeopardize the continued existence of UWR Chinook salmon and UWR steelhead, and was likely to adversely modify designated critical habitat for the two species. When the draft was released, the USFWS had not completed its analysis of the Project's effects on bull trout, thus a jeopardy/non-jeopardy conclusion for that species was not included. Because the draft Opinion concluded jeopardy for two species, it included a draft RPA to avoid jeopardy. The Action Agencies developed a set of combined comments on the Federal review draft, which the Services received on January 12, 2001.

On March 22, 2001, the Services provided a revised draft of the RPA to the Action Agencies. The Action Agencies responded with a consolidated set of comments on April 25, 2001. The Services and the Action Agencies met frequently throughout the summer and fall of 2001 to revise and refine the RPA.

By letter dated May 24, 2002, the Action Agencies submitted an amendment to the 2000 BA (USACE 2000) proposing to increase the volume of stored water that could be released from Project dams to accommodate new Reclamation water service contracts. The USACE proposed to add an additional 10,000 acre-feet to the total amount of storage immediately available for water service contracts, for a total of 95,000 acre-feet. The USACE determined that the amended action would result in insignificant incremental effects on listed species, and that the existing BA adequately described the effects of the action on listed species. NMFS replied on August 7, 2002, that it would adjust the scope of the ESA consultation to include this amendment to the water service contracting program, and advised Reclamation to ensure that any actions taken prior to issuance of the Opinion be taken in a manner consistent with section 7(d) of the ESA. Reclamation replied to the Services by letter, dated January 10, 2003, confirming its decision to resume full contracting activities for irrigation water service from the Willamette

Project. Reclamation stated that it would proceed to review, approve, and execute short-term contracts in a manner consistent with section 7(d) of the ESA.

In October 2002, the Services, USACE, BPA, and Reclamation formed a senior-level policy group, called the Managers' Forum, to address Willamette Project issues. This group met approximately monthly through the winter of 2003 to review the progress of the consultation, and to discuss and resolve outstanding issues.

Although the Services initially intended to prepare a single, jointly written Biological Opinion for the Willamette Project, the size and complexity of the consultation ultimately argued against this approach. The Services decided in February 2003, to write two separate Biological Opinions. Despite this change, the Services have still considered this to be a joint consultation, and continued to coordinate between themselves.

By letter dated July 25, 2003, NMFS submitted a revised draft jeopardy Opinion, Chapters 1 through 8, to the Action Agencies for review and comment. On April 26, 2004, NMFS provided a preliminary revised draft RPA. On December 28, 2004, the Action Agencies provided consolidated comments on the NMFS revised draft Opinion, Chapters 1 through 8, identifying a number of key areas of concern that the Action Agencies believed should be resolved before completing consultation.

1.2.2 ESA Consultation on Willamette Project Hatcheries

On March 29, 2000, the USACE and BPA requested initiation of Section 7(a)(2) consultation on the impacts of the artificial propagation programs in the Willamette Basin on listed UWR Chinook salmon and UWR steelhead. On July 14, 2000, NMFS issued a *Biological Opinion on the Impacts from Collection, Rearing, and Release of Salmonids Associated with Artificial Propagation Programs in the Upper Willamette Spring Chinook and Winter Steelhead Evolutionarily Significant Units* (NMFS 2000a; hereinafter called the 2000 Hatchery Opinion), which provided an incidental take statement (ITS) to the USACE and BPA for operation of the hatchery mitigation programs in the Willamette Basin through September 30, 2003. Since expiration of the 2000 Hatchery Opinion, the Action Agencies worked with NMFS to put in place a new biological opinion, as described below.

1.2.3 Merging Hatcheries & Project Operations into a Single Consultation, Development of the 2007 Supplemental BA, and Completion of the NMFS Opinion

On January 3, 2006, the USACE notified the Services of the Action Agencies' decision to prepare a revised proposed action and supplement the 2000 BA. The Action Agencies proposed that the hatchery and Willamette Project consultations be merged because they had many related and overlapping actions. The revised proposed action integrated hatchery operations and recommendations for hatchery reform described in the Oregon Department of Fish and Wildlife's (ODFW) Hatchery Genetic Management Plans (HGMPs). Also, it incorporated measures to be consistent with NMFS' Hatchery Listing Policy (NMFS 2005a), which clarifies that any hatchery-origin population that is part of the same ESU or DPS as a listed natural-origin

population must also be listed under ESA. The Action Agencies proposed to include in the Supplemental BA certain structural measures they had the authority to implement, such as replacing hatchery fish collection facilities located at the base of some of the dams, which were not originally equipped to handle ESA-listed fish. In addition to hatchery operations, the Action Agencies decided to revise the proposed action for the Willamette Project to more accurately reflect current operations, particularly the mainstem and tributary flow modifications implemented since 1999, and to address other issues that came up since 2000.

Throughout 2006 and early 2007, the Action Agencies and Services met regularly to clarify and add detail to measures that would be included in the revised proposed action. The Action Agencies issued the Supplemental BA (USACE 2007a) on May 31, 2007.

On July 17, 2007, NMFS submitted a letter to the Action Agencies requesting additional information on actions proposed in the Supplemental BA. While the Action Agencies were preparing additional analyses in response to NMFS' request, NMFS organized a series of technical and senior policy meetings to clarify outstanding issues. These meetings with the Action Agencies and USFWS, which were facilitated, took place from September 2007 through January 2008 and culminated in general agreement on the terms of a RPA.

During the period, October 2007 through June 2008, the Action Agencies provided the following additional information to NMFS to assist in completion of this Opinion:

- October 2, 2007 letter from the USACE to NMFS, providing reference material and Project operations' modeling results;
- December 14, 2007 letter from USACE to NMFS, identifying specific fish passage and water quality measures that had been agreed to in the 2007 facilitated meetings;
- January 30, 2008 letter from USACE to NMFS, clarifying the measures identified in the December 14, 2007 letter;
- June 2, 2008 email from Alan Donner, USACE, to NMFS, providing additional Project operational and flow modeling analyses in response to NMFS' request; and
- June 17, 2008 letter from USACE, on behalf of the Action Agencies, to NMFS, providing analyses of the effects of the revised proposed action on North American green sturgeon and Southern Resident killer whale, and an analysis of effects of the proposed action taking into consideration climate change. The Action Agencies also requested EFH consultation with NMFS, as required by the MSA.

From January through April, 2008, NMFS was revising its earlier draft Opinion to evaluate the revised proposed action described in the Supplemental BA (USACE 2007a), as well as the subsequently provided additional information, as described in the previous paragraph, and the draft RPA. During this same period, NMFS participated in two staff-level meetings with Oregon Water Resources Department (OWRD), Reclamation, BPA, and USACE to seek clarification on possible mechanisms to protect flows released from Project reservoirs for fish purposes from out-of-stream diversion by holders of Oregon water rights for natural flows. In this Opinion, NMFS includes an RPA measure that requires the Action Agencies to take actions and provide information to OWRD to assist in the process of protecting flows for fish purposes.

NMFS issued a draft Opinion on April 30, 2008 for review by the Action Agencies. In addition to written comments from the Action Agencies, NMFS received verbal comments at 4 days of meetings held with them and USFWS in early May, 2008. NMFS considered Action Agencies' comments, as well as verbal comments received from several Tribes (see section 1.3 below regarding consultation with affected Tribes), in the preparation of this final Opinion, issued July 11, 2008.

1.2.4 Litigation & Settlement

On September 20, 2007, Willamette Riverkeepers and Northwest Environmental Defense Center (plaintiffs) filed a complaint in the United States District Court for the District of Oregon, against NMFS, USFWS, USACE and Reclamation (defendants) alleging violations of the ESA, Administrative Procedure Act (APA) and the National Environmental Policy Act (NEPA) in connection with this consultation. Defendants filed their answer on November 16, 2007. Plaintiffs and Defendants agreed to a Stipulated Settlement Agreement, dated February 26, 2008. The Settlement Agreement includes, among other things, agreement by the Services to complete their Opinions by July 11, 2008.

1.3 CONSULTATION WITH AFFECTED INDIAN TRIBES

The Secretarial Order: American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and Endangered Species Act (SO) clarifies the responsibilities of the Departments of Commerce and the Interior when actions or regulations under the ESA "may affect Indian lands, tribal trust resources, or the exercise of American Indian tribal rights." The SO further states, "The Departments will carry out their responsibilities under the Act in a manner that harmonizes the federal trust responsibilities to tribes, tribal sovereignty, and statutory missions of the Departments." Specifically, NMFS is directed to solicit relevant information from the tribes should they wish to offer any, and to encourage Action Agencies to include affected Tribes in their consultation process.

On October 3, 2001, NMFS contacted tribal fisheries managers alerting them to the Willamette Project ESA consultation and proposing to hold an informational meeting with them. The following Tribes were contacted: Confederated Tribes of the Warm Springs Reservation (CTWS), Yakama Indian Nation (Yakama), Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Nez Perce Tribe, Confederated Tribes of Siletz Indians (CTSI), and Confederated Tribes of the Grand Ronde Community of Oregon (CTGR). On November 13, 2001, the Services and Action Agencies met jointly with technical representatives of CTSI, CTWS, and CTGR for initial coordination regarding the scope and content of the Willamette Project ESA consultation. Representatives from all three Tribes expressed interest in the consultation, especially as it might affect harvest of salmon and Pacific lamprey (*Lampetra tridentata)* at Willamette Falls.

By letters to tribal council leaders dated February 14, 2008, NMFS notified the tribes listed above, as well as the Columbia River Inter-Tribal Fish Commission (CRITFC), each of whom may potentially have an interest in the Proposed Action, of its ESA consultation regarding the Willamette Project. Copies of these letters were also sent to designated contact personnel in their

respective tribe's natural resources or fisheries programs. The letters summarized the purpose of this consultation and solicited information, traditional knowledge or comments the tribes might provide to help in the consultation. The letters also invited the tribes to participate in an informational meeting about the Willamette Project and this consultation, hosted jointly by the Services and Action Agencies, to be held on May 5, 2008. Subsequently, NMFS staff contacted designated personnel at each tribe to discuss the proposed action and to seek the tribe's perspective on potential effects of the proposed action on any Tribal resources and rights.

Tribal biologists or attorneys, or both, from the CTWS, CTUIR, CTSI, and CTGR attended the May 5, 2008 meeting. The Tribal Council Chairman of CTWS also participated. Additionally, technical staff from CRITFC and U.S. Bureau of Indian Affairs (BIA) were present. At that meeting, the Action Agencies described the Willamette Project and conservation measures proposed in the Supplemental BA (USACE 2007a). NMFS and USFWS presented summaries of each agency's respective draft biological opinions, including the RPA measures that NMFS was proposing to include in its jeopardy opinion for UWR Chinook salmon and UWR steelhead. Tribal representatives were invited to ask questions and provide information and verbal comments.

Tribal representatives at the May 5, 2008 meeting requested an opportunity to review the draft Opinion. In response, NMFS invited tribal representatives to view copies of the draft Opinion at NMFS' Northwest Regional Office in Portland, Oregon. On May 22, 23, and 27, tribal representatives from CTUIR, CTWS, CTGR, and CRITFC reviewed the April 30, 2008 draft Opinion. NMFS staff were available to answer questions and listen and respond to verbal comments.

Following this opportunity to review the draft opinion, CTUIR and CRITFC representatives requested an informal meeting with NMFS staff to discuss their concerns. This meeting was held on June 2, 2008. CTWS, CTUIR, YIN, and CRITFC representatives requested another informal meeting with NMFS policy and technical staff, which was held on June 19, 2008. At this meeting, tribal representatives discussed three primary issues: tribal participation and roles in implementation structure, lamprey protection, and tribal participation in studies and decisions related to fish passage, flows, and other RPA measures. NMFS responded that the RPA coordination implementation process included tribal participation. Additionally, NMFS indicated that it would propose consideration of lamprey protection and tribal participation in studies and other measures in its recommended conservation measures.

1.4 LISTED SPECIES OCCURRING WITHIN THE ACTION AREA

There are 13 ESA-listed salmon and steelhead species that may be affected by the Proposed Action. Species that may be affected by this action include: UWR Chinook salmon (*O. tshawytscha)*, UWR steelhead (*O. mykiss*), Lower Columbia River (LCR) Chinook salmon, LCR coho salmon *(O. kisutch)*, LCR steelhead, Middle Columbia River (MCR) steelhead, Columbia River (CR) chum salmon *(O. keta)*, Snake River (SR) spring/summer Chinook salmon, SR fall Chinook salmon, SR sockeye salmon *(O. nerka)*, SR steelhead, Upper Columbia River (UCR) spring Chinook salmon, and UCR steelhead. The listing status and critical habitat designations for each of the species that may be affected by the Proposed Action are identified in Table 3-1.

Except for LCR coho salmon, critical habitat has been designated for all of the anadromous fish potentially affected by the Proposed Action.

Southern Resident killer whales are listed as endangered and the Southern DPS of North American green sturgeon is listed as threatened under the ESA. Both species may be affected by the actions discussed in this consultation. After conducting the analyses included as Appendices A and B to this Opinion, NMFS determines that the Proposed Action and the RPA are not likely to adversely affect either species or critical habitat designated for the Southern Resident killer whale.

1.5 APPLICATION OF ESA SECTION 7(A)(2) STANDARDS – ANALYTICAL APPROACH

This section describes NMFS' approach to applying the standards for determining jeopardy, and destruction or adverse modification of critical habitat that are set forth in the ESA's Section 7(a)(2) and in 50 CFR 402.02 (the consultation regulations). Additional details regarding this analysis are provided by the *Endangered Species Consultation Handbook*, issued jointly by the Services (USFWS and NMFS 1998). In conducting analyses of actions under the ESA's Section 7 and as directed by the consultation regulations, NMFS follows these steps:

- Identifies the action area based on the action agency's description of the proposed action, and describes the proposed action (Section 2 of this Opinion).
- Evaluates the current status of the listed species with respect to biological requirements indicative of survival and recovery and the primary constituent elements (PCEs) of any designated critical habitat (Section 3 of this Opinion).
- Evaluates the relevance of the environmental baseline in the action area to the species' biological requirements and the current status within the action area, as well as the status of any designated critical habitat (Section 4 of this Opinion).
- Determines whether the proposed action reduces the abundance, reproduction, or distribution of the species, or negatively alters any PCEs of designated critical habitat within the action area (Section 5 of this Opinion).
- Determines and evaluates any cumulative effects within the action area (Section 6 of this Opinion).
- Evaluates whether the effects of the proposed action, taken together with cumulative effects and the effects within the environmental baseline, can be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the affected species, or are likely to destroy or adversely modify critical habitat (Section 7 of this Opinion; see CFR 402.14(g)).

The jeopardy standard is survival with an adequate potential for recovery. We apply this standard for the Willamette consultation in such a way that we determine the effects of the Proposed Action, analyze whether these effects appreciably reduce the likelihood of the species survival and recovery, and determine whether the proposed action contributes to survival with an adequate potential for recovery. If, in completing the last step of the analysis, NMFS determines that the action is likely to jeopardize the ESA-listed species or adversely modify critical habitat,

NMFS must identify a reasonable and prudent alternative (RPA) to the proposed action that avoids jeopardy or adverse modification of critical habitat by contributing towards the species survival with an adequate potential for recovery. (see CFR §402.02). In making these determinations, NMFS must rely on the best available scientific and commercial data.

In the critical habitat analysis, NMFS determines whether the proposed action will destroy or adversely modify designated or proposed critical habitat for ESA-listed species by examining any change in the conservation value of the PCEs of that critical habitat. This analysis focuses on statutory provisions of the ESA, including: Section 3, which defines "critical habitat" and "conservation"; Section 4, which describes the designation process; and Section 7, which sets forth the substantive protections and procedural aspects of consultation. This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.2. Instead, NMFS relies upon the Hogarth memo (NMFS 2005b).

1.6 TERM OF THE OPINION

The term of this PA and the Opinion and incidental take statement is through 2023, and encompasses completion of certain major structures intended to improve fish passage and water quality at high priority Project dams, and includes monitoring and evaluations necessary to design effective structures and assess measures in the Proposed Action. Additional major structures and other measures may be in completed after 2023, but steps towards their completion are part of this consultation. NMFS may choose, based on the best available information, to extend this Opinion and the incidental take statement at the request of the Action Agencies. NMFS will determine whether an extension is appropriate, and if so, NMFS will also determine the appropriate length of the extension.

1.7 CONCLUSIONS

In this Opinion, NMFS concludes that the Proposed Action would jeopardize the continued existence of UWR Chinook salmon and UWR steelhead, and would destroy or adversely modify their critical habitat because it does not adequately address adverse effects of the dams, revetments and hatcheries on listed fish and their habitat, factors that are suppressing the viability of both species and are contributing to the high risk of extinction for UWR Chinook. NMFS therefore provided the Action Agencies with a Reasonable and Prudent Alternative (RPA), a package of measures that allows for the survival with an adequate potential for recovery for these two species. A number of the RPA measures will provide benefits in the short-term, reducing each species' short-term risk of extinction, including measures to improve downstream habitat by changing flows and temperature, updating hatchery operations and facilities, improving irrigation diversions and water contracts, upgrading fish collection facilities and outplanting procedures, and conducting habitat improvement projects. These measures will immediately (during the first one-to-seven years of this Opinion) improve population viability and reduce the short-term risk of extinction. This is especially important for UWR Chinook salmon, for which the risk of extinction is "high."[1] Project operations have had a key role in

[1] The Willamette/Lower Columbia Technical Recovery Team (WLCTRT) (McElhany et al. 2007) estimated the risk of extinction over 100 years for UWR Chinook ("high;" see Figure 3-5 in Section 3.2.1.3). The TRT did not estimate the species' short-term extinction risk.

degrading habitat conditions downstream, which in the North and South Santiam, South Fork McKenzie, and Middle Fork Willamette are the only areas still accessible to Chinook for spawning, incubation, and early rearing. The Action Agencies began new reservoir operations in 2000 to meet mainstem and tributary flow objectives for both listed Chinook and steelhead. These, and operations that began in 2005 at the new Water Temperature Control facility at Cougar Dam, are already able to have a positive influence on adult Chinook returns. Under the RPA, interim temperature control operations at Detroit will improve water temperatures in the North Santiam, increasing the survival of eggs, juveniles, and prespawning adults of both species and thus population productivity. All of these measures will reduce extinction risk in the short term as well as contributing to long-term viability.

The RPA includes a number of measures that will be completed in the second half of the term of the Opinion, the eighth to fifteenth years. These include three significant passage facilities at three dams and temperature control at a different dam, as well as other measures. These measures will contribute significantly to both species' survival and potential for recovery. The RPA also requires that the Action Agencies complete various research and monitoring efforts, feasibility studies, and where needed, environmental impact analysis. These evaluations will lead to the construction of facilities and adjustments in operations during the second half of the term of this Opinion that will ensure that conditions are significantly improved for all affected life stages of UWR Chinook and UWR steelhead. These will include further adjustments to flows, passage at three projects, and temperature control at another. The Action Agencies will adapt their operations to new information as well as physical habitat properties, including those related to climate change, as the information becomes available over the next 15 years.

Outside of the Willamette Basin, adverse effects of the Proposed Action are limited to very small changes in flows in the mainstem lower Columbia with slight to negligible effects on listed salmonids and their habitat. NMFS concludes that the Proposed Action does not jeopardize the continued existence of the other 11 species of Interior and Lower Columbia Basin salmon and steelhead, which are affected by the Proposed Action only in that portion of the action area. NMFS also concludes that the Proposed Action avoids any destruction or adverse modification critical habitat for the ten Interior and Lower Columbia Basin species for which it has been designated. NMFS determines that the Proposed Action and the RPA are not likely to adversely affect the Southern Resident killer whale DPS or the Southern DPS of North American green sturgeon, or to destroy or adversely modify critical habitat designated for the Southern Resident killer whale.

Chapter 2
Proposed Action

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2. PROPOSED ACTION

2.1 GENERAL DESCRIPTION & PURPOSES OF THE WILLAMETTE PROJECT

This chapter provides a summary of the Federal action under consultation, the continued operation of the Willamette Project. The proposed action described in the 2000 Biological Assessment (USACE 2000) represented the operation of the Willamette Project at the time of the 1999 listing of UWR winter steelhead and spring Chinook as threatened under the ESA. The proposed action at that time included few actions or measures to conserve ESA-listed species or their habitats. Subsequently, the Action Agencies have modified system operations as described in the Supplemental BA, (USACE 2007a), and proposed new measures in the Supplemental BA to minimize ongoing effects to listed species and to restore habitat affected by the Project. For this consultation, NMFS considers the Proposed Action to be:

- operations and facilities described in the 2000 BA that were not modified by the 2007 Supplemental BA,
- operations in the 2000 BA that *were* modified by the 2007 BA,
- new operations and measures proposed in the 2007 Supplemental BA.

The Willamette Project is a collection of actions that include the operation of 13 USACE dam and reservoir complexes, existence and maintenance of approximately 42 miles of revetments,[1] and operation and maintenance of four hatcheries and related fish collection and holding facilities.

The USACE began the Willamette Project by constructing Fern Ridge Dam near Eugene in 1941 as the first element of the Willamette Basin Plan. Over the next 20 years, the USACE constructed twelve additional dams as part of this Project: Cottage Grove (1942); Dorena (1949); Detroit (1953); Lookout Point, Dexter, and Big Cliff (1954); Hills Creek (1961); Cougar (1963); Fall Creek (1966); Green Peter and Foster (1968); and Blue River (1969). Big Cliff and Dexter are reregulation projects, linked to operation of the Detroit and Lookout Point projects, respectively. Foster serves as both a storage reservoir and as a reregulation facility for Green Peter. The 13 projects are shown in Figure 2-1 and general operational restrictions for each are described in Table 2-1. In conjunction with these, numerous fisheries mitigation facilities were also built, and other ancillary support facilities.

Besides their use for flood control, the USACE reservoirs in the Willamette Basin contain approximately 1,593,700 acre-ft of usable multiple-use storage (Table 2-1). They release stored water from mid-April until the end of November in a manner that supports other Project purposes such as irrigation, navigation, power generation, recreation, instream flows below projects for aquatic life, wildlife, and municipal and industrial water supply (USACE 2000). Eight of the dams have power generation capability.

[1] Revetments are fortified riverbank sections intended to constrain the meandering of rivers.

Figure 2-1 Principal Corps of Engineers facilities in the Willamette Basin.

Table 2-1 Operational Data for Willamette Basin Projects

Project	Minimum Flood Control Pool	Maximum Conservation Pool	Total Conservation Storage	Minimum Authorized Flow Feb - June	Minimum Authorized Flow July - Nov[2]	Drawdown Priority
	Feet (NGVD)[3]	Feet (NGVD)	Acre-Feet	cfs	cfs	
Hills Creek	1,448.0	1,541.0	194,000	100	100	4th
Lookout Point	825.0	926.0	324,200	1,200	1,000	1st
Fall Creek	728.0	830.0	108,200	30	30	5th
Cottage Grove	750.0	790.0	28,600	75	50	5th
Dorena	770.0	832.0	65,000	190	100	5th
Cougar	1,532.0	1,690.0	143,900	300	200	2nd
Blue River	1,180.0	1,350.0	78,900	50	30	3rd
Fern Ridge	353.0	373.0	93,900	50	30	last
Green Peter	922.0	1,010.0	250,000	300	300	5th
Foster	613.0	637.0	248,000	600	400	last
Detroit	1,450.0	1,563.5	281,600	1,000	750	last
Big Cliff[4]						
Dexter						
Total			1,593,700	3,895	2,990	

[2] During a drought, project releases may be cut back to "Minimum Authorized Flows" or below after coordination with State and Federal agencies.

[3] National Geodetic Vertical Datum.

[4] Big Cliff and Dexter are reregulating dams that have no appreciable storage.

2.2 WILLAMETTE PROJECT ADMINISTRATION, ROLES OF USACE, BPA, RECLAMATION

The USACE's Portland District is the primary Federal agency responsible for operation and maintenance of the Willamette Project; however, Reclamation (Reclamation) and the BPA also have important roles, as described in this section.

2.2.1 US Army Corps of Engineers' Roles

2.2.1.1 Flow Management

Flow management (including flood prevention) of the Willamette Project is the responsibility of the USACE's Portland District.[5] The Portland District's responsibilities include coordination among agencies and interested parties and development of plans for water management within the basin. The Portland District coordinates competing demands from power interests, irrigation demands, minimum stream flow requirements, recreational users, and others parties during plan development. Seasonal planning for the spring and summer is based in part on seasonal forecasts by the Natural Resources Conservation Service (NRCS).

The USACE Northwest Division's Reservoir Control Center (USACE) is responsible for reservoir regulation and flow management on a daily basis and makes the daily decisions regarding regulation of flow and storage in the Willamette Basin. The USACE's daily decisions on flow releases are based in part on the hydrologic model maintained by the National Weather Service River Forecast Center, while taking into account current reservoir elevations and inflows, the forecast for precipitation, current snow pack conditions, and runoff conditions. The Portland District coordinates USACE operations with BPA, Reclamation, NMFS, USFWS, ODFW, the Oregon Water Resources Department (OWRD), the City of Springfield, and other concerned governmental entities.

2.2.1.2 Revetment Existence & Maintenance

The USACE in the past built about 93 miles of revetments[6] on the Willamette River and its tributaries as a component of the Willamette Project (USACE 2000). Of the 138 sites that the USACE built, it is directly responsible for 88 sites, equal to about 42 miles, constructed prior to 1951. The USACE has relinquished actual ownership of the other 50 revetment sites to adjacent riparian landowners, but continues to administer programs[7] for their repair and maintenance (USACE 2007a).

[5] In addition, USACE coordinates water releases from their dams with releases from non-USACE dams in the Willamette Basin such as those owned by Portland General Electric on the Clackamas River and Reclamation's Scoggins Dam on the Tualatin River in order to meet downstream flow targets during floods.

[6] Reinforced riverbanks that constrain the river from meandering.

[7] Emergency Assistance Program under Public Law 84-99 (USACE 2000, pp. 2-80) and Section 404 of the Clean Water Act (USACE 2000, pp. 1-25), for example.

2.2.1.3 Hatchery Program

In the Willamette Basin, the USACE operates five fish hatcheries and four satellite facilities used for adult collection, holding, and spawning, rearing, and/or acclimation. These facilities were originally intended to mitigate for anticipated adverse fisheries impacts of the Willamette Project such as blocked fish access to historic habitat above dams and altered downstream water temperatures and flow regimes.

There are also several fish traps that are either adjunct facilities of the hatchery program, or, in some cases (Green Peter/Foster, Cougar, and Fall Creek, for example) were intended to provide continued means for fish to access habitat that was otherwise blocked by dams. USACE operates some of these traps itself, contracts with ODFW to operate others, and discontinued use of other facilities that did not function correctly.

2.2.2 US Bureau of Reclamation's (Reclamation, Pacific Northwest Regional Office) Roles

Reclamation is responsible for the administration of a water marketing program that sells water stored in USACE reservoirs to agricultural users.[8] The existence of the USACE reservoirs results in more summer flows being available for irrigated agriculture than would naturally occur. Reclamation does not operate any of the physical facilities (such as dams, pumps, and canals) of the Willamette Project.

2.2.3 Bonneville Power Administration's Roles

The BPA transmits and markets electrical power generated by those USACE Willamette Project dams that have power producing facilities. Eight of the USACE-owned and operated dams in the Willamette Project produce power for BPA, which pays for approximately 37% of the capital, operations, and maintenance costs of those eight projects (USACE 2000). The Willamette Project generates approximately 184 average annual megawatts (aMW) with annual market value of $82.8 million (Foudrea 2007). BPA also builds and operates transmission lines that deliver the electricity.

The Northwest Power Act requires BPA to fund protection, mitigation, and enhancement activities. A portion of BPA's power-derived revenues are used to mitigate the adverse effects of the hydroelectric systems through funding a variety of mitigation projects throughout the Columbia Basin, including the Willamette Basin.

2.3 PROJECT PURPOSES & RESPONSIBILITIES

The following subsections summarize features or aspects of the Willamette Project that are common to several or all facilities and that pertain to specific authorized and incidental purposes of the Willamette Project. These project purposes are described below, and include flood control, irrigation water supply, municipal and industrial water supply, navigation, flow

[8] Non-agricultural water contracts, such as for municipal or industrial use, for example, would not be administered by Reclamation, but rather by USACE. There are no non-irrigation contracts currently, however.

augmentation, hydroelectric power, recreation, fish and wildlife conservation, and system operation. This section also includes a brief description of the USACE's ongoing land management, bank protection, and emergency assistance programs.

2.3.1 Flood Control

Flood control is a principal purpose of the Willamette Project. Willamette reservoirs are drawn down to minimum flood control pool between September and December according to established operating protocols that take into account various water management objectives as well as flood control.[9] The primary flood control season begins in December and ends in late January. During the flood control season the reservoirs are drawn down to and kept at minimum flood-control levels (called "minimum flood-control pool") so that water can be stored during flood events[10] for subsequent controlled release. Operations during flood events have resulted in quick reductions in project releases, sometimes in a matter of hours, in order to prevent overbank or flooding conditions at control points located immediately downstream of each project and at other locations in the system (Table 2-2). Flood regulation goals for the Middle Fork and mainstem Willamette River are presented in Table 2-3. A representative flood control operation is depicted in Figure 2-2.

Table 2-2 Principal Downstream Flood Control Points for Willamette Basin Projects (USACE 2000 Table 2-2).

Project	River	Downstream (River) Control Points
Detroit	North Santiam	Mehama (North Santiam); Jefferson (Santiam); Salem (mainstem Willamette)
Green Peter	Middle Santiam	Waterloo (South Santiam); Jefferson (Santiam); Salem (mainstem Willamette)
Foster	South Santiam	Waterloo (South Santiam); Jefferson (Santiam); Salem (mainstem Willamette)
Blue River	Blue	Vida (McKenzie); Harrisburg (mainstem Willamette)
Cougar	McKenzie	Vida (McKenzie); Harrisburg (mainstem Willamette)
Fall Creek	Fall Creek	Jasper (Middle Fork Willamette); Harrisburg (mainstem Willamette)
Hills Creek	Middle Fork Willamette	Jasper (Middle Fork Willamette); Harrisburg (mainstem Willamette)
Lookout Point	Middle Fork Willamette	Jasper (Middle Fork Willamette); Harrisburg (mainstem Willamette); Salem (mainstem Willamette)
Dorena	Row	Goshen (Coast Fork Willamette); Harrisburg (mainstem Willamette)

[9] As an example, between mid-September and mid-October, salmon spawn downstream of Cougar, Dexter (Lookout Point), and Big Cliff (Detroit) dams. The State's water management objectives include trying to keep flow levels constant and within site-specific ranges so that salmon redds are not dewatered.

[10] It is not uncommon to experience floods while still in the drawdown mode.

Project	River	Downstream (River) Control Points
Cottage Grove	Coast Fork Willamette	Goshen (Coast Fork Willamette); Harrisburg (mainstem Willamette)
Fern Ridge	Long Tom	Monroe (Long Tom); Salem (mainstem Willamette)

Table 2-3 Representative Downstream Control Points on the Middle Fork and Mainstem Willamette Rivers (USACE 2000 Table 2-3).

Gauging Station	ID Number	Willamette River Mile Distance	Drainage Area (mi^2)	Flood Regulation Goals (cfs)
Middle Fork Willamette River near Jasper, OR	USGS 14152000	RM 195.0	1,340	20,000
Willamette River at Eugene, OR	USACE CBT Code "EUGO"	RM 182.4	2,030	39,000
Willamette River at Harrisburg, OR	USGS 14166000	RM 161.0	3,420	45,000
Willamette River at Albany, OR	USGS 14174000	RM 119.3	4,840	70,000
Willamette River at Salem, OR	USGS 14191000	RM 84.2	7,280	90,000

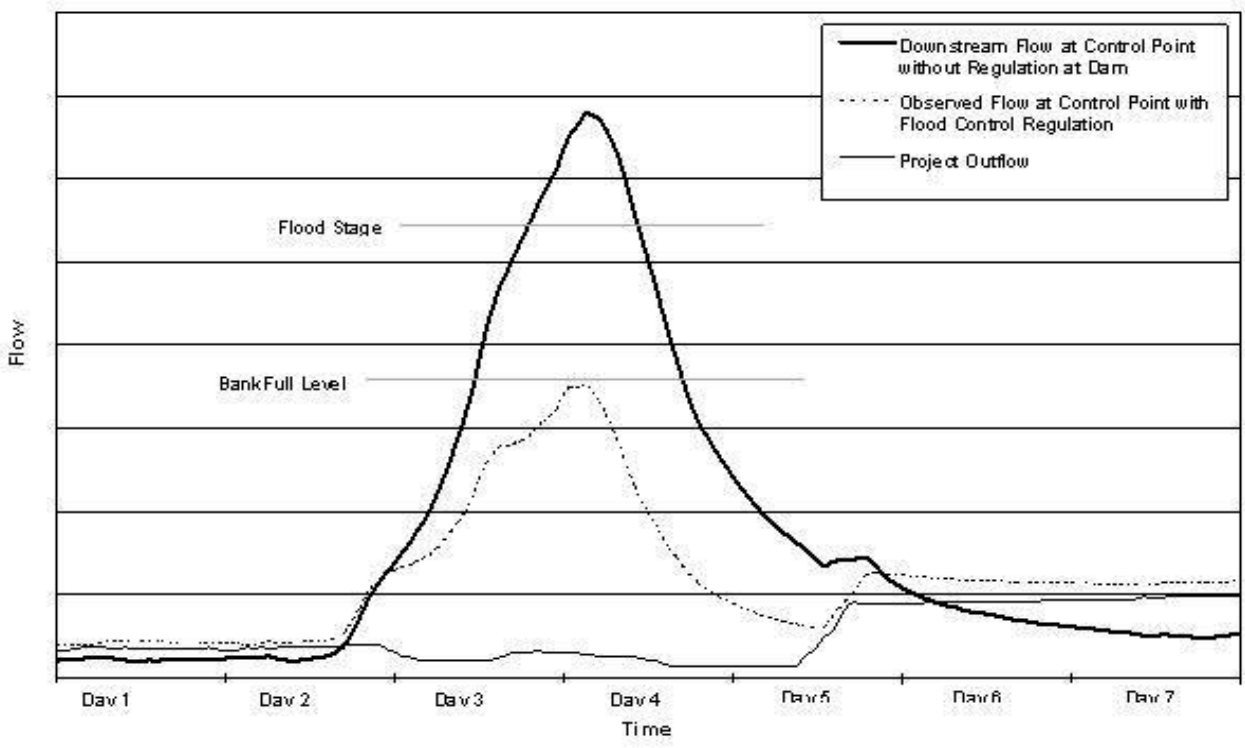

Figure 2-2 Typical Flood control Operating Strategy of Willamette Project Facilities (USACE 2000 Figure 2-1).

The USACE assesses storm tracks and the antecedent conditions in each sub-basin to determine which projects are subject to controlled releases during any given flood event. USACE makes use of real-time continuous monitoring of hydro-meteorological conditions in and near the basin when it prepares flood forecasts and schedules project releases, generally for the next 72-hour period, in 6-hour increments. Inflow is generally passed through each project until flood forecasts predict that outflows must be reduced to prevent project releases from combining with uncontrolled local flow from downstream areas to exceed flood regulation goals at the downstream control points. After flows have receded and the danger of flooding has passed, the USACE coordinates the release of stored flood water among the projects to prevent overbank conditions downriver, and to return the reservoir to the minimum flood-control pool in anticipation of the next potential flood.

Downward ramping rates (rates of change in dam discharges) or upward ramping rates are set by the USACE, and depend on factors such as weather, flow forecasts, and flood control storage, which result in a high or low flow situation. During a high flow situation, ramping rates for reducing or increasing releases can be rapid in order to meet flood control goals. During a low flow situation, ramping rates are more restrictive with respect to hourly and daily changes in order to avoid rapid fluctuations in flow levels. If the forecast flood runoff volume indicates that reservoir space would be exceeded, a special flood regulation schedule is used. This special schedule calls for gradual increases in reservoir releases to avoid sudden increases in outflow as each reservoir fills.

Flood control space in power-producing reservoirs is divided between primary and secondary storage.[11] Evacuation of water stored in the primary flood control zone is made through spillway and/or regulating outlets as rapidly after a flood as downstream conditions permit. Water constituting secondary flood control space is generally discharged through the turbines. The optimal power generation situation occurs when it is possible to discharge all of secondary flood control space and reservoir inflows through the power turbines, thereby avoiding the loss of power generation that would occur if water were to pass through non-turbine outlets. However, the power turbines have limited capacity and at times additional releases must be made through regulating outlets and/or spillways to evacuate more rapidly to minimum flood-control pool levels. The maximum evacuation releases for normal flood control regulation at each project are listed in Table 2-4.

[11] Primary flood control storage is that space needed to control floods that statistically have a 2% chance of happening in any year (50-year flood). Secondary flood control storage provides additional space to control larger floods that statistically have a 1% chance of occurring (100-year flood).

Table 2-4 Maximum evacuation releases Evacuation Releases (cfs) for Normal Flood Control Regulation, as Measured at Downstream Control Points (USACE 2000 Table 2-4).

	Coast Fork Willamette at Goshen	Middle Fork Willamette at Jasper	McKenzie at Vida	Willamette at Harrisburg	Long Tom at Monroe	Willamette at Albany	N. Santiam at Mehama	S. Santiam at Waterloo	Santiam at Jefferson	Willamette at Salem
Cottage Grove	3,000			3,000		3,000				3,000
Dorena	5,000			5,000		5,000				5,000
Hills Creek		8,000		8,000		8,000				
Lookout Point		15,000		15,000		15,000				15,000
Fall Creek		4,500		4,500		4,500				4,500
Cougar			6,500	6,500		6,500				6,500
Blue River			3,700	3,700		3,700				3,700
Fern Ridge					3,000	3,000				3,000
Green Peter								11,000	11,000	
Foster								18,000	18,000	18,000
Detroit							17,000		17,000	17,000
Total Evacuation[1]	8,000	19,500	10,200	37,700	3,000	40,700	17,000	18,000	35,000	75,700
Bankfull Flow[2]	12,000	20,000	14,500	42,000	6,000	70,000	17,000	18,000	35,000	90,000
Regulation Goal	12,000	20,000	14,500	42,000	4,650	70,000	17,000	18,000	35,000	90,000

[1] Above control point

[2] At control point

Floods are less likely to occur from February through early May. This period is referred to as the conservation storage season. Storage space in the reservoirs is filled gradually during this period for later use for purposes such as irrigation, recreation, power production, and water quality. Each project has a refill rule curve that provides guidance in refilling a project in a controlled manner to desired reservoir elevations by specific dates. However, departures from refill rule curves may result from regulation of floods, excessive snow pack above the reservoirs, inadequate water supply, or critical power needs. Excess flood water stored above the rule curve during the conservation storage season is evacuated in accordance with downstream channel capacity. However, when the water supply is inadequate to maintain both minimum flows and the scheduled rate of filling, maintaining minimum instream flows downstream of the facility generally takes precedence. Deficiencies in storage can be made up at any time beyond early May when the water supply is adequate. Refill of a project can also be delayed when excessive snow pack above the reservoirs causes concern for flooding.

2.3.2 Irrigation Water Supply

Congress identified irrigation as a major purpose in project authorizing legislation. Collectively, the total joint-use conservation storage at all 13 projects totals approximately 1.6 million acre-ft (USACE 2000, Table 2-1). Reclamation is responsible for management and development of contracts for use of irrigation water that is stored at USACE projects. On behalf of the Federal government, Reclamation obtained two water rights certificates (No. 72755 and 72756) from the State of Oregon for a total of 1,640,100 acre-ft of stored water for irrigation use only. Specific proposed action measures regarding use of stored water for irrigation are described below in Table 2-13, in Section 2.9 (Water Marketing Program).

2.3.3 Municipal & Industrial Water Supply-

Initially, Congress authorized Reclamation to issue contracts for stored water for agricultural purposes only. However, the Flood Control Act of 1950 reauthorized and expanded authorization to the USACE to construct and operate the Willamette Project, as described in HD 531, and included municipal and industrial water supply as an intended and authorized project purpose (USACE 2000). USACE has not issued any contracts to municipal or industrial users, but USACE may reallocate existing storage space and use by municipal or industrial users at a later time, if necessary.

2.3.4 Navigation

The Action Agencies are not proposing any measures for navigation except for flow augmentation. Navigation remains an authorized purpose for the upper Willamette River above Willamette Falls. In 1871, Congress authorized the first plan for improving the channel between Portland and Eugene (River and Harbor Act of 1871). The plan has been modified several times since to provide for such things as an 8-ft channel between Portland and Oregon City and a 2.5- to 3.5-ft deep channel between Oregon City and Albany, both of which the USACE completed in 1939. A 2.5- to 3.5-ft deep channel was completed between Albany and Corvallis in 1945. On the Yamhill River, a dam and lock at river mile (RM) 8 provided the 18-mile channel to McMinnville, but due to lack of use by commercial traffic, operation of the Yamhill Lock was

discontinued in 1954, with the lock and adjacent property turned over to Yamhill County in 1959 for a park. Uncompleted work on the upper navigation channel consisted of channel improvements and streamflow regulation to control depths of 6 ft at low water from Oregon City to the mouth of the Santiam River and 5 ft from that point to Albany. The USACE maintained the completed portion of the navigation channel to the vicinity of Corvallis until 1973 when commercial navigation traffic declined to a point where further maintenance could not be justified. The portion between Corvallis and Eugene was de-authorized by the Water Resources Development Act of 1986. In the early 1990s, the Mid-Valley Council of Governments investigated the feasibility of deepening the upper Willamette River navigation channel between Newberg and Independence to facilitate recreational and commercial boat traffic. The study found it was not cost effective to deepen the navigation channel at that time.

An element of the upper Willamette River navigation project is the Willamette Falls Locks at RM 26 above the mouth of the Willamette River in the city of West Linn, Clackamas County, Oregon. The canal and locks were first constructed by private interests in 1873. The USACE surveyed the locks and in 1899, recommended government ownership. The project was authorized by the Rivers and Harbors Act of 1910 (Public Law 61-264) and the Federal government purchased the locks in 1915. The existing project consists of four locks each with a vertical lift of about 10 ft, a canal basin, and a guard lock used to prevent flooding when river levels are high. From 1987 to 1993, an annual average of about 5,700 vessels passed through the locks. In 1974, the locks were placed on the National Register of Historic Places. In 1991, the locks also were established as an Oregon Civil Engineering Landmark.

The Flood Control Act of 1938 and the Rivers and Harbors Act of 1945 authorized modifications to the Willamette Falls Locks including a new single lift main lock and a guard lock to replace the existing facilities; however, this project was de-authorized by the Water Resources Development Act of 1986 because navigation did not develop as anticipated. Though the locks last operated from May to October in 2007, continuance of lock operations is uncertain due to funding and maintenance limitations.[12]

2.3.5 Flow Augmentation

Project authorizing documents (HD 544, 75th Congress, third session, March 16, 1938) stipulated a minimum flow of 5,000 cfs between Albany and the Santiam River, and 6,500 cfs downstream to Salem to provide navigation depths of 6 ft and 5 ft, respectively, above Willamette Falls. It was also recognized in HD 544 that these navigation flows would increase flows during the low-water period and would "benefit sanitary conditions along the mainstream" by diluting wastes and increase "the dissolved oxygen content of the stream with a resultant beneficial effect on fish life." HD 531, 81st Congress, second session, March 20, 1950, also stipulates the above minimum flows to allow open-river navigation from Portland to Corvallis and recognizes that these flows would reduce pollution concentrations in the river, and would make oxygen available for fish life. The water quality and fishery strategies for the Willamette River are currently based on the navigation flow requirements originally established at Albany and Salem.

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[12] Willamette Falls Historical Foundation (http://Willamettefalls.org/HisLocks)

The 2000 BA describes the USACE's system operations to augment flows in the mainstem Willamette. These operations and flow levels have been modified since then, and the 2007 Supplemental BA provides updated information. The revised proposed actions regarding mainstem Willamette and tributary flow objectives are described later in Section 2.8.

2.3.6 Hydroelectric Power Generation

Hydroelectric power facilities are installed at eight of the 13 USACE projects in the Willamette Basin: Hills Creek, Lookout Point, Dexter, Cougar, Green Peter, Foster, Detroit and Big Cliff; electrical energy generated at these projects is marketed by BPA. There are two types of Federal hydropower projects in the basin: storage and reregulation. Lookout Point, Detroit, and Green Peter are storage projects and are associated with reregulation dams located downstream (Dexter, Big Cliff, and Foster, respectively). The Foster project also acts as a storage facility. The Hills Creek and Cougar storage projects do not have reregulation dams located downstream. Power facilities do not exist presently at the Fall Creek, Blue River, Dorena, Cottage Grove, or Fern Ridge projects. However, non-federal entities are seeking permits to install hydropower projects at Dorena and Fall Creek.

Power generation at Willamette Project dams is generally linked to releases for other Project purposes such as flood control and environmental needs, though some flexibility exists to generate electricity at different levels throughout the day and during different seasons. Projects with hydropower facilities include exclusive storage space for power generation, but the quantity of storage is relatively small. Drawdowns into power storage are limited to special power requirement periods that may develop during extended cold spells. In general, exclusive power storage is kept full to increase the hydraulic head for power generation. Generation at storage (peaking) projects is often correlated with daily and weekly fluctuations in power demand (load), and flows downstream are therefore subject to frequent fluctuations that require reregulation. Reregulation reservoirs (Big Cliff, Dexter, Foster) are used to moderate flow fluctuations from associated upstream storage projects in order to reduce adverse affects on aquatic and human habitat and life below.

The average monthly generation in megawatts from 1983 to 1995 for each of the Willamette hydropower projects is shown in Table 2-5. The larger, high-head projects of Detroit, Green Peter, Lookout Point, and Cougar generate considerably more power than the lower-head reregulation dams of Big Cliff, Foster, and Dexter. Generation can change drastically from year to year depending on the amount of runoff that occurs in a basin.

Table 2-5 Average monthly power generation (in megawatts), Willamette basin projects (1983-1995). (from USACE 2000 Table 3-8)

Month	Detroit	Big Cliff	Green Peter	Foster	Cougar	Lookout Point	Dexter	Hills Creek	TOTAL (MW)
January	52	14	42	15	17	38	11	20	209
February	38	10	22	12	11	28	6	13	139
March	36	9	21	12	10	28	6	13	134
April	36	10	23	13	15	32	6	16	149
May	51	12	27	11	19	47	9	21	197
June	42	10	18	9	16	40	7	18	161
July	26	6	12	5	14	27	6	10	105
August	23	5	13	0.5	22	33	8	10	119
September	43	11	23	89	22	37	10	28	182
October	56	16	26	12	21	36	10	27	203
November	65	17	52	16.7	18.7	53	13	26	262
December	58	15	58	18	19	46	12	23	245
TOTAL	527	134	333	136	205	446	103	222	2105

2.3.7 Recreation

Recreation use and development is authorized at all the USACE's projects under Federal legislation, including the Federal Water Projects Recreation Act of 1964 (Public Law 89-72) and the Flood Control Act of 1944. Under these authorities, USACE is primarily responsible for providing recreation facilities. The USACE cooperates with the U.S. Forest Service (USFS), Oregon State Parks, ODFW, and Linn and Lane Counties to build and manage a system of water-related recreation facilities. Recreation facilities are provided at all of the USACE's projects and along most of the downstream reaches. Annual visitation to the reservoirs includes 3.6 million recreation visits to USACE-managed areas, in addition to the estimated 700,000 visits to USFS areas managed by the State of Oregon (including Detroit State Park) and county parks located on the reservoirs.

In recent years, the USACE has received increased pressure from reservoir recreational interests and marina operators to maintain reservoirs at high levels throughout the entire recreational season (nominally Memorial Day through Labor Day), such as at Detroit where docks, boat ramps, and other facilities become difficult or impossible to use as the water surface lowers. As a result, the USACE has established a drawdown priority for the projects (Table 2-6). Those projects with the highest recreation demand are the last to be used for meeting flow requirements at Albany and Salem, so their pool elevations are usually are held high until early September. This can result in the tributaries into which they discharge having less water than is optimal for other purposes, fisheries and water quality, for example. On the other hand, those projects with

lower recreation demand are used first for meeting summer mainstem Willamette flows, and are drawn down earlier, and may have higher than proportional tributary flows downstream of their dams. The three most important recreational lakes in the system, Detroit, Fern Ridge, and Foster, are usually the last to be evacuated to meet summer flow requirements.

Table 2-6 Priorities of Willamette Basin Storage Projects (USACE 2000 Table 2-9).

	Drawdown Order for Augmenting Summer Stream Flow	Priority Purposes (USACE 1989)				
		Flood Control[1]	Power Generation	Recreation[2]	Navigation	Irrigation
Detroit	Last	✓	✓	✓	✓	✓
Big Cliff	NA		✓			
Green Peter	5th	✓	✓		✓	✓
Foster	Last	✓	✓	✓	✓	✓
Blue River	3rd	✓			✓	✓
Cougar	2nd	✓	✓		✓	✓
Fall Creek	5th	✓			✓	✓
Hills Creek	4th	✓	✓		✓	✓
Lookout Point	1st	✓	✓		✓	✓
Dexter	NA	✓	✓		✓	✓
Dorena	5th	✓		✓	✓	✓
Cottage Grove	5th	✓		✓		
Fern Ridge	Last	✓		✓	✓	✓

Notes:
1. Has highest priority to ensure public safety
2. during summer months

2.3.8 System Operation

The 13 Project dams are operated as a system. Seasonal regulation of each reservoir is guided by the flood control rule curves for that reservoir. Rule curves are presented in the Biological Assessment, Appendix E, in USACE (2000) for each project, and updated rule curves are

included as Appendix C of this Opinion.[13] The function of the rule curve is to show how much storage space a reservoir should reserve for flood control at any given time of the year. There are three defined control periods in a year: flood control, conservation storage, and conservation holding and release.

Conservation storage means storing water for later use, not for environmental protection. The dates of these seasons vary slightly by project. The USACE is responsible for the daily regulation of all 13 dams, and for coordination with other Federal agencies, such as BPA. During wet winter conditions, when flood control is the primary authorized purpose, coordination with BPA can occur as frequently as once a week, and, at times, coordination can occur several times a day.

Each project is drawn down, as noted earlier, according to a prioritization system based primarily on hydrologic flood control and recreational needs. System drawdown priorities, as well as individual project priorities, are presented above in Table 2-6.

The Willamette Project is operated in conjunction with the Columbia River Basin Project to provide power to the Northwest power grid system. Generally, power production in the Willamette Basin is not adjusted directly to compensate for power shortfalls elsewhere within the system, except insofar as individual projects are operated under a load-following schedule to meet additional power demands within the Willamette Basin and nearby areas.

2.3.9 Land Use Management

Within the Willamette Basin, the USACE administers over 30,000 acres of Project lands. The USACE Regulation 1130-2-435 directs that the land use classifications for project lands be consistent with project land allocations. A project land's "allocation" identifies and documents the specific or generally authorized purposes for which the land was acquired. USACE lands are further classified based on their highest and best uses. The process of zoning the project area into land use classifications represents a further distribution of management categories which, based on the resource available and public need, would allow for full use while protecting project resources. USACE land use classifications define resource management and development practices, which may be either appropriate or inappropriate for that parcel of land. There are five land use categories into which lands at USACE projects may be classified: Project Operations, Recreation, Mitigation, Environmental Sensitive Areas, and Multiple Resource Management. The last can be further subdivided into Low-Density Recreation Use, General Wildlife Management, Vegetative Management, Inactive and/or Future Recreation Areas, and Easement Lands. The extent (acreage) of these lands on each of the projects is summarized in Table 3-13 of the BA (USACE 2000).

2.3.10 Bank Protection Program

The Flood Control Acts of 1936, 1938, and 1950 authorized the Willamette River Bank Protection Program and allowed the USACE to construct and maintain 450,000 linear feet of

[13] The rule curve for Foster Reservoir shown in USACE 2000 does not reflect current spill operations at Foster that were initiated subsequent to 2000. However, this information, as well as rule information for all projects, is included as an MS Excel spreadsheet in Appendix C.

protection works (USACE 2000). The program acts to prevent bank erosion, which affects farmland, roads, bridges, and other improvements. In 1971, the Senate and House Committees on Public Works expanded the program's scope to 510,000 linear feet. The Water Resources Development Act (WRDA) of 1950 required local sponsorship for any new bank protection projects, and it transferred responsibility for maintenance of revetments constructed after 1950 from the USACE to the local sponsor. Maintenance activities include vegetation control among revetment structures, which in the past has included the application of herbicides. However, in recent years, the USACE's inspection letters to sponsors have not required vegetation removal (USACE 2000).

The USACE has constructed or authorized construction of about 489,800 linear feet of erosion protection at 230 locations in the system. These projects are commonly rock revetments constructed of heavy quarry stone (riprap) placed on river banks to keep them from being eroded by the force of flowing water, wind, or wave action. Bank protection structures below RM 59.6[14] (near Dayton) are not part of the Willamette Project and are not maintained by the USACE.

2.3.11 Emergency Assistance Program

Willamette Project operations are must comply with by the Emergency Assistance Program under Public Law 84-99. Table 2-12 in USACE (2000) lists the variety of activities and types of assistance that the USACE may provide in association with flood control and bank protection works. Activities that most directly influence listed species include assisting with emergency bank reconstruction work, and preparation for anticipated, unusually large flood events.

2.3.12 Fish Conservation

The Flood Control Act of 1950 references a USACE report, HD 531, that recognizes the huge runs of anadromous fish in the Willamette River system before the project dams were built. HD 531 states that the dams will adversely affect anadromous fish, and that mitigation is needed. The USACE stated in the report that until passage is feasible, hatcheries are mitigation that should be used for these dams, effects on blocking passage for anadromous fish. More recently, section 306 of the Water Resources and Development Act of 1990 states that environmental protection is one of the USACE's primary missions in planning, constructing, operating and maintaining water resources projects.

2.4 THE 2007 SUPPLEMENTAL BIOLOGICAL ASSESSMENT

The Action Agencies updated their 2000 Biological Opinion in 2007, specifically noting:

> "the intent of the Supplemental BA is not to replace the 2000 BA, but to provide information on the changes influencing the consultation since the 2000 BA was completed; hence, it is not intended as a stand alone document. Unless otherwise stated the elements of the revised proposed action supplement the proposed action

[14] Roughly, north of about McMinnville

> described in the 2000 BA; the base operation for the Willamette Project to meet authorized purposes remains in place." (USACE 2007a)

NMFS has attempted to combine these two large documents and present a single Proposed Action that summarizes continued Project purposes and operations described in the 2000 BA as well as new actions proposed in the 2007 Supplemental BA. The Supplemental BA is organized by the following categories:

Continuing Coordination & Management (USACE 2007a)
This section proposes implementation of a regional forum called the Willamette Action Team for Ecosystem Restoration (WATER) and other related mechanisms to coordinate operation of the Willamette Project and implementation of ESA and related conservation measures between the Action Agencies, the Services, and other agencies and entities with water resource management and fish and wildlife responsibilities in the Willamette Basin.

***Project* Plans** (USACE 2007a)
This section provides an updated description of routine activities associated with operation and maintenance (O&M) of fish collection and handling facilities and presents a proposal for preparing an annual management plan for the facilities in coordination with the Services and ODFW. It also describes routine and non-routine activities associated with outages of turbines and regulating outlets that may have significant implications for aquatic species and habitat, and proposes mechanisms for coordinating with the Services in the event of their occurrence.

Flow Management (USACE 200a)
This section describes changes to reservoir storage and downstream flow timing and volume implemented subsequent to the 2000 BA (USACE 2000) including mainstem and tributary minimum flow objectives and ramping rate guidelines.

Hatchery Operations & Reform Actions (USACE 2007a)
This section describes the operation of the five hatcheries in the Willamette Basin that were constructed and are at least partially funded by the Action Agencies as mitigation for impacts of the construction of the Willamette Project. Measures to reform operation of the hatcheries to better meet the needs of ESA-listed are proposed by the Action Agencies.

Habitat Restoration & Management Actions (USACE 2007a)
This section describes current and proposed actions for restoring degraded habitat utilized by ESA-listed species both onsite (on-project) and offsite (downstream of project lands). This includes measures to address restoration of habitat associated with the Willamette Bank Protection Program.

Structural Modifications: Fish Passage, Temperature Control & Hatcheries (USACE 2007a)
The Action Agencies propose to undertake a series of studies to evaluate the feasibility of large-scale structural modifications; where shown to be technically feasible, biologically justified and cost-effective, the Action Agencies would seek authorization and funding needed to implement those measures.

Water Quality Improvements (USACE 2007a)
The Action Agencies propose to coordinate with the Services, U.S. Environmental Protection Agency (USEPA), ODFW, and Oregon Department of Environmental Quality (ODEQ) to develop and implement a Water Quality Management Plan (WQMP) that describes how the projects would be operated to better meet key water quality requirements for ESA-listed species consistent with Total Maximum Daily Loads (TMDLs) for temperature and total dissolved gas (TDG) developed by ODEQ in compliance with the Clean Water Act (CWA). The Action Agencies propose to operate the recently completed Cougar Dam water temperature control (WTC) facility to better meet downstream water temperature requirements of ESA-listed species. Cougar Dam is the only dam in the Willamette Project with selective withdrawal capability necessary to manage temperatures. The Action Agencies also propose to undertake an extended research, monitoring, and evaluation (RM&E) program associated with Cougar Dam. Evaluation of the physical and biological outputs associated with the Cougar Dam facility are critical to the decision-process associated with the potential for structural modification of other dams in the system.

Research, Monitoring & Evaluation Program (USACE 2007a)
The RM&E activities are integrated throughout the various elements of the proposed actions described in this chapter. Effectiveness monitoring and evaluation is critical for implementing and adaptively managing activities and measures associated with flow management, habitat restoration, hatchery operations and water quality improvements. In addition, rigorous RM&E efforts of existing baseline and possible future habitat and ESA population conditions under a range of potential structural and operational alternatives would be required to determine the feasibility of those alternatives. A mechanism for developing an integrated comprehensive RM&E program in coordination with the Services and others is proposed.

Contract Water Marketing Program (USACE 2007a)
The USACE and Reclamation propose to continue marketing irrigation water supply storage program with interim limitations to the amount of storage to be contracted and with proposed revisions water storage contracts designed to protect ESA-listed species.

Table 2-7 presents a summary of the revised Proposed Action, including current status and key milestones for implementation.

2.5. TERM OF PROPOSED ACTION

The 2000 BA (USACE 2000) presented the Proposed Action with no end date. The Action Agencies anticipated that the revised Proposed Action presented in this Supplemental BA would also continue for the life of the Willamette Project. Subsequently, the Action Agencies requested that the Services issue their Biological Opinions for a term of "at least 15" years (USACE 2007a), based on the following unique aspects of the Proposed Action: (1) availability of program funds appropriated by Congress or provided by others; (2) completion of more detailed evaluation to determine the feasibility of implementation of significant structural or operational modifications; and (3) continued RM&E needed for adaptive management-based decisions for implementation. Consequently, the Action Agencies recognize that there is a significant uncertainty associated with their ability to implement many elements of the supplemental proposed action, specifics of the mitigation measures, and the potential implementation time

frame. Wherever possible, the Action Agencies attempted to define key steps or milestones in the individual actions to be used by the Action Agencies and the Services to determine relative progress toward implementation.

Table 2-7. Summary of Revised Proposed Action, Based on Willamette BA (USACE 2000) and Supplemental BA, Table 3-1 (USACE 2007a).

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
	Base project operation described in 2000 BA (USACE 2000) remains in place unless otherwise specified.	Ongoing Operation & Maintenance	Ongoing
	Continuing Coordination and Management		
2.6	Establish a formalized collaborative regional forum (WATER) for coordination of ESA activities.	Ongoing on an ad hoc basis through ESA Manager's Forum, Interagency Flow management Work Group, and Steelhead and Chinook Above Barriers (SCAB) Committee.	Establish charter and implement forum within 1 year of completion of the Opinion.
	Project Plans		
	Describes routine and non-routine O&M activities for outages (turbine, regulating outlets & spillway gates)	Ongoing - occurs informally on an ad hoc basis through the Interagency Flow Management Work Group.	Ongoing
2.7	Prepare Willamette Fish Passage and Management Plan: (1) identify optimal criteria for operating existing fish passage facilities; (2) describe scheduled and unscheduled maintenance of existing infrastructure that could impact listed fish; and (3) identify protocols for handling, sorting, and releasing fish collected a USACE-funded fish collection facilities. Updated annually; similar to Fish Passage Operations and Maintenance Committee process.	New action	Prepare plan within 2 months of completion of the Opinion.
	Flow Management		
	Establish a formal Flow Management Committee under the WATER to coordinate and collaborate with the Services and other Federal, state, and tribal entities.	New, but occurs already through the interagency Flow Management Work Group.	Tied to WATER; establish charter within 1 year of completion of the Opinion.
2.8	Establish a protocol for notifying Services of deviations from flow targets and related coordination.	Occurs informally.	Tied to WATER; establish charter within 1 year of completion of the Opinion.

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
2.8	Make every effort to meet or exceed minimum mainstem flow objectives as measured at Salem and Albany.	Occurs informally.	Existing targets; ongoing management activity.
	Make every effort to meet or exceed minimum tributary flows that ensure adult fish access to existing spawning habitat below USACE dams, protect eggs deposited during spawning, and provide rearing habitat for listed juvenile salmonids and other fish.	Occurs informally.	Existing targets; ongoing management activity.
	Adopt and follow specific hourly and daily ramp-down rates under normal operating conditions to reduce stranding and desiccation of juvenile fish, redds, and aquatic invertebrates resulting from unnatural flow fluctuations associated with operations of USACE dams.	Occurs informally.	Implement interim guidance immediately; complete a detailed Ramping Rate Study within 2 years of Opinion completion.
	Continue Foster Dam spring fish spill operation.	Occurs informally.	Existing operation; ongoing management activity.
	Flow-related research, monitoring, and evaluation (RM&E) program.	Partially ongoing at low level; future comprehensive RM&E funding contingent on obtaining funds from variety of sources.	Develop a comprehensive RM&E program within 12 months of completion of Opinion; tied to WATER RM&E Committee to develop program.
2.9	**Contract Water Marketing Program**		
	Reclamation and USACE propose to continue the existing irrigation water marketing program for the Willamette Project.	Ongoing marketing program	Continue immediately upon completion of consultation.
	No identified future cap on irrigation water marketing from the Project; water marketing of up to 95,000 acre-feet can be supported by current reservoir operations.	New action	
	In the event that future irrigation demand exceeds 95,000 acre-feet, Reclamation and USACE would reevaluate the availability of water from conservation storage for the water marketing program and consult with the Services.	New action	
	New form of long-term contract to specify ESA protections	New action	

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
2.10	**Hatchery Operations and Reform Actions**		
	Hatchery facilities - continue to operate and maintain four spring Chinook hatcheries (Marion Forks, South Santiam, McKenzie, and Willamette) and associated collection facilities.	Ongoing activities with new goal (hatchery reform): combination of mitigation and conservation hatchery program to increase natural production.	Ongoing
	Hatchery facilities - (1) rebuild collection facilities (Minto, Foster, Dexter); (2) resolve outstanding infrastructure needs; (3) develop long-term hatchery maintenance plans; (3) complete Environmental Review Guide for Operations (ERGO) assessments.	New actions contingent on funding.	Initiate modification of Minto fish collection facility in FY 2008. Implementation of other modifications contingent on findings of system configuration evaluations.
	Hatchery operations - continue use of current broodstock - most suitable for conservation purposes.	Ongoing activities	Ongoing
	Hatchery operations - increase % wild fish in broodstock; (2) ensure broodstock collected throughout the run; (3) insert coded wire tags into all releases in addition to adipose fin clip and otolith mark to ensure prompt ID of hatchery fish and mechanical sorting; (4) experimental release of smaller fish at Marion Forks to mimic natural life history pattern.	New actions	Initiate in FY 2008 pending increase in hatchery monitoring budget.
	Spring Chinook Reintroduction/Outplant Program – Goal is to increase natural production and increase availability of natural-origin fish for broodstock. Methods: (1) continue to release spring Chinook into habitat upstream of Detroit, Foster, Cougar, Lookout Point, and Hills Creek dams; (2) use new protocols for collection, handling, transporting, and releasing fish to increase likelihood of successful spawning; (3) work with USFS and BLM to develop suitable release sites; (4) protocols updated annually by Fish Passage and Hatchery Management Committee and included in Willamette Fish Passage and Management Plan; attached to Hatchery and Genetic Management Plans.	Ongoing activities coordinated through the ad hoc SCAB Committee. Future evaluation and implementation would be integrated into the system configuration feasibility studies.	Potential Columbia River Fish Mitigation (CRFM) funds for studies: RM&E critical to adaptively manage the program with co-managers.

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
2.10	Reducing straying of hatchery-origin McKenzie spring Chinook; evaluate options for constructing a trap at Leaburg Dam; combine with other efforts (including reducing mitigation production).	New action	Timing uncertain; would require coordination through EWEB and others.
	Summer steelhead: segregated program (minimize interactions with wild winter steelhead).		
	Continue use of South Santiam non-native summer steelhead.		
	Primarily RM&E to evaluate impacts (effectiveness of natural spawners, competition hatchery vs. natural origin juveniles); consider reductions in some subbasins.		
	Rainbow trout - relatively minor ESA-issues (other than how to meet production via water supply at Leaburg Hatchery).		
	Hatchery-related RM&E.		
	Genetic and life history characteristics monitoring.		
	Monitoring the conservation of wild/naturally spawning populations.		
	Reintroduction of spring Chinook into historic habitat.		
	Segregated hatchery program RM&E.		
	Habitat Restoration and Management Actions		
	Onsite habitat restoration and management activities: continue to use existing authorities and programs for land and water resource stewardship on USACE-administered lands to manage onsite habitat to benefit and protect ESA-listed species.	O&M environmental stewardship	Ongoing activities
	Offsite habitat restoration	CAP and GI are the only programs for offsite habitat restoration; strategic implementation with Services.	Some studies and construction ongoing; implementation of others is uncertain.

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
2.11	General Investigations (GI) Program: a. Willamette Floodplain Restoration Study b. Eugene/Springfield Metro Area Study c. Lower Willamette Ecosystem Restoration	GI (CG for implementation) Ongoing; complete by FY 2009. Ongoing; complete by FY 2010. Ongoing; complete by FY 2011.	Ongoing activities; implementation uncertain.
	Continuing Authorities Program (CAP): Sections 1135 and 206	Construction General (CG)	
	Willamette River Bank Protection Program: Comprehensive evaluation of habitat and biological impacts of revetments placed or funded by USACE bank protection program: (1) inventory and analyze; (2) identify sites where removal or modification may be feasible; (3) evaluate cumulative effects; (4) provide estimate of areas threatened by future erosion and bank protection; (5) procedures and criteria for justifying new bank protection projects; (6) identify and evaluate current and alternative measures; and (7) recommend and establish criteria for future bank protection and maintenance, repair and rehabilitation of existing sites.	New action	FY 2008 pending availability of funds
	Implement future bank protection modification or removal projects.	New action	Uncertain; implementation may occur through ongoing or future CAP/GI efforts.
	Habitat restoration RM&E.	Partially ongoing	Integrated into ongoing GI, CAP and Willamette Bank Protection Program measures (offsite) and/or O&M stewardship (onsite).
Section	**Summary of Revised Proposed Action**	**Current Status**	**Milestones/ Implementation Schedule**
2.12	**Structural Modifications: Fish Passage, Temperature Control and Hatcheries**		
2.12.1	Complete Post-authorization Change (PAC) report for the Willamette River Temperature Control Project.	Ongoing	FY 2007 ongoing

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
	Implement PAC report recommendations: (1) add fish passage facilities at Cougar; (2) undertake detailed post-construction monitoring and evaluation program.	Willamette Temperature Control Project	Initiate implementation FY 2008
2.12.2	Upgrade Minto Fish Collection and Handling Facility	New action	Complete Detailed Design Report (DDR) in FY 2008; P&S in FY 2009; Implementation in FY 2010.
	Work with the Services and ODFW to establish priorities and implement upgrades to remaining fish collection and handling facilities	New action	Integrate decision process into System Configuration studies.
2.12.3	System Review Feasibility Studies: Undertake a series of studies looking comprehensively at the entire basin and then systematically at the key subbasins to evaluate the feasibility and relative benefits of structural and related operational modifications to the Willamette dams designed to improve survival and productivity of ESA-listed aquatic species. Collectively called the System Review Study, these studies would include evaluation of: (1) the technical feasibility; (2) biological justification; and (3) cost-effectiveness of these and other potential measures so that the relative effectiveness and efficiency of potential Federal actions can be compared. In addition to addressing ESA, System Review would also address structural and operational needs associated with CWA compliance. The studies would be conducted in close coordination with the Services and other state/Federal agencies and tribes. The studies would result in decision documents stating agency positions on individual measures. For those measures determined to be feasible and recommended, the Action Agencies would seek authorization and funds for implementation through normal budget and program procedures.	New action	
2.12.3	Phase I: Reconnaissance	New action	Reconnaissance in FY 2008; $750,000

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
2.12.3	Phase II: Comprehensive Overview Systemwide Feasibility Study	New action	FY 2009 and outyears; Program CRFM
	Phase III: Detailed Subbasin System Configuration Studies	New action	Uncertain depending on funds. Goal is to complete the first Phase III study with Decision Document by FY 2011.
	Phase IV: Pre-construction Engineering and Design	New action	Uncertain depending on funds. Goal is to complete the first Phase IV study with Decision Document by FY 2012.
	Phase V: Implementation	New action	Uncertain depending on funds. Goal is to initiate construction of first Phase V project by FY 2013.
	RM&E for Structural Modification		Integrated into studies at Feasibility level per ER 1105-2-100.
2.12.4	Construction Activities Environmental Coordination and Management: Establish a WATER Technical Committee to coordinate construction activities based on Cougar Environmental Coordinating Committee (ECC).		Tied to WATER; establish charter within 1 year of completion of Opinion.
	Adopt Best Management Practices (BMPs) for construction of all structural modifications to the dams and assoc. facilities, including fish collection and handling, fish passage improvements, and water temperature control (WTC) implemented to improve conditions for ESA-listed species.		Patterned on BMPs established and followed for Cougar Temperature Control Project implementation.
2.13	**Water Quality Improvements**		
2.13.1	Cougar Dam WTC Project: Continue to operate the Cougar WTC Project to meet downstream temperature targets for protection of Chinook salmon.	Ongoing	Ongoing

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
2.13.1	Provide an extended biological RM&E program for Cougar WTC. The RM&E program would include effects of the WTC operation on downstream ecosystem and fish entrainment in the tower. Program objectives are to determine most effective protocols to implement WTC and trap-and-haul program, and to document the biological benefits realized from these protective and restorative measures.	Ongoing and new action	Initiate in FY 2008
	Develop a Cougar WTC Monitoring and Evaluation Plan in coordination with the Services and other members of the Cougar ECC.	New action	Complete by FY 2008
2.13.2	TMDL Water Quality Management Plan (WQMP): Coordinate with the Services and ODEQ, and USEPA to prepare a WQMP to address the TMDL for temperature and other water quality parameters consistent with the needs of ESA-listed species.	New action	Develop plan in FY 2008
	Participate in an Interagency Management Process for temperature-related improvements in Willamette Basin.	New action	Integrated into WATER's Water Quality/Temperature Control Committee
	Assist with collection and analysis of data necessary to support ODEQ revisions of load allocations for each of the 13 dams and reservoirs.	New action	Develop plan in FY 2008; implementation in FY 2009 and outyears in conjunction with specific projects.
	Demonstrate compliance and consistency with the Opinion for the Willamette Project.	New action	Develop plan in FY 2008; implementation in FY 2009 and outyears in conjunction with specific projects.
	Develop a temperature management plan to show temperature improvements needed to achieve load allocations.	New action	Develop plan in FY 2008; implementation in FY 2009 and outyears in conjunction with specific projects.

Section, as numbered in this Opinion, Chapter 2	Summary of Revised Proposed Action	Current Status	Milestones/ Implementation Schedule
	Develop a data and information strategy that may be used for future Use Attainability Analyses for the dams.	New action	Develop plan in FY 2008; implementation in FY 2009 and outyears in conjunction with specific projects.
2.13.3	Ongoing water quality RM&E program.	Ongoing action	Ongoing
	Future water quality RM&E program.	New action	
	Develop/implement multi-year water quality RM&E plan		
2.13.3	Develop/implement Water Temperature study		
	Develop/implement total dissolved gas monitoring plan.		
2.14	**Research, Monitoring and Evaluation Program**		
	Collaborate closely with the Services, ODFW, and others in developing and managing the comprehensive Willamette Basin RM&E program. The coordinating mechanism is the WATER Research Monitoring and Evaluation Committee.	New action	Develop the RM&E program in FY 2008; implement beginning in FY 2009.
	Guiding principles and Strategic questions		

2.6 CONTINUING COORDINATION & MANAGEMENT

This section summarizes existing and proposed mechanisms for continuing coordination and consultation in regard to ESA-listed species and related resource issues in the Willamette Basin.

Proposed Action: The Action Agencies would establish a formalized, collaborative body to assist in the coordinated implementation of the ecosystem restoration measures described in this revised proposed action.

Within 1 year of the completion of the Supplemental BA (USACE 2007a), the Action Agencies, in coordination with the Services and other Federal and state agencies and tribes with fisheries and water resource management responsibilities in the Willamette River Basin, would develop and implement a Charter for a collaborative body to be known at the Willamette Action Team for Ecosystem Restoration (WATER).

The basic purpose and goals of WATER would be to:

- Facilitate a long-term partnership among the Action Agencies and the Services for implementation of measures for recovery of ESA-listed species.
- Provide a forum for coordination and decision-making among the sovereign governments (Federal/state/tribal) working to implement strategies for ESA compliance and related missions and authorities, including Clean Water Act (CWA) compliance associated with the 13 Federal dams operated and maintained by the USACE in the Willamette River Basin.
- Provide an opportunity for input and thorough discussion amongst the Federal and state agencies and tribes actively engaged in these efforts.
- Increase the transparency of decisions on operation and configuration of the Willamette Basin dams as they relate to ESA and CWA compliance.
- Clearly define decision authority and provide a vehicle for elevating decision-making and conflict resolution associated with those efforts to appropriate levels of the involved governmental bodies.

The details of WATER would be worked out during development of the Charter. The Action Agencies initially propose that WATER would follow the hierarchical structure shown in Figure 2-3, below. The suggested structure is discussed in the following sections.

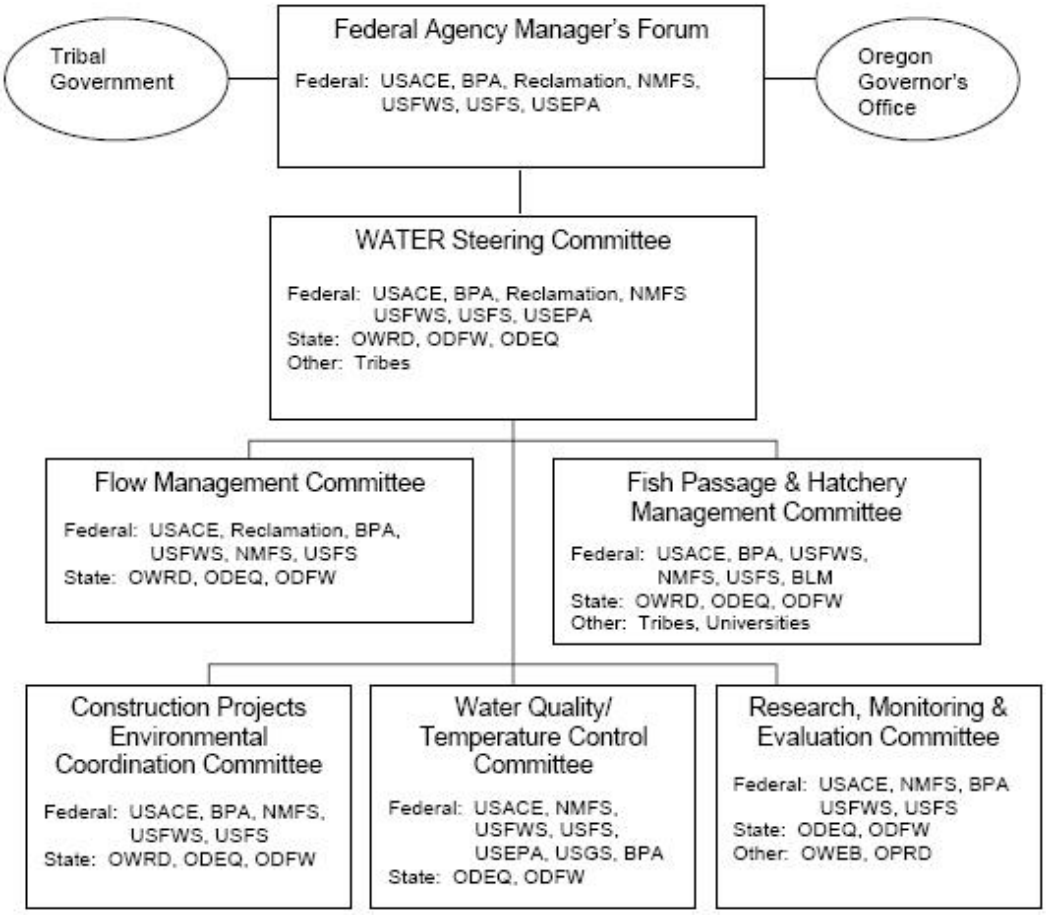

Figure 2-3 Proposed Organizational Structure, Willamette Action Team for Ecosystem Restoration (USACE 2007a).

2.6.1 Federal Agency Manager's Forum

This group would evolve from the existing Manager's Forum established to provide Federal agency senior management level oversight to the Willamette Project ESA consultation. The Forum would act as a regional policy and management level body representing the key participating Federal agencies with responsibility for operating and maintaining the Federal dams in the Willamette Basin (USACE, Reclamation, BPA), and implementation and compliance with ESA (the Services). The existing Forum would be expanded to include Federal agencies with responsibility for CWA compliance USEPA), and other agencies with closely related land and water management responsibilities (USFS). While the Forum would be limited to Federal managers, they would coordinate with executives of the other governmental sovereigns (Oregon governor's office, tribal organizations), as needed. The Forum would meet infrequently (annually or less, or as-needed) at critical milestones, to establish or confirm priorities, or to resolve issues elevated from the WATER Steering Committee level.

2.6.2 WATER Steering Committee

The WATER Steering Committee would be composed of senior project and program managers representing the Federal agencies involved in the ESA Section 7 consultation for the Willamette Project, as well as other key Federal agencies with land and water resource management responsibilities critical to implementation of ESA measures. The Steering Committee would provide project management oversight. It would also be the level at which the participating entities would seek to resolve most disputes and conflicts. The Steering Committee would provide oversight to the work of the five technical coordinating committees (Figure 2-3 above) including establishing annual budget and work priorities. The Steering Committee would be responsible for overseeing and coordinating the activities of the technical coordinating committees engaged in implementation of the separable elements for ESA and CWA compliance and recovery.

2.6.3 WATER Technical Coordinating Committees

Five technical coordinating committees would be established to oversee implementation of the different elements of the proposed action and related resource management activities. The Steering Committee would provide oversight for the technical committees, but the technical committees are the level at which much of the detailed work of implementing ESA and CWA compliance activities would be staffed, planned, scoped, designed, and implemented.

The technical committees would be populated by key functional area technical experts from each of the involved Federal and state agencies and tribes including the Action Agencies, NMFS, USFWS and other key participants including other Federal agencies (USFS, USEPA, U.S. Geological Survey [USGS]), state agencies (ODFW, OWRD, ODEQ, and others), tribal organizations, and other entities. Experts from academia and consulting firms may also become engaged as members of the technical committees, as needed. The makeup of the committees would be reflective of the scope of their respective areas of responsibility.

The number, scope, and responsibilities of the technical committees would be established by the Action Agencies working in collaboration with the Services. The ultimate number, responsibilities, and scopes of the technical committees formed would be determined by the Action Agencies working with the Services through development of a charter for WATER.

2.6.4 Flow Management Committee

The Flow Management (FM) Committee would evolve from the existing ad hoc interagency Flow Management Work Group that has been assisting the USACE in managing the operation of the Willamette Project since the 1990s. The function and responsibilities of the FM Committee are described in detail in Section 2.8.1. The FM Committee would be chaired by a representative of the USACE (Portland District Reservoir Regulation and Water Quality Section). Other members would include key Federal and state agencies with water management authorities and responsibilities in the Willamette Basin including the Services, BPA, Reclamation, USEPA, OWRD, ODEQ, and ODFW. The FM Committee would continue to act in an advisory capacity to the USACE, which would retain ultimate authority for operating reservoir elevations and

downstream flows to meet authorized project purposes. However, more formalized rules, guidelines, and procedures would be established for ensuring that the agencies have adequate opportunity for providing input and coordination into flow management operations and for elevating and resolving disputes that may arise.

The FM Committee would meet frequently throughout the year including monthly meetings during the development and implementation of the annual conservation storage and release plan, and almost weekly (via conference calls) during real-time operations and would advise the USACE on the following tasks:

- Reviewing and evaluating reservoir operating criteria including mainstem and tributary flow targets, and revising operating manuals where appropriate.
- Designing and implementing flow monitoring and evaluation studies needed to determine the effects of reservoir operations on downstream habitat conditions, aquatic species, and water quality conditions.
- Developing the annual operating plan for the conservation storage and release season.
- Providing advice and consultation during real-time operations, particularly but not limited to the conservation storage and release season.
- Conducting annual reviews of Willamette Project operations and documenting issues, concerns and opportunities associated with improving operations to better meet ESA and CWA compliance requirements where possible.

2.6.5 Fish Passage & Hatchery Management Committee

Fish passage around several USACE dams currently uses hatchery collection facilities, and initial efforts to reestablish populations of salmon upstream of the dams involves the use of hatchery fish produced by USACE-funded hatcheries. Therefore, fish passage and hatchery-related issues would be addressed by one committee in the short term. The Fish Passage and Hatchery Management (FPHM) Committee would address issues related to fish passage at USACE dams, to ensure that operation of USACE-funded hatcheries minimizes impacts and supports recovery of ESA-listed species, and to coordinate reintroduction efforts in areas upstream of the dams. A major responsibility of the FPHM Committee would be to develop and annually update the Willamette Fish Passage and Management Plan (FPMP) as described in Section 3.2.2. The Action Agencies envision the FPHM Committee as an interagency team with similar organization and function as the Fish Passage Operations and Maintenance Team on the Columbia River.

The FPHM Committee would evaluate the results of fish passage and hatchery-related RM&E efforts (and refine RM&E efforts accordingly), as well as annually update the Willamette FPMP including broodstock collection protocols and disposition of hatchery- and natural-origin fish, based on the results of RM&E, run size predictions, or structural changes, such as new fish collection facilities, passage facilities, or WTC structures. Because all hatcheries funded by the Action Agencies are partially funded by the State of Oregon (via ODFW), the Action Agencies, and the State of Oregon are responsible for effective hatchery operation and monitoring. Thus, the FPHM Committee would serve as the forum for developing a thorough implementation plan

for the hatchery monitoring program that specifies which RM&E tasks would be funded and/or carried out by the State of Oregon, the Action Agencies, or other entities.

2.6.6 Construction Projects Environmental Coordinating Committee

The Construction Projects Environmental Coordinating (CPEC) Committee would work to coordinate implementation of all future structural modifications undertaken at the Willamette dams to address ESA fish and related needs including fish collection and handling, fish passage, hatchery and WTC facilities. The roles and responsibilities of the CPEC Committee are described in Section 3.6.5. The Action Agencies envision the CPEC Committee as an interagency team with similar organization and function as the Environmental Coordination Committee (ECC) established for construction of the Cougar Dam WTC with NMFS, USFWS, and other key agencies and entities as members.

2.6.7 Water Quality/Temperature Control Committee

The primary responsibility of the Water Quality and Temperature Control (WQTC) Committee would be to ensure integration of water quality improvement requirements undertaken by the Action Agencies to address the needs of ESA-listed species with the requirements undertaken to address CWA requirements. In addition to the Action Agencies and Services, other key members of the WQTC Committee would include USEPA, USGS, and ODEQ.

Activities and responsibilities of the WQTC Committee may include:

- Assisting in the development of study plans for water quality RM&E.
- Assisting in development of uniform water quality criteria and standards for CWA and ESA compliance.
- Reviewing and evaluating water quality RM&E results.
- Assisting in development of criteria for prioritizing WTC proposals.
- Research, Monitoring and Evaluation Committee

The RM&E Committee would be established to oversee development and management of the Willamette RM&E program. In addition to the Action Agencies and Services, other participants of the RM&E Committee may include ODFW, USGS, USEPA, tribes, universities, and others. The Action Agencies foresee this committee overseeing an annual planning process for developing the Willamette RM&E program that is similar to the Federal Columbia River Power System (FCRPS) Regional Forum that develops and manages the USACE Anadromous Fish Evaluation Program. The RM&E Committee, consisting of technical representatives from each resource management agency, would function as a technical review group. This committee's role would be to identify RM&E needs and priorities, develop research summaries, provide peer review for research proposals and reports, and provide recommendations on ongoing and future actions based on research results. The RM&E Committee would be chaired by a USACE representative who would convene meetings, record minutes, and assures that action items are completed. Based on the recommendations of the RM&E Committee, the Action Agencies would solicit study proposals, oversee study completion, and facilitate peer review of study

proposals and research reports to ensure results are based on sound science. Section 3.8 provides additional information regarding the RM&E Committee.

2.7 PROJECT PLANS

The Action Agencies propose the following project plans: (1) describe the kinds of routine scheduled and non-routine unscheduled maintenance activities associated with project operations; (2) outline the Willamette Fish Passage and Management Plan , which would thoroughly describe the operation of all USACE infrastructure that handles or impacts ESA-listed fish, including existing fish collection and passage; and (3) propose mechanisms for coordinating and consulting with the Services and other key stakeholders in the event that unscheduled outages occur.

2.7.1 Routine & Non-routine Operations & Maintenance Activities

Proposed Action: The USACE would continue routine and non-routine maintenance at Project dams.

Each calendar year turbine units, regulating outlets, and spillway gates at the Willamette Project are placed out of service for routine and non-routine maintenance. All turbine units are placed out of service for 1-2 weeks each year for annual maintenance. In almost all cases, this requires the units to be completely dewatered. The units are inspected, cleaned, and lubricated. Each unit is also on a rotating schedule for a more rigorous inspection and cavitation repair approximately every 5 years. This requires the unit to be completely dewatered and placed out of service for 4-8 weeks. In addition to routine maintenance, turbine units are placed out of service for non-routine maintenance. Each turbine unit undergoes a unit rewind every 25-50 years. Each rewind is about 5 months in duration. Turbine units may also be replaced every 25-50 years. Routine and non-routine maintenance on turbine units is always scheduled; however, each year turbine units and regulating outlets may malfunction or be placed out of service for an emergency which results in an unscheduled outage. Timing of these outages is unpredictable and the durations are uncertain.

2.7.2 Willamette Fish Passage & Management Plan

Proposed Action: To minimize impacts to listed fish in the Willamette Basin resulting from the operations and maintenance of the existing infrastructure, the Action Agencies would develop a Willamette Fish Passage and Management Plan within 2 months of the completion of the Willamette Project Biological Opinion.

The Willamette FPMP would: (1) identify optimal criteria for operating fish passage facilities while still meeting authorized project purposes; (2) describe scheduled and unscheduled maintenance of existing infrastructure that could potentially negatively impact listed fish; and (3) identify protocols for handling, sorting, and releasing fish collected at USACE- funded fish collection facilities. The FPMP would also describe mechanisms and procedures for coordinating and consulting with Federal and state resource agencies in the event of scheduled or

unscheduled maintenance. With guidance from the WATER FPHM Committee, USACE would update the FPMP annually to provide ODFW and USACE operators and managers with clear guidance on how to operate each facility. The FPMP would clearly identify the number, origin, and species of fish to be released into habitat upstream of USACE dams, incorporated into the hatchery broodstock, or taken to other destinations. Annual updates would be based on results of RM&E activities, construction of new facilities, recovery planning guidance, predicted annual run size, and changes in hatchery management. The Willamette FPMP would generally follow the draft outline and the "example" section provided in Appendix A of the Supplemental Biological Assessment, (USACE 2007a) Outline of Fish Passage and Management Plan.

2.8 FLOW MANAGEMENT MEASURES

Proposed Action: The Action Agencies would manage water storage and releases at the Willamette Project to avoid or minimize adverse effects on listed fish species by carrying out the following measures:

2.8.1 WATER Flow Management Committee

The Action Agencies would establish a formal Flow Management Committee under WATER to coordinate and collaborate with the Services and with other Federal, state, and tribal entities in the operation of the Willamette reservoirs and in the implementation of measures in Sections 2.8.2 through 2.8.7 (min mainstem flows thru RME below). The USACE would take a leadership role in the administration of this committee, providing for coordination, administration costs, and meeting space. The committee would serve the purpose of providing for development and implementation of the annual Willamette Conservation Plan (WCP), including continued coordination with the Services and with other official agencies and entities throughout the flow management season.

2.8.2 Protocol for Notification of Deviations

The Action Agencies would notify members of the FM Committee by e-mail or phone if conditions or circumstances (e.g., flood damage reduction, emergency operating conditions, etc) might result in deviations from measures in Sections 2.8.3, 2.8.4, 2.8.5, or 2.8.6 (minimum mainstem flows, tributary flows, ramping rates, Foster spill below). If the FM Committee is not e-mailed prior to the deviation event, the USACE would notify the Services within 48 hours of the action taken and would coordinate with the Services within 30 days thereafter. A brief summary report explaining the action taken and the circumstances requiring it would be prepared within the 30-day period following the action. This approach would be taken only if it is not possible to coordinate with the FM Committee or the Services prior to the event.

2.8.3 Minimum Mainstem Flows

The Action Agencies would operate the Project to make every effort to meet or exceed minimum mainstem flow objectives (Table 2-8 below USACE 2007a Table 3-2) as measured at Salem and Albany, Oregon, during April through October in abundant and adequate flow years following the framework described in Appendix D of this Opinion (USACE 2007, Appendix B) and in

collaboration with the Services and other official parties as indicated under Section 2.6.4, the WATER Flow Management Committee. Reduced flow targets would be met in drier years (USACE 2007a, Appendix B).

The flow objectives in Table 2-8 below (USACE 2007a Table 3-2) combine the statutorily authorized minimum flows (House Document 531) as measured at Albany and Salem for the June through October period, which guided historical operations, with new mainstem "fish flow" objectives for April through June. The June through October mainstem flow objectives were described in the Action Agencies' original BA (USACE 2000). The spring targets were added in the 2007 Supplemental BA (USACE 2007a), even though the USACE first began using them in 2000 and have treated them as primary operating criteria since then.

Table 2-8 Mainstem Willamette Flow Objectives (USACE 2007a Table 3-2).

Time Period	7-Day Moving Average[1] Minimum Flow at Salem (cfs)	Instantaneous Minimum Flow at Salem (cfs)	Minimum Flow at Albany (cfs) [2]
April 1 - 30	17,800	14,300	---
May 1 - 31	15,000	12,000	---
June 1 - 15	13,000	10,500	4,500
June 16 - 30	8,700	7,000	4,500
July 1 - 31	---	6,000	4,500
August 1 - 15	---	6,000	5,000
August 16 - 31	---	6,500	5,000
September 1 - 30	---	7,000	5,000
October 1 - 31	---	7,000	5,000

[1] An average of the mean daily flows in cubic feet per second (cfs) observed over the prior 7-day period.
[2] Generally, Congressionally authorized minimum flows (House Document 531). September flows were extended into October.

The flow management protocol described in Appendix D of this Opinion (USACE 2007a, Appendix B) characterizes available flow and water storage during each flow year as "abundant," "adequate," "insufficient" or "deficit" based on the forecasted system-wide storage available by mid-May (Table 2-9, USACE 2007a Table 3-3). The frequency of occurrence for each type of flow year was calculated over the 66-year period of record from 1936-2001 (USACE 2007a, Appendix C).

The "insufficient" threshold volume is based on results of water management actions implemented in 2001 to carefully balance risks associated with the multiple uses for Willamette Basin flow and storage, including the needs of ESA-listed fish species. Attempts to balance these concerns were not previously undertaken in drier years. The "deficit" years would require diligent evaluations of flow management alternatives and coordination during development of the annual Willamette Conservation Plan (page 41) CP using adaptive management. Reservoir-specific draft limits would be used throughout the flow management season in "insufficient" and

in "deficit" years to balance flows among tributaries and to avoid loss of all the usable storage and control of minimum flow discharge below any one project.

Table 2-9 Characterization and Historic Frequency (N=64; 1936-1999) of Water Year Types in the Willamette River Basin (USACE 2007a Table 3-3).

Characteristics of Water Year Types	Abundant	Adequate	Insufficient	Deficit
Mid-May storage (MAF)[1]	≥ 1.48	1.20 to 1.47	0.90 to 1.19	< 0.90
Frequency	58%	17%	9%	16%
Meet all mainstem flow objectives?	Yes	Yes	No	No
Alternative flow targets below objectives	N/A	N/A	Linear sliding scale based on flow targets used during 2001 water year [2]	Balance seasonal flows to retain some control of discharge [2]
Likely status of priority recreational reservoirs[3]	Full throughout most or all of recreation season	Full through most of recreation season	May fill; unlikely to remain full throughout season	Unlikely to fill
Likely Status of Other Reservoirs	Likely to fill; drafted as necessary to meet mainstem flows	May fill; unlikely to remain full throughout season	Unlikely to fill	Unlikely to fill

1 Forecasted useable system-wide reservoir storage accumulated by May 10-20 in millions of acre-feet (MAF).

2 Reservoir-specific draft limits would be used to ensure projects can meet minimum flows through the fall.

3 Detroit, Fern Ridge, and Foster are considered the high-priority reservoirs. "Full" designation means that the project is at an acceptable level for recreation, but physically may not be at maximum conservation pool, or normal summer levels.

2.8.4 Minimum & Maximum Tributary Flows

The Action Agencies would operate to make every effort to meet or exceed minimum tributary flows (Table 2-10 USACE 2007a Table 3-4) depending upon available storage and inflow into each of the associated reservoirs and consistent with flood damage reduction and public safety requirements. The Action Agencies would make every effort to meet or exceed these minimum flows to ensure adult fish access to existing spawning habitat below USACE dams, protect eggs deposited during spawning, and provide rearing habitat for listed juvenile salmonids and other fishes. During winter steelhead and spring Chinook salmon spawning seasons, the Action Agencies would make every effort to maintain flows below the specified maximum flow rate (also in Table 2-10) under normal operating conditions. Because the Action Agencies do not consider "flood damage reduction actions" as "normal operating conditions," the maximum flows listed in Table 2-10 may be exceeded during flood damage reduction operations.

Table 2-10 Minimum and Maximum Tributary Flow Objectives Below Willamette Dams (Donner 2008).

DAM	PERIOD	PRIMARY USE	MINIMUM FLOW (CFS) [1]	PERCENT OF TIME FLOW IS EQUALED OR EXCEEDED[4]	MAXIMUM FLOW (CFS) [2]	PERCENT OF TIME FLOW IS EQUALED OR EXCEEDED[4]
Hills Creek	Sep 1 - Jan 31	Migration &	400	99.9		
	Feb 1 - Aug 31	Rearing	400	99.9		
Fall Creek	Sep 1 - Oct 15	Chinook spawning	200	95	400 through Sep 30, when possible	25
	Oct 16 - Jan 31	Chinook	50 [3]	99.9		
	Feb 1 - Mar 31	Rearing	50	99.9		
	Apr 1 - May	Rearing	80	99.9		
	Jun 1 - Jun 30	Rearing/adult	80	99.9		
	Jul 1 - Aug 31	Rearing	80	95		
Dexter	Sep 1 - Oct 15	Chinook spawning	1200	99.9	3,500 through Sep 30, when possible	10
	Oct 16 - Jan 31	Chinook	1200 [3]	99.9		
	Feb 1 - June	Rearing	1200	99.9		
	Jul 1 - Aug 31	Rearing	1200	99.9		
Big Cliff	Sep 1 - Oct 15	Chinook spawning	1500	95	3,000 through Sep 30, when possible	5
	Oct 16 - Jan 31	Chinook	1200 [3]	98		
	Feb 1 - Mar 15	Rearing/adult	1000	99.9		
	Mar 16 - May	steelhead	1500	99.9	3,000	25
	Jun 1 – Jul 15	steelhead	1200 [3]	99.9		

DAM	PERIOD	PRIMARY USE	MINIMUM FLOW (CFS) [1]	PERCENT OF TIME FLOW IS EQUALED OR EXCEEDED[4]	MAXIMUM FLOW (CFS) [2]	PERCENT OF TIME FLOW IS EQUALED OR EXCEEDED[4]
	Jul 16 - Aug	Rearing	1000	99.9		
Foster	Sep 1 - Oct 15	Chinook spawning	1500	75	3,000 through Sep 30, when possible	1
	Oct 16 - Jan 31	Chinook	1100 [3]	80		
	Feb 1 - Mar 15	Rearing	800	95		
	Mar 16 - May	steelhead	1500	80	3,000	30
	May 16 - Jun	steelhead	1100 [3]	95		
	Jul 1 - Aug 31	Rearing	800	99		
Blue River	Sep 1 - Oct 15	Chinook spawning	50	99.9		
	Oct 16 - Jan 31	Chinook	50	99.9		
	Feb 1 - Aug 31	Rearing	50	99.9		
Cougar	Sep 1 - Oct 15	Chinook spawning	300	99.9	580 through Sep 30, when possible	60
	Oct 16 - Jan 31	Chinook	300	99.9		
	Feb 1 - May	Rearing	300	99.9		
	Jun 1 - Jun 30	Rearing/adult	400	99.9		
	Jul 1 - Jul 31	Rearing	300	99.9		
	Aug 1 - Aug	Rearing	300	99.9		

[1] When a reservoir is at or below minimum conservation pool elevation, the minimum outflow will equal inflow or the Congressionally authorized minimum flows, whichever is higher.

[2] Maximum flows are intended to minimize the potential for spawning to occur in stream areas that might subsequently be dewatered at the specified minimum flow during incubation.

[3] Incubation flows are intended to be no less than ½ the maximum 72-hour average discharge observed during the preceding spawning season. Efforts will be made to avoid prolonged releases in excess of the recommended maximum spawning season discharge to avoid spawning in areas that would require high incubation flows that would be difficult to achieve and maintain throughout the incubation period.

[4] Flow duration estimates are based on HEC-ResSim model output data for the BiOp operation. Period of Record of model data is Water Years 1936-2004.

The Action Agencies would meet these tributary flow levels whenever sufficient water storage and inflow is available, subject to flood damage reduction operational demands. Hydraulic modeling and draft limits would be used (as described in Appendix D of this Opinion and in USACE 2007a, Appendix B) to adjust discharge rates to below the minimum flow levels in Table 2-10 when necessary to avoid depletion of reservoir storage and subsequent loss of ability to regulate flows. Note the "chance of not meeting flow" in Table 2-10 for an indication of the frequency with which the Action Agencies are likely to fall below these minimum flows based on the 66-year period of record from 1936-2001 (Donner 2008). These actions would be coordinated through the WATER FM Committee according to the protocol described in Section 2.8.1 above.

When reservoirs are operating for flood damage reduction, pools are held at or below the flood control rule curve. During winter flood operation season, this level is equivalent to the minimum conservation pool level. This means there is no stored water available for flow augmentation, and if inflow is less than the preferred minimum outflow levels depicted in Table 2-10, then outflow would equal inflow down to the project authorized minimum flows. The Action Agencies expect to be able to forecast and or evaluate the potential for these incidences relatively far in advance and would coordinate them through the FM Committee in accordance with Section 2.8.1 above.

Maximum flows during spawning periods would be observed depending on current and predicted levels of inflow, the elevation of each reservoir in relation to its rule curve, and the need to effectively manage high flow events that could result in flood damage. Likewise, the Action Agencies would attempt to manage flows during incubation periods to be no less than ½ the maximum 72-hour average discharge observed during the preceding spawning season. The need to evacuate a reservoir in preparation for the flood damage reduction season, or to bring it back into compliance with its rule curve following storage of a high water event, is likely to result in discharges that are in excess of the maximums in Table 2-10. The frequency of historic exceedences over the 66-year period of record from 1936-2001 (USACE 2007a, Appendix C) is included in the last column of the table under "chance of not meeting flow." The Action Agencies would strive to keep these occurrences and their durations at a minimum, while continuing to provide for flood damage reduction, as necessary. Exceedences would be coordinated and reported in accordance with the protocol outlined under Section 2.8.1 above.

During spring and summer, hydrologic modeling of flows and storage in the Santiam River would be used to balance rates of discharge that occur during the winter steelhead spawning season with subsequent flows needed during the incubation period to protect natural production of winter steelhead. Use of storage would also consider, and balance with, the need to meet mainstem Willamette River minimum flow objectives and the need to meet minimum tributary flow objectives in the fall during the spring Chinook salmon spawning season.

The Action Agencies are less able to balance spawning period flows (approximately September 1 through October 15) and subsequent incubation period flows (currently through approximately January 31) during fall and winter to protect spring Chinook salmon. This is because the reservoirs are evacuated in September and October (often exceeding maximum spawning flow rates) prior to the onset of the flood damage reduction season, leaving little or no storage in

reservoirs for use in maintaining incubation flows above levels of reservoir inflow. The Action Agencies would avoid unnecessarily high flows during the spawning season for spring Chinook salmon, especially through 30 September, as a means of reducing the risk of redd desiccation due to uncontrollably low flows during the subsequent incubation period. However, their ability to do so is limited by operational requirements associated with providing effective flood damage reduction capability.

2.8.5 Ramping Rates

The Action Agencies would adopt and follow specific hourly and daily ramp-down rates (Table 2-11) at Project dams whenever possible consistent with project purposes. The Action Agencies would use the ramping rates depicted in Table 2-11 for decreasing the flow levels below Willamette Project dams under normal operating conditions to reduce stranding and desiccation of juvenile fish, redds, and aquatic invertebrates resulting from unnatural flow fluctuations associated with operations of USACE dams. Because the Action Agencies do not consider "flood damage reduction actions" as "normal operating conditions," the ramping rates listed in Table 2-11 may be exceeded during flood damage reduction operations. The Action Agencies would work with the WATER FM Committee to plan and carry out studies to characterize channel configuration, ramping rates, flow-habitat relationships, and flow dynamics below Willamette Project dams. Those evaluations would be conducted in the context of the broader flow-related RM&E program described in Section 2.8.7 below.

Table 2-11 Maximum Ramping Rates During Flow Level Changes Below Upper Willamette Basin Dams (cfs) (USACE 2007a, Table 3-5).

Nighttime Rampdown Rates to Achieve 0.1 ft/hour [1, 2, 4, 6, 7]

HCR[5]		LOP[5]		FAL[5]		DOR		COT		CGR[5]		BLU[5]		FRN		FOS[5]		DET[5]	
Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change
400		1200		50				50		400		50		30		800		1000	
600	60 [3]	1500	125	100	20 [3]	100		300	30 [3]	500	80 [3]	250	30 [3]	80	20 [3]	900	100	1200	100
1000	75 [3]	2000	145	300	40 [3]	500	50 [3]	500	40 [3]	1200	100 [3]	500	50 [3]	150	30 [3]	1900	150	1500	110
1500	90 [3]	2500	150	500	50	1000	60 [3]	800	50	2400	150	700	60 [3]	300	40	2000	155	2000	130
1700	100	3000	170	700	60	3700	100					2300	100	1000	50				

Highlighted flows are higher than the minimum flows needed to protect ESA species, but are included to represent the lowest flow rate at which 0.1 ft/hr ramp rate is currently possible at these dams.

Daytime Rampdown Rates to Achieve 0.2 ft/hour [1, 2, 6, 7]

HCR[5]		LOP[5]		FAL[5]		DOR		COT		CGR[5]		BLU[5]		FRN		FOS[5]		DET[5]	
Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change	Q	Flow diff for 0.1' change
400		1200		50				50		400		50		30		800		1000	
600	120	1500	250	100	40 [3]	100		300	60	500	160	250	60 [3]	80	40	900	200	1200	200
1000	150	2000	290	300	80	500	100	500	80	1200	200	500	100	150	60	1900	300	1500	220
1500	180	2500	300	500	100	1000	120	800	100			700	120	300	80	2000	310	2000	260
		3000	340	700	120									1000	100				

1 Avoid a flow volume reduction of more than 50% per hour or the lesser of 1 foot or 50% per 24 hours.

2 Listed are decrements in release that approximately yield the resulting change in flow of 0.1 foot/hour or 0.2 foot/hour. The accuracy of any flow change is subject to the variability of the equipment and instrumentation.

3 Small listed increments in flow are impractical to achieve under current equipment capability.

4 From 1 January - 31 March a nighttime ramp is preferable. A rate of 0.2 ft/hour is considered acceptable for protecting juvenile spring Chinook salmon [NOTE: need to clarify w/Action Agencies].

5 Higher priority because of the presence of ESA listed salmon and steelhead. When system operations prevent USACE from meeting rampdown rates at all projects, USACE will place priority on achieving ramp rates at these projects noted as high priority for fish protection.

6 Change in flow at flows higher than those listed are less critical for protecting ESA species because of proportionally smaller flow volume change.

7 Ramping rates listed are for reservoir operation other than when reducing project outflow to manage for downstream flood damage reduction.

The Action Agencies would not achieve prescribed ramping rates in instances where actual hydrologic conditions turn out to be significantly different from the forecasted conditions. For example, the rate of change in outflows may have to be accelerated to avoid dropping below the minimum pool elevation with a prolonged ramp-down if inflow drops off faster than expected following a storm event. This typically occurs during recessions following significant rain events that require evacuation of flood storage.

2.8.6 Foster Dam Spring Spill

The Action Agencies would continue the spring spill operation at Foster Dam, as described in Section 2.3.2.3 (Chapter 2-32) of the Action Agencies' 2000 BA (USACE 2000) without change. Under this operation, approximately 92 to 238 cfs (0.5 to 1.5 feet of water depth), depending upon reservoir elevation and inflow, would be spilled daily from 0600 through 2100 hours from April 15 through May 15 each year to facilitate passage of juvenile and kelt winter steelhead and juvenile spring Chinook salmon that may be passing from the reservoir near its surface.

2.8.7 Flow-related Research, Monitoring & Evaluation

The Action Agencies would develop and implement a comprehensive research, monitoring and evaluation program to determine compliance with, and effectiveness of the measures in Section 2.8. The RM&E program would be designed to better discern and evaluate the relationships between flow management operations and the resulting dynamics of ecosystem function and environmental conditions downstream of Willamette Project dams, and related effects on ESA-listed fish species. The recommendations for a Flow Management RM&E program would be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and following the principles and strategic questions developed by the committee.

In the mainstem Willamette River and its major tributaries affected by USACE dams, the Action Agencies would plan and carry out studies to characterize functional relationships between anadromous fish migration and flows. These studies would focus on the aspects of fish distribution (e.g., habitat use) and behavior (e.g., migration timing) in relation to rates of discharge by time of year. The Action Agencies, in cooperation with the Services and with the FM Committee, would use this information to better inform and balance tributary and mainstem flow management. If warranted, the Action Agencies would modify, with the approval of the Services, the mainstem flow objectives presented in Table 2-8 (USACE 2007a, Table 3-2) based on relevant findings.

In the tributaries affected by USACE dams, the Action Agencies would plan and implement studies to characterize channel configuration, the effects of ramping, flow-habitat relationships, and flow dynamics below the Willamette dams. Where appropriate, the Action Agencies would experiment with a variety of flow management options (e.g., pulsed flows) that are intended to enhance normative ecosystem function and to restore or rejuvenate critical fish habitat (Gregory et al. 2007). This would include an evaluation of relationships between tributary flow rates and critical habitat for Oregon chub, especially under low flow conditions. The Action Agencies, in cooperation with the Services and with the FM Committee, would use information from these studies to better inform and balance tributary flow management, including minimum and maximum flow levels, ramping rates, and special actions (e.g., pulsed flows). The Action Agencies would also attempt to more clearly define the impacts of contractual irrigation and

withdrawals on tributary flows. As a result of these studies, or if modeling indicates that tributary flow objectives are not physically feasible to achieve as proposed, the Action Agencies may modify, with the approval of the Services, the tributary flow objectives presented in Table 2-10 above or the ramping rates presented in Table 2-11 above (USACE 2007a, Table 3-5) based on relevant findings.

The Action Agencies do not currently have a clearly established source of funding available for implementing a comprehensive flow-related RM&E program. Funding would likely need to be derived from a variety of potential sources. The earliest that significant funding may be available for this program is FY 2010 (i.e., beginning September 1, 2009).

2.9 Bureau of Reclamation Water Marketing Program

Proposed Action: Reclamation and the USACE would continue the existing irrigation contract water marketing program for the Willamette Project. Reclamation would issue new contracts and maintain existing ones such that the total water marketing program would not exceed 95,000 acre-feet. Taking both existing contracts and pending contract applications into account, 14,569.33 acre-feet would remain available to meet future irrigation demands under the duration of the consultation. In the event that future irrigation demand exceeded 95,000 acre-feet, Reclamation and the USACE would reevaluate the availability of water from conservation storage for the water marketing program and consult with the Services.

Section 8 of the Flood Control Act of 1944 gave authority to the Secretary of the Interior to market water stored by Project dams. A series of letters exchanged during 1952 and 1953 constitute the agreement between Reclamation and the USACE that allows for the sale of water from the Willamette Project for irrigation purposes. Conservation storage space totaling 1,592,800 acre-feet is included in 11 of the 13 reservoirs. Reclamation received water right certificates from the OWRD to store water in the storage space allocated to irrigation. Irrigated agriculture in the Willamette Basin is used primarily in July to October for late maturing crops.

At present a total of 205 long-term water service contracts are in effect. Sixty-two percent (127 of 205) of existing contracts have been entered into since 1990. Although the largest contract can provide up to 9,625 acre-feet of water for the irrigation of 3,500 acres and several others contract for more than 1,000 acre-feet annually, most of the contracts serve smaller acreages to individual water users. Cumulatively, the 205 contracts can provide up to a maximum of 50,231 acre-feet of stored water for irrigation of 25,027 acres of land (USACE 2007a).

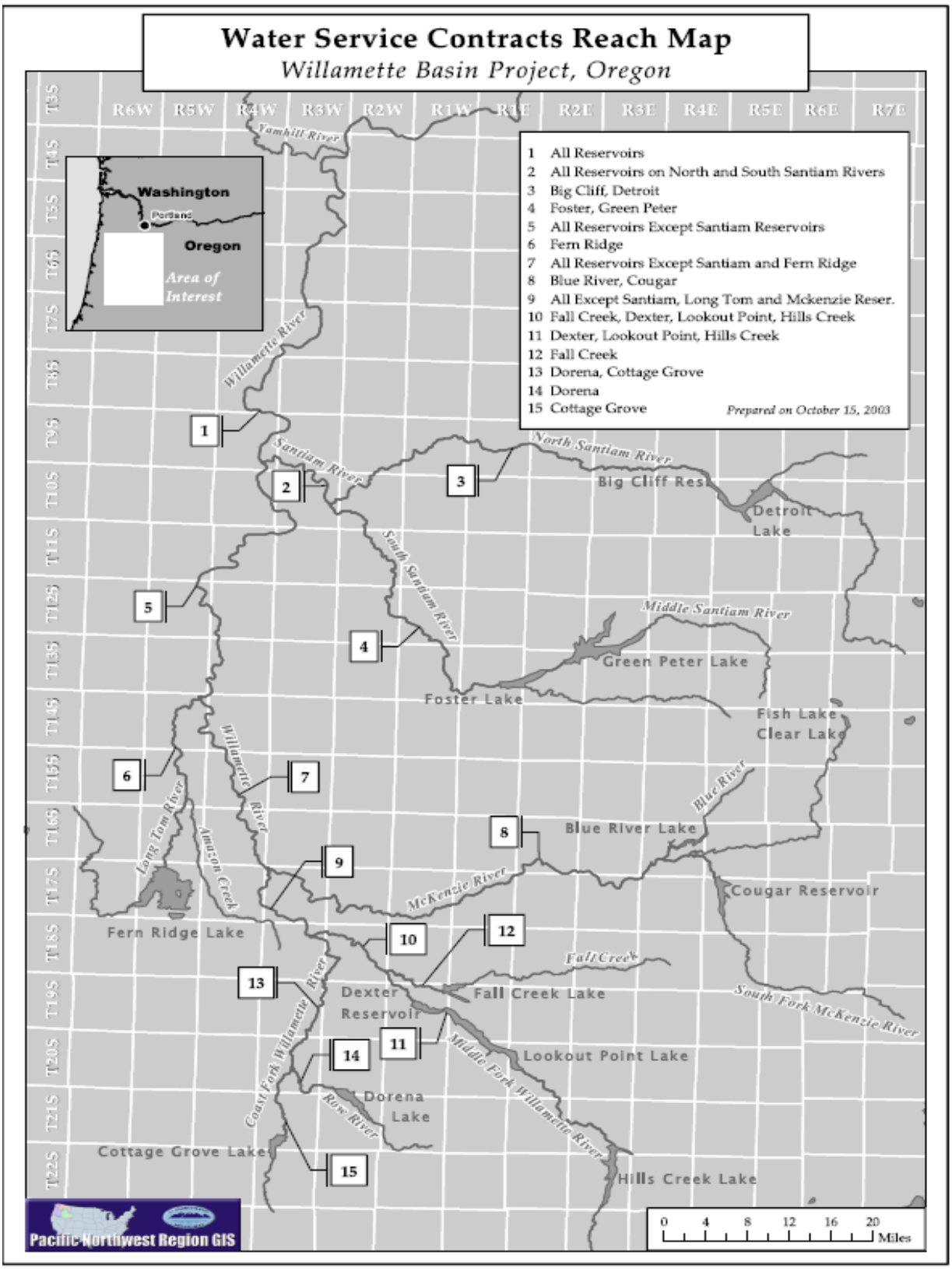

Figure 2-4 Water Service Contracts Reach Map, Willamette Basin (USACE 2007a Fig. 3-13).

Table 2-12 (USACE 2007a, Table 3-24) and the water service contracts reach map for the Willamette Basin, Figure 2-4 (USACE 2007a, Figure 3-13) identify the number of contracts and quantity of stored water provided under each of the 15 reaches downstream of USACE reservoirs. A list of the 205 existing contracts is found in USACE 2007a, Appendix D. In 1999, Reclamation estimated that 40% of the contracts provided stored water to be used as supplemental water on lands with primary natural flow and/or groundwater rights, while the remaining 60% were used as a primary source of water.

Subsequent to the initial listing of UWR Chinook salmon and UWR steelhead in 1999, Reclamation placed a moratorium on issuing new long-term contracts. In 2003, Reclamation lifted the moratorium, yet has not entered into any contracts with terms longer than 1 year.

Table 2-12 Storage Volumes Currently Under Contract for Irrigation Use (USACE 2007a Table 3-24).

Reach	Reservoir Providing Water	Number of Contractors	Total Acre-feet Contracted	Total Acres Served
Willamette River				
Downstream of Santiam River	All	28	6,760.05	3,544.44
Santiam River - Long Tom	All except Santiam Basin	15	3,631.39	1,842.62
Long Tom River - McKenzie	All except Santiam Basin	5	570.00	255.00
McKenzie River - Coast Fork	Fall Creek,	1	9.50	3.80
Long Tom River	Fern Ridge	58	24,052.875	9,876.55
Middle Fork Willamette River				
Downstream of Fall Creek	Fall Creek,	1	135.73	54.29
Fall Creek - Dexter	Dexter/Lookout Point,	2	92.00	36.80
Fall Creek	Fall Creek	2	12.50	5.00
Coast Fork Willamette River				
Middle Fork - Row River	Dorena, Cottage Grove	9	1,164.55	469.61
Row River - Cottage Grove	Cottage Grove	1	56.387	45.11
Row River	Dorena	1	51.00	20.40
McKenzie River	Blue River, Cougar	31	1,640.115	854.48
Santiam River to Forks	Detroit/Big Cliff, Green	7	1,485.05	1,646.60
North Santiam River	Detroit/Big Cliff	30	9,473.545	5,807.26
South Santiam River	Green Peter, Foster	14	1,096.11	564.68
TOTALS		**205**	**50,230.802**	**25,026.64**

As of March 2007, there were a total of 62 applications pending for water service from the project in the various stages of processing (a summary of applications per reach is included in USACE 2007a, Appendix D). These requests, if approved, would provide up to 30,200 acre-feet of stored water to irrigate 17,649 acres of land. Upon execution of these contracts, the water marketing program would include 267 active long-term contracts for the annual irrigation of 42,675 acres with up to 80,431 acre-feet of stored water; approximately 5 % of the active conservation storage space available in project reservoirs.[15] Table 2-13 (USACE 2007a, Table 3-25) identifies the number of existing and pending contracts, volume of stored water, and acreage served for each of the 15 reaches downstream of USACE dams.

At the current low level of use for water service contracts, the USACE does not make special operational adjustments, such as increasing flow releases, to meet contract requirements. The USACE does not propose to make special flow adjustments at its dams to supply the total water marketing program of 95,000 acre-feet during the term of this action.

Reclamation and the USACE propose to avoid potential impacts of water contracts on listed species through the USACE's ongoing reservoir management activities and through continued inclusion of protective language developed for contracts. Reclamation has developed a revised form of water service contract that would be used for all new long-term contracts from the project. All existing contracts entered into since 1995 contain a subarticle that allows for review and modification of the terms and conditions of the contract by Reclamation, at any time, to avoid or minimize impacts to endangered species or other valuable natural resources. New contracts would contain similar language and would require review at least every 5 years, to ensure that continued use of the contracted water would avoid or minimize impacts to species and/or critical habitat that are proposed, listed, or designated under the ESA.

Neither Reclamation nor the USACE monitors the diversion, use, or return flow associated with the water service contracts. The diversion works are privately owned structures maintained and operated by the contractors. Diversion of the water made available under these contracts occurs pursuant to state water rights. Prior to taking water under Reclamation contract, OWRD requires all contractors to obtain a water right permit to divert stored water under their contracts. Monitoring of these diversions falls under the jurisdiction of the local OWRD watermaster.

Table 2-13 Storage Volumes under Existing and Pending Irrigation Contracts (USACE 2007a, Table 3-25).

Reach	Reservoir Providing Water	Number of Contractors	Total Acre-feet Contracted	Total Acres Served
Willamette River				
Downstream of Santiam River	All	53	23,275.32	11,593.40
Santiam River - Long Tom River	All except Santiam	24	12,424.54	8,890.52
Long Tom River - McKenzie	All except Santiam	6	768.75	334.50
McKenzie River - Coast Fork	Fall Creek,	1	9.50	3.80

[15] The 205 contracts presently in force cover approximately 3% of the available conservation storage space.

Reach	Reservoir Providing Water	Number of Contractors	Total Acre-feet Contracted	Total Acres Served
Long Tom River	Fern Ridge	63	24,594.275	10,310.20
Middle Fork Willamette River				
Downstream of Fall Creek	Fall Creek,	4	958.73	498.29
Fall Creek - Dexter	Dexter/Lookout	4	94.75	37.90
Fall Creek	Fall Creek	2	12.50	5.00
Coast Fork Willamette River				
Middle Fork - Row River	Dorena, Cottage	10	1,166.05	470.21
Row River - Cottage Grove	Cottage Grove	1	56.387	45.11
Row River	Dorena	1	51.00	20.40
McKenzie River	Blue River, Cougar	38	1,740.165	915.96
Santiam River to Forks	Detroit/Big Cliff,	8	1,835.05	1,882.60
North Santiam River	Detroit/Big Cliff	34	12,269.045	7,071.36
South Santiam River	Green Peter, Foster	18	1,174.61	596.08
TOTALS		**267**	**80,430.672**	**42,675.33**

Reclamation would require new water service contracts to comply with state and Federal fish screening and passage standards, and existing contractors would be notified of their responsibility to comply with these standards. New contracts would include language requiring the contractor to submit written verification that any required fish passage structures are compliant with state and Federal standards, and that the contractor would install, operate, and maintain such structures throughout the contract period.

2.10 FISH HATCHERIES & RELATED PROGRAMS

Congress recognized that the 13 dams and 42 miles of revetments associated with the Willamette Project would adversely impact the fisheries resources of the Willamette River and authorized the construction, operation, and maintenance of hatcheries and related facilities to mitigate for fish losses (HD 544, 75th Congress, 3rd Session, 1938; Public Law 732, 79th Congress, 2nd Session, 1946). The USACE funds ODFW to manage and operate all facilities associated with the Willamette Hatchery Mitigation Program. Hatchery facilities are distributed throughout the Willamette Basin in tributaries with USACE dams that formerly contained large historical populations of spring Chinook salmon and winter steelhead (Figure 2-5). Most of the hatcheries also operate satellite fish collection facilities for broodstock collection and as collection sites for adult fish that are released into areas upstream of USACE dams.

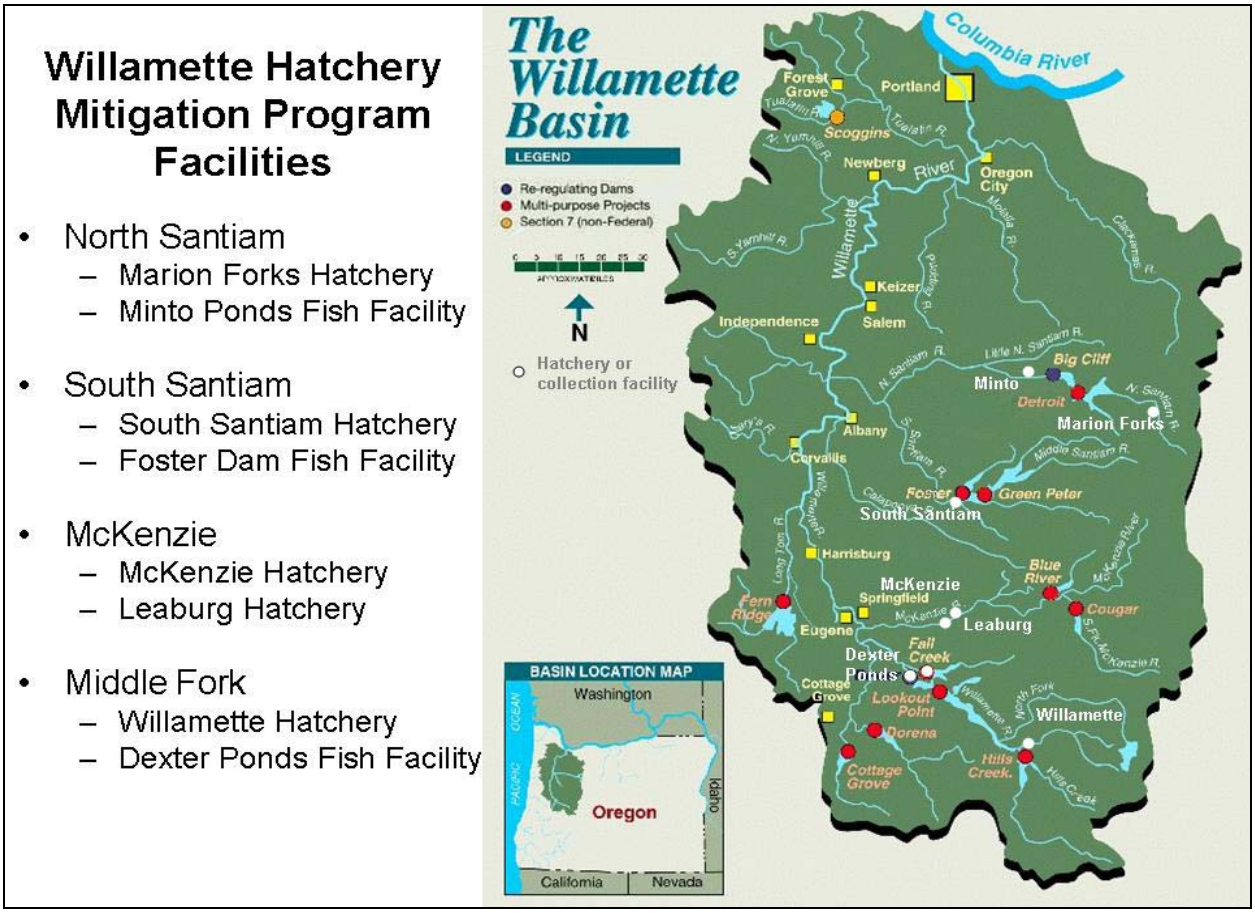

Figure 2-5 Location of USACE-funded Dams, Hatcheries, and Collection Facilities (USACE 2007a).

The State of Oregon contributes additional funds to each hatchery facility based on a percentage described in the 1990 Cooperative Agreement as described in Table 2-14 (below). The percentage of state funds varies with each facility, and the USACE proposes to continue funding each facility according to these percentages until a new agreement is negotiated. The mitigation production requirements for each facility are described in the 1990 Cooperative Agreement and are discussed in more detail in the following sections. Currently, the program funds production of spring Chinook salmon, summer steelhead, and rainbow trout at eight facilities.

Table 2-14 Summary of Cost-sharing Arrangements for USACE-funded Hatcheries and Collection Facilities (USACE 2007a).

Subbasin	Hatchery Program	Hatchery Facility	Operation and Maintenance	Funding percentages**	
				USACE/BPA	ODFW
North Santiam	North Santiam Spring Chinook	Marion Forks Hatchery	ODFW	83.75%	16.25%
		Minto Pond Fish Facility	ODFW		
South Santiam	South Santiam Spring Chinook	South Santiam Hatchery	ODFW	70%	30%

Subbasin	Hatchery Program	Hatchery Facility	Operation and Maintenance	Funding percentages**	
				USACE/BPA	ODFW
	Summer Steelhead	Foster Dam Fish Facility	ODFW/USACE		
McKenzie	McKenzie Spring Chinook	McKenzie Hatchery	ODFW	50%	50%
		Leaburg Dam*	EWEB	0%	0%
Middle Fork Willamette	Middle Fork Willamette Spring Chinook	Willamette Hatchery	ODFW	83.75%	16.25%
		Dexter Pond Collection Facility	ODFW/USACE		
McKenzie	Rainbow Trout	Leaburg Hatchery	ODFW	100%	0%

*Leaburg Dam is owned and operated by the Eugene Water & Electric Board (EWEB). The USACE does not own, fund, or operate Leaburg Dam, but the ladder is used to collect wild hatchery broodstock and to remove hatchery spring Chinook from the wild fish sanctuary upstream of Leaburg Dam.
** Cost sharing is based on the 1990 Cooperative Agreement.

2.10.1 Spring Chinook Reintroduction/Outplant Program

Proposed Action: The Action Agencies would continue the Spring Chinook Reintroduction/Outplant Program and evaluate the long-term feasibility of establishing viable spring Chinook salmon populations in existing habitat in the North Santiam above Detroit Dam, South Santiam above Foster Dam/Green Peter Dam, South Fork McKenzie above Cougar Dam, and into the Middle Fork Willamette above Lookout Point and Hills Creek Dams.

For the past 15 years, ODFW has been releasing excess adult hatchery spring Chinook collected at USACE facilities into historic habitat, including areas upstream of USACE dams. Initially, these releases were intended to provide nutrient transfer from the ocean to freshwater and juvenile fish to serve as a prey base for native resident fish (bull trout) and wildlife. While supplementing natural production of spring Chinook was not one of the original goals, field observations indicated that some juvenile fish were being produced upstream of the dams and passing downstream successfully (Taylor 2000; Beidler and Knapp 2005). Thus, ODFW expanded releases, and currently ODFW and the USACE release (outplant) excess hatchery adults (and some wild adults in certain circumstances) above USACE dams in the North Santiam, South Santiam, McKenzie, and Middle Fork Willamette subbasins. Operation of the Reintroduction/Outplant Program has been coordinated by an informal interagency group of biologists from ODFW, NMFS, USFWS, USACE, and U.S. Forest Service. Details of these past releases, including summaries of the limited data regarding juvenile production, are described in Beidler and Knapp (2005).

The outplant/reintroduction component of the Proposed Action is included in the Hatchery Program section because all of the outplanted fish are typically collected during normal broodstock collection at the traps near the base of the dams. The existing hatchery-related facilities are currently used to collect fish for broodstock and outplanting efforts. The following

paragraphs summarize the major components of the Spring Chinook Reintroduction/Outplant Program that are part of the revised proposed action in the Supplemental BA (USACE 2007a).

The Action Agencies would carry out and evaluate these activities for 15 years (3 generations) to increase the percentage of natural-origin fish returning to the Willamette Basin. Outplanting protocols would employ techniques and strategies to collect, hold, and release outplants in a manner that increases the likelihood for spawning success and ensures that outplanted fish represent the range of life history characteristics of the natural population (to the extent possible with the current temperature regime). The releases would be conducted in accordance with the Willamette FPMP, described below, which specifies the operating schedule for each fish facility, the number and origin of adult fish released from each fish facility above the dams, and handling, transport, and release protocols for the reintroduced fish. The Willamette FPMP would be updated annually.

2.10.1.1 Willamette FPMP: Fish Disposition & Outplant Protocol Development

Proposed Action: The Action Agencies would prepare the Willamette FPMP, including the "Fish Disposition and Outplant Protocol" sections of each chapter. The FPMP would be completed within 2 months of issuance of the Biological Opinion, and updated annually.

The Fish Disposition and Outplant Protocol section of the Willamette FPMP would serve as an annual reintroduction/outplanting plan that describes the number, timing, origin, and destination of adult spring Chinook to be outplanted upstream of USACE dams and into other accessible habitat. These chapters would also be attached as Section 15 of each HGMP. The Action Agencies and ODFW, through the FPHM Committee, would adjust these protocols annually based on expected run size, recent RM&E results, structural changes at the facilities, run timing/size, and strategies identified in the ESA-recovery planning process or hatchery reform efforts, such as the Columbia River Hatchery Reform Project (NMFS 2006a)

Rationale

To date, there has been no formal fish passage or outplant plan to guide spring Chinook fish passage and reintroduction in the Willamette Basin – these activities have been overseen on an as needed basis by the interagency SCAB Committee and implemented by hatchery and USACE staff. By formally developing and updating these protocols annually, all agencies at all levels (i.e., policymakers to hatchery technicians) would have written explanation of the outplanting and reintroduction program for the coming year, including timing, numbers, and location of fish releases; and the specific protocols for conducting the releases. This would also enable Federal land management agencies (USFS and U.S. Bureau of Land Management [BLM]) to appropriately allocate resources for ESA consultations on their land based on known presence of ESA-listed species released in the vicinity of their land.

2.10.1.2 Current Reintroduction & Outplant Protocol

The following actions describe protocols listed in the May 15, 2006 letter from NMFS to the USACE and ODFW. These protocols were developed and agreed upon by the interagency SCAB Committee, and the USACE has agreed to follow them. The SCAB Committee also

developed preliminary guidelines regarding the location and frequency of collect fish for outplanting; and guidance on when and where to release fish at the various release locations to increase the likelihood of spawning success.

Proposed Action: The Action Agencies would ensure that outplanted fish represent the life history characteristics of the natural population (to the extent possible) and promote successful production. Timeline: ongoing/immediate.

The Action Agencies would ensure that all outplanted fish are of a suitable stock for reintroduction efforts (i.e., UWR spring Chinook, see Section 3.4); fish represent the full range of life history characteristics exhibited by the naturally spawning populations; and that the specific fish are selected to improve the likelihood of producing juveniles. The Action Agencies would ensure consideration of age/size distribution, condition, and sex ratio of outplanted fish. The Action Agencies would also consider the use of other life history stages (e.g., juveniles) in reintroduction efforts, if the recommended by the FPHM Committee to increase productivity.

Rationale

A successful reintroduction and supplementation program would depend on the use of fish that represent the range of genetic diversity and life history characteristics of the natural-origin portion of the UWR spring Chinook ESU. The Action Agencies would balance these needs with considerations for ensuring that collection and release timing of outplants are planned to ensure the greatest likelihood of seeding available habitat and improving spawning success.

Proposed Action: The Action Agencies would collect, hold, transport, and release outplanted fish in a manner that increases the likelihood for spawning success. Timeline: ongoing/immediate.

- Until new fish collection facilities are constructed, the Action Agencies (often through ODFW) would operate fish facilities in a manner that minimizes harm and stress to adult spring Chinook by implementing new handling, transport, and release protocols. These protocols would be described in more detail in the Fish Disposition and Outplant Protocol section of the FPMP (and attached as Section 15 of the HGMP). In general, the USACE would implement the following practices to reduce stress on adult Chinook handled at Minto Pond, Foster, Dexter, and Cougar fish facilities, and at other locations where fish may be collected (e.g., McKenzie Hatchery or Leaburg Dam), when appropriate:
- Whenever possible, use MS-222 or Aqui-S/Clove oil as an anesthetic instead of CO_2 (not always possible if fish are released into areas with allowable harvest).
- Transport adults at a loading density of at least 25 gallons/fish (i.e., 50 fish/1,500-gallon tank).
- Treat outplanted fish with erythromycin and oxytetracycline as appropriate.
- Use Nov-Aqua in transport tank to reduce stress during transport.
- Minimize the difference in water temperature between the truck and receiving waters.

Rationale

These activities should reduce stress on adult fish as they are handled, transported, and released. Reducing stress should reduce the susceptibility of outplanted fish to various diseases; ultimately reducing the high rates of pre-spawning mortality that were documented in some years. Reductions in pre-spawning mortality are necessary to ensure successful production upstream of USACE dams or in other historic habitat (e.g., Little North Santiam River).

Proposed Action: The Action Agencies would employ safe release methods for transported fish. Timeline: ongoing/immediate. Modify release sites to comply with these criteria as soon as possible.

Until new release sites are developed, the Action Agencies would increase the likelihood that outplanted fish would survive to spawn by:

- Minimizing the distance between the truck and the receiving waters.
- Avoiding the use of collapsible hoses.
- Releasing fish into low-velocity water with adequate depth and proximity to holding habitat.
- Attempting to avoid releasing fish in close proximity (spatially or temporally) to recreational use.

Rationale

Release locations in the many subbasins were selected opportunistically at locations where managers could get the liberation trucks relatively close to the river. Release sites were not selected based on the suitability of surrounding habitat for providing recovery, holding, and spawning habitat for released adults. Many of the current release sites have relatively poor river access, forcing drivers to release fish using methods that elevate stress or cause direct or delayed injury or mortality. These release practices (e.g., use of collapsible hoses, sliding on tarps, direct release from bridges, etc) have likely contributed to high pre-spawning mortality of outplanted fish. Furthermore, some sites are located at river access points that experience heavy recreational pressure that leads to disturbance, harassment, or poaching of outplanted fish. Implementation of new release protocols should reduce the incidence of stress, injury, and mortality, which would translate to higher spawning success.

Proposed Action: The Action Agencies would work with fishery co-managers and land management agencies to develop suitable release sites for adult spring Chinook above Detroit, Foster, Lookout Point, Hills Creek, and Cougar reservoirs. Work with the FPHM Committee to identify small fixes to current sites in 2008, but ensure that any new facilities are developed based on monitoring efforts associated with the outplant program. When suitable sites are identified, work with land management agencies (e.g., USFS and BLM), or private landowners to develop infrastructure.

The Action Agencies would work with state and Federal co-managers and landowners (through the FPHM Committee) to identify potential new release sites for spring Chinook salmon upstream of several reservoirs. The USACE would provide information on the quality and quantity of holding and spawning habitat in the vicinity of potential sites using the database

developed in the habitat assessment completed[16] by R2 Resource Consultants. The FPHM Committee would select sites based on proximity to suitable holding and spawning habitat and the ability to develop suitable infrastructure necessary to safely release UWR spring Chinook (and potentially UWR winter steelhead) into quality habitat as part of the spring Chinook reintroduction program.

Rationale

Poor release conditions likely increase the incidence of pre-spawning mortality in adult releases. New release sites must be developed to allow safe transfer of fish from the truck, adequate recovery in pools without recreational pressure or poaching, and reasonable proximity to quality holding and spawning habitat. Improving release conditions should reduce stress and associated pre-spawning mortality.

2.10.1.3 Outplanting Research, Monitoring, & Evaluation

Proposed Action: The Action Agencies would develop and carry out a thorough RM&E program to monitor the progress of the reintroduction/outplant program.

During the 15 year evaluation period, the RM&E program would be used to determine if adult fish (or other life stages) can be safely collected, sorted, transported, and released into the upstream habitat; habitat upstream of the dam is capable of supporting the holding, spawning, and (to the extent necessary) rearing life stages of spring Chinook; the reservoir environment is capable of sustaining juveniles (in terms of productivity and predation) or if juveniles can safely bypass the reservoir environment; juvenile survival through the dam is sufficient to provide a benefit to the population; and habitat conditions downstream of the dams support juvenile rearing/outmigration, and adult upstream migration. The data collected would result in recommendations on: (1) locations where it is feasible to re-establish self sustaining populations (short term and long term); (2) potential population size for each subbasin; (3) operational methods for higher juvenile and adult survival; (4) infrastructure needs (i.e., structural modifications) to ensure long term viability of populations; and (5) genetic considerations for broodstock in each subbasin. This program must be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and following the principles and strategic questions developed by the committee.

[16] As of 1/15/2009 this report was still being compiled, but is expected to be completed by the time the Biological Opinion is issued.

2.10.2 North Santiam Spring Chinook Hatchery Program

Proposed Action: The Action Agencies would continue funding 83.75% of the O&M costs of Marion Forks Hatchery, the primary rearing facility for the North Santiam spring Chinook program, and the Minto Pond facility, the broodstock collection and juvenile acclimation facility. In accordance with the 1990 Cooperative Agreement, the annual funding level would be based on what is required to rear no more than 84,000 pounds of juvenile spring Chinook and steelhead, which is the USACE mitigation responsibility for lost salmon and steelhead spawning and rearing habitat on the North Santiam River upstream of Detroit and Big Cliff Dams.

Currently, the North Santiam spring Chinook program releases about 61,000 pounds of spring Chinook smolts annually. The goals of the North Santiam spring Chinook program are to:

- Mitigate the loss of spring Chinook catch in sport and commercial fisheries caused by construction and operation of Big Cliff and Detroit Dams.
- Provide adequate fish to the hatchery to maintain the broodstock to perpetuate program goals as outlined in the ODFW *Santiam River Subbasin Fish Management Plan* (OAR 635-500-1666).
- Maintain a suitable conservation broodstock for ongoing and future population recovery efforts throughout the subbasin, including reintroduction efforts above the Big Cliff/Detroit dam and reservoir complex.

Because of the conservation role of this hatchery program, the USACE proposes to operate the North Santiam spring Chinook program as an integrated hatchery program with conservation-oriented genetic protocol. The operation of the program is described in detail in the North Santiam spring Chinook HGMP (ODFW 2008a; USACE 2007a).

2.10.2.1 Minto Pond Fish Facility

Proposed Action: The Action Agencies would operate and rebuild the Minto Pond Fish Facility. The conceptual timeline for reconstruction of Minto Pond is described in Section 2.12, Structural Modifications.

The USACE owns the Minto Pond facility on the North Santiam River (Figure 2-6 below) and the 21.32 acres surrounding it. This facility is used to collect adults for the North Santiam spring Chinook program. The facility was designed as an adult salmon collection facility and was not designed to accommodate live sorting of adult fish. This facility also handles adult winter and summer steelhead, which are returned to the river to spawn naturally, recycled downstream to increase harvest opportunities, or given to local food banks. Migrating adults are blocked by the barrier dam and guided to the fish ladder entrance. Attraction water is provided from an intake and 36-inch in diameter pipe located upstream of the barrier dam. The trap consists of a short fish ladder, pre-sort holding pool, a fish lock and brail, an anesthetic tank, and a sorting table. Sorted fish are routed via PVC tubes to various locations, including a concrete post-sort holding pond that measures 164-feet long by 32-feet wide, and is 6-feet deep. The holding pond was

constructed in 1975, but was recently divided into four alleyways with vertical aluminum poles. The roof of the sorting and spawning facility has been retrofitted to facilitate transfer of fish from the anesthetic tank to the rooftop where they are loaded via a tube onto a truck for transportation.

Figure 2-6 Minto Pond Fish Facility, North Santiam River near Niagara, Oregon.

The Action Agencies would build a new fish collection facility at Minto Pond, if funding is available, that complies with NMFS criteria for upstream passage/collection facilities. The facility would provide adequate attraction of fish into the trap, automated sorting (when possible), and water-to-water transfer of fish into transport trucks. The facility would also serve as an effective juvenile acclimation facility that allows for volitional release. In the Supplemental BA (USACE 2007a), the Action Agencies indicate that preliminary design work has been included in the USACE's fiscal year 2008 budget, but there is not a certain date proposed for construction and initial operation of the proposed facility.

In the short term, the USACE proposes to continue operating Minto Pond in its current condition (with minor safety upgrades) while it completes designs for a new facility.

2.10.2.2 Marion Forks Hatchery

Proposed Action: The Action Agencies would operate and maintain the Marion Forks Fish Hatchery. Timeframe: Immediate/ongoing.

Marion Forks Hatchery is located on 15 acres owned by the USFS, Willamette National Forest (Figure 2-7 below). A 1949 Memorandum of Understanding between the USACE and the USFS granted the USACE use of the 40-acre parcel associated with Marion Forks Hatchery. All structures associated with Marion Forks are the property of the USACE.

Figure 2-7 Marion Forks Fish Hatchery, Detroit Ranger District, Willamette National Forest.

Marion Forks Hatchery has 34 stacks of heath stack vertical incubators. Because of the hatchery's cold water supply, it is equipped with a water heating system that enables the operators to increase growth rates in attempts to meet target sizes. Marion Forks Hatchery is equipped with 12 Canadian-style troughs and 48 circular ponds. There are no spawning facilities at Marion Forks; all spawning occurs at Minto Pond. The ODFW also raises Clackamas (011 stock) and Sandy (019 stock) spring Chinook; South Santiam River (024 stock) summer steelhead; and rainbow trout at Marion Forks, but the majority of the production is North Santiam (021 stock) spring Chinook.

The Action Agencies propose to continue funding 83.75% of the operation and maintenance of Marion Forks Fish Hatchery as the primary hatchery facility used to meet the North Santiam spring Chinook mitigation requirements.

2.10.2.3 Actions for both Minto Pond & Marion Forks Hatchery

Proposed Action: The Action Agencies would resolve hatchery infrastructure maintenance needs and develop a long-term Hatchery Maintenance Plan. Timeframe: safety upgrades immediate/ongoing; complete Hatchery Maintenance Plan in September 2007; carry out maintenance according to schedule in the plan.

The USACE and ODFW are developing a prioritized list and database of maintenance needs at each hatchery facility, including Marion Forks Hatchery and the Minto Pond Fish Facility. The Action Agencies and ODFW would use this list to develop a Hatchery Maintenance Plan that identifies long-term maintenance needs for each facility. The Action Agencies and ODFW would develop a strategy to address these needs through annual budget requests or other processes. The Action Agencies and ODFW would continue to implement actions identified in the Minto Pond safety inspection report.

2.10.2.4 Broodstock

Proposed Action: The Action Agencies would continue use of the North Santiam (stock 021) spring Chinook. Timeframe: ongoing/immediate.

Broodstock for the North Santiam spring Chinook (stock 021) were derived from the local wild population. Because the North Santiam spring Chinook Program is both a mitigation and conservation hatchery program, this is the most suitable stock to propagate.

Proposed Action: The Action Agencies would continue collecting all North Santiam spring Chinook broodstock at Minto Pond. Timeframe: ongoing/immediate.

All broodstock for the North Santiam spring Chinook program are collected at the Minto Pond Fish Facility located about 3 miles downstream of Big Cliff Dam. A 12-foot high barrier weir at the Minto Pond facility spans the North Santiam River and serves as a barrier to upstream-migrating fish, directing them into the trap. Any changes in broodstock collection location, including collection at Upper or Lower Bennett Dam (owned by the Santiam Water Control District and the City of Salem), would be discussed in the FPHM Committee.

Proposed Action: The Action Agencies would continue to collect broodstock throughout the run to ensure the hatchery population is similar to the naturally spawning population.

The Minto Pond Fish Facility is usually opened in March to collect and pass UWR winter steelhead. Adult spring Chinook are collected at the trap between mid-May and October. However, due to cold temperature releases from Detroit and Big Cliff Dams, spring Chinook typically do not arrive at Minto Pond until mid-July, with the majority arriving in August. The Action Agencies propose to continue the current practice of allowing Chinook salmon broodstock to hold in the river below Minto and be collected between August and October. If water temperature control is installed at Detroit Dam (see Section 2.12 [structural actions]), then the Action Agencies and ODFW, through the FPHM committee, would revisit this practice, as fish would likely return to the facility earlier. Likewise, reconstruction of the Minto Pond Fish Facility may warrant or enable modifications to the broodstock collection protocol to ensure that the broodstock represents the entire range of run timing. If RM&E indicates differences in run timing of hatchery and wild fish is substantially different, then modifications to the broodstock collection protocol should be made. Potential modifications include collection of early-run fish from Upper Bennett Dam. Any changes in broodstock collection timing, including collection at Upper or Lower Bennett Dam, would be discussed in the FPHM Committee.

Proposed Action: The Action Agencies would incorporate an appropriate percentage of natural-origin fish incorporated into the broodstock to ensure the hatchery population is similar to the naturally spawning population. Timeframe: ongoing/immediate.

The Action Agencies and ODFW would increase the percentage of natural origin fish into the North Santiam spring Chinook broodstock in order to achieve the management goal of operating the program as an integrated program with a conservation-oriented genetic protocol. The

percentage of non-adipose, fin-slipped fish incorporated into the brood would follow the guidance in Table 2-15 (below). The Action Agencies would modify these guidelines based on recommendations from the Hatchery Scientific Review Group (HSRG) and/or the FPHM Committee.

Table 2-15 Proposed Broodstock Collection Guidelines for the North Santiam Spring Chinook Hatchery Program.

North Santiam Spring Chinook	Hatchery Broodstock			Reintroduction Above Detroit Reservoir Proportion of Wild and Hatchery Fish	
Returns of Chinook to North Santiam (hatchery and wild) as indexed by Bennett Dam counts	Maximum percent wild fish in hatchery broodstock (600 fish goal)	Corresponding maximum number wild fish in broodstock	Maximum percent of wild pop. taken for brood	Wild fish	Hatchery fish
<3,000 (low run)	30	180	50	ensure wild fish incorporated into broodstock	As needed to have minimum spawning escapement of at least 500 fish
3,000-7,000 (medium run)	40	240	30	none at this time	
>7,000 (high run)	50	300	20	none at this time	

2.10.2.5 Adult Transport, Holding, & Prophylactic Treatment

Proposed Action: The Action Agencies would continue to spawn North Santiam spring Chinook on-site at the Minto Pond Fish Facility. Timeframe: immediate/ongoing.

Spawning/mating occurs on-site at the Minto Pond Fish Facility; no transport of broodstock is necessary. With the current temperature regime, most broodstock are held in the river below Minto Dam and are retained in the holding ponds at Minto Pond beginning with collections in mid-July. The Action Agencies do not propose any changes to the holding protocol for broodstock. In 2006, ODFW experimented with holding early-arriving adults at Minto Pond between July and September, and these adults experienced relatively low pre-spawning mortality. The Action Agencies support continued evaluations of the holding potential of early-arriving brood, if possible, given the current water temperature regime (or of brood collected at Bennett Dam).

2.10.2.6 Mating

Proposed Action: The Action Agencies would continue to use random spawning protocol with a 1:1 male-to-female ratio. Timeframe: immediate/ongoing.

The Action Agencies do not propose any changes to the spawning protocol, unless results of RM&E indicate that spawning is not truly random with respect to run representation, age, and size of broodstock.

Fish are selected and paired at random in order to minimize selective pressures from hatchery practices. The typical sex ratio of returning adults is almost 2:1 male to female, but the typical spawning sex ratio for this program is a 1:1 male-to-female. Jacks are used in approximately the same proportion as they occur in the return. Males are not reused. Collection of 300 males and 300 females allows for an annual egg take of around 1.1 to 1.3 million eggs. If the hatchery reduces the number of eggs retained, a representative sample of each male/female cross is culled. Exceptions may occur if there is a high degree of disease or epidemics associated with certain parents; if this occurs, offspring of diseased parents may be culled, in order to maximize long-term survival of the brood.

2.10.2.7 Incubation & Rearing

Proposed Action: The Action Agencies would continue to incubate and rear all North Santiam spring Chinook at Marion Forks Hatchery. Timeframe: immediate/ongoing.

The Action Agencies do not propose any changes to the incubation and rearing protocol, with the exception of changes necessary to accommodate experimental changes in release size or timing.

Eggs are transferred immediately to Marion Forks Hatchery for incubation and rearing. All North Santiam spring Chinook are reared at Marion Forks Hatchery. Egg take typically ranges from 900,000 eggs to 1.5 million eggs, which allows surplus for bacterial kidney disease (BKD) culling. Fish are ponded at between 1650-1850 temperature units (TUs), which usually occurs between mid-February and mid-March. Egg to fry survival averages around 83%; fry to smolt survival averages around 95%, and overall egg to smolt survival is around 85%. Due to cold water temperatures, fish raised at Marion Forks Hatchery grow relatively slowly. Details regarding incubation, rearing, and growth rates are described in Chapter 9 of the HGMP (ODFW 2008a).

2.10.2.8 Marking

Proposed Action: The Action Agencies would continue to adipose fin-clip and otolith mark all North Santiam spring Chinook at Marion Forks Hatchery. Timeframe: immediate/ongoing.

The Action Agencies propose to continue the current practice of adipose fin-clipping and otolith marking all North Santiam spring Chinook.

Proposed Action: The Action Agencies would insert coded wire tags (CWTs) into all juvenile hatchery fish in addition to current practice of adipose fin-clipping and otolith marking. Timeframe: purchase CWTs for all fish in experimental releases in FY 2008. Include purchase of CWTs for all North Santiam releases in FY 2009 budget request and out years.

In addition to the current practice of adipose fin-clipping and otolith marking all hatchery releases, the Action Agencies propose to insert CWTs into all hatchery releases. Tag codes should be assigned according to releases in order to evaluate alternative release strategies.

2.10.2.9 Acclimation & Release

Proposed Action: The Action Agencies would continue acclimating and releasing the majority of North Santiam Spring Chinook at Minto Pond Facility. Timeframe: immediate/ongoing.

The Action Agencies propose to continue acclimating and releasing the majority of smolts at Minto Pond and allowing for volitional release. The Action Agencies would provide flows that allow acclimation and volitional release whenever possible until a new facility is built that functions throughout a wider range of river levels. In previous years, some North Santiam spring Chinook have been directly released into the North Santiam River. However, in recent years, all North Santiam spring Chinook releases have been acclimated at Minto Pond. Typical acclimation (when releases from Big Cliff Dam permit) lasts at least 3-4 weeks depending on the physiological readiness of the fish. The fish are held in the pond for 3-4 weeks and then the screens are pulled to allow the fish to emigrate when they are ready, which may take up to 2 weeks. High spring flows can sometimes render the pond unusable for acclimation because flow-through is reduced.

Proposed Action: The Action Agencies would experimentally release a portion of hatchery juveniles at a size and time more similar to natural-origin fish. Timeframe: the FPHM Committee would develop the scope and details of the experimental release within 1 year of issuance of the biological opinion, targeting release in 2009. The FPHM Committee would also develop a suitable evaluation to accompany the release (e.g., PIT tag), which may be combined with objectives of other studies.

The Action Agencies, through ODFW, would shift production to release a group of juveniles at a size and time that more closely approximates the life history pattern of natural-origin juveniles. The Action Agencies propose an experimental release of 200,000 subyearlings as described in Table 2-16, but would thoroughly discuss the details of this release with the FPHM Committee. The Action Agencies propose to initiate the experimental release in the North Santiam Basin due to the relatively low risk to natural production and the ability of Marion Forks Hatchery to produce fish of a smaller size. However, the Action Agencies seek input from FPHM on the most appropriate subbasin for the release, and also seek review of the potential action by the HSRG/CRHRP. The Action Agencies would finalize details of the release with the FPHM committee, develop a monitoring and evaluation process, and determine if the releases are worth implementing on a larger scale in other basins.

Table 2-16 Proposed Release Schedule for North Santiam Spring Chinook.*

Life Stage	Release Location	Release Date	Mean Size at Release (fish per lb)	Number of Fish Released	Total Pounds Released
Eyed Eggs				0	0
Unfed Fry				0	0
Fry	Big Lake			1,500	15
Fingerling	Detroit Reservoir	June	200	100,000	500
Subyearling**		March	20	200,000**	10,000
Yearling (age-1 smolts)	North Santiam River (at Minto)	March	11	500,000***	45,455
TOTALS				701,500	55,955

* New releases are highlighted in green; changes in historical releases are in yellow. Proposal to be finalized by the FPMP Committee within one year post-issuance, targeting an initial experimental release in 2009.
** Subyearling release would be implemented experimentally in 2009.
*** 667,000 smolts were released annually until and including 2007. 500,000 smolts represent a target smolt release in years after 2007 when the subyearling release is implemented.

2.10.2.10 Spring Chinook Reintroduction/Hatchery Outplant Program & Disposition of Fish Arriving at Minto Pond

Several species of fish arrive at the Minto Pond Facility throughout the year, including spring Chinook, winter steelhead, and non-native hatchery summer steelhead. In addition to collection for broodstock needs, fish are transported to various locations based on management priorities (Table 2-17 below). Priorities for disposition of excess broodstock and non-hatchery species arriving at the Foster Trap are determined by balancing goals for natural production, the Spring Chinook Reintroduction/ Outplant Program, hatchery management, and harvest opportunities; while ensuring that tribal obligations are satisfied. The Action Agencies and ODFW balance these goals with the physical limitations of the existing facility and the associated demands on hatchery personnel. In recent years, the majority of excess spring Chinook broodstock have been collected and transported to unseeded, historic habitat in efforts to reestablish natural production of spring Chinook (see Spring Chinook Reintroduction/Outplant Program in Section 2.10.2). In the North Santiam Basin, adult spring Chinook have been released at three locations along the North Santiam upstream of Detroit Reservoir and at Cleator Bend on the Breitenbush River. Unmarked spring Chinook have been released into the Little North Santiam River (a tributary located downstream of Big Cliff Dam). Fish are also passed over the barrier dam at Minto and into the 4 miles of habitat between Minto and Big Cliff Dam. A summary of these releases is found in Beidler and Knapp (2005).

Table 2-17 Management Goals for Fish Collected at Minto Pond.

Species	Destination	Target Number of Adult Fish		Maximum % of Wild Run
		Clipped	Unclipped	
Spring Chinook	Broodstock	420	180	30*
	North Santiam above Minto Pond	As needed to meet unclipped goal, after broodstock target met	500	
	North Santiam above Detroit Dam	2000* (1,200 in short-term)	None at this time given downstream survival uncertainty; Long-term goal is to use wild fish.	
	Breitenbush above Detroit Dam	1000* (600 in short-term)	None at this time given downstream survival uncertainty; Long-term goal is to use wild fish.	
	Little North Santiam at The Narrows	0	400	
Winter steelhead	North Santiam above Minto	0	All	
	Remove from system	All	0	
Summer steelhead	Recycling below Minto	Any excess to brood	0	N/A
	Remove from system	Excess to brood and recycling	All	N/A

* Sliding scale based on run size.
** These targets are for actual spawners. May need to adjust for prespawning mortality.

Detailed protocols for disposition of excess hatchery broodstock, wild fish, and other species collected at Minto Pond would be contained in the "Fish Disposition and Outplant Protocols" section of the Willamette FPMP. The FPMP would contain detailed, on-the-ground disposition protocols for all species of fish (clipped/unclipped) arriving at Minto Pond including excess adult hatchery fish. Organized by date, it would specify priorities for disposition of wild/unclipped fish; and establish numerical goals (and perhaps minimum number of females) for release at each release site. These numerical goals would updated annually by the FPHM Committee.

2.10.2.11 Research, Monitoring & Evaluation Needs for the North Santiam Spring Chinook Salmon Hatchery Program

The following RM&E questions are specific to the North Santiam Basin and the spring Chinook program. Any RM&E recommendations must be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.

1. Investigate options for increasing North Santiam spring Chinook.

2. Reduction of hatchery fish spawning in the wild.
3. Testing assumptions about fish mixing the river below fish traps.
4. Experimental release of smaller spring smolts or fall?
5. Potential to collect early-run fish at Bennett dams and hold at Minto Pond to ensure incorporation of early run fish into the broodstock.
6. Potential to collect early-run fish at Minto for potential passage upstream of Detroit.
7. Investigate improvements to fin-clipping - try using automated trailer?

2.10.3 South Santiam Spring Chinook Hatchery Program

Proposed Action: **The Action Agencies would continue funding 70% of the operations and maintenance costs of South Santiam Hatchery, the primary rearing facility for the South Santiam Spring Chinook Program; and the Foster Fish Facility, the broodstock collection facility. In accordance with the 1990 Cooperative Agreement, the annual funding level would be based on what is required to rear no more than 71,000 pounds of juvenile spring Chinook and steelhead, which is necessary to mitigate for the 1400 spring Chinook adults that historically spawned annually in the areas upstream of Foster Dam, and the areas inundated by and between Foster and Green Peter Dams.**

Currently, the South Santiam Spring Chinook Program releases about 87,833 pounds of spring Chinook smolts annually. The goals of the South Santiam spring Chinook program are to:

- Mitigate the loss of spring Chinook catch in sport and commercial fisheries caused by construction and operation of Foster Dam.
- Provide adequate fish to the hatchery to maintain the broodstock to perpetuate program goals as outlined in the ODFW *Santiam River Subbasin Fish Management Plan* (OAR 635-500-1666).
- Maintain a suitable conservation broodstock for ongoing and future population recovery efforts throughout the subbasin, including reintroduction efforts above the Foster/Green Peter dam and reservoir complex.

Because of the conservation role of this hatchery program, the USACE proposes to operate the South Santiam spring Chinook program as an integrated hatchery program with conservation-oriented genetic protocol. The operation of the program is described in detail in the South Santiam spring Chinook HGMP (ODFW 2008b).

2.10.3.1 Foster Fish Facility

Proposed Action: The Action Agencies would operate and modify the Foster Fish Facility. Timeframe: operation of the current facility is ongoing/immediate. The timeline for constructing significant modifications to the Foster Fish Facility is not identified, but additional information is provided in Section 2.12.

Figure 2-8 Foster Fish Facility. Fish ladder leading to the trap-and-fish elevator.

The USACE owns the Foster Fish Facility, located on the south side of Foster Dam near river mile (RM) 37 on the South Santiam River (Figure 2-8 below), as well as many acres surrounding it. This facility is used to collect adults for the South Santiam Spring Chinook Program. It was designed as an adult salmon collection facility and was not designed to accommodate live sorting of adult fish. This facility also handles adult winter and summer steelhead, which are returned to the river to spawn naturally, passed over Foster Dam (winter steelhead only), recycled downstream to increase harvest opportunities, or given to local food banks. A fish ladder provides access to the approximately 12-foot by 40-foot trap which has a mechanical sweep to crowd fish into an anesthetic tank. From the anesthetic tank (CO_2 is used), fish are manually placed into a mechanical loading bell or slid down 10-inch plastic pipes for placement into the transport trucks. A grate can be lowered to close the ladder to fish passage and is used to control the numbers of adults migrating into the trap during peak run times. Overloading of the trap is possible without this device. Broodstock are transported approximately 10 minutes to the adult holding pond at South Santiam Hatchery; other fish are transported to release sites upstream or downstream of Foster Dam.

Adults holding in the existing trap at the facility

The Action Agencies would significantly modify the fish collection facility at Foster Dam, if funding is available, to comply with NMFS criteria for upstream passage/collection facilities. The facility would provide adequate attraction of fish into the trap, automated sorting (when possible), and water-to-water transfer of fish into transport trucks. The preliminary design also included construction of natural holding pools on the south bank of the river adjacent to the trap, which would replace or augment the holding ponds currently used at South

Santiam Hatchery. In the short term, the USACE proposes to continue operating the Foster Fish Facility in its current condition (with minor upgrades) while it completes designs and prioritizes funding for the modifications.

2.10.3.2 South Santiam Hatchery

Proposed Action: The Action Agencies would operate and maintain the South Santiam Fish Hatchery. Timeframe: immediate/ongoing.

South Santiam Hatchery is located about 2 miles east of Sweet Home, Oregon at the base of Foster Dam on 12.6 acres along the north shore of the South Santiam River at RM 37 (Figure 2-9 below). The hatchery consists of a dividable adult holding pond, a small incubation room, and ten Burrows raceways equipped with 24-inch in diameter pipes to allow for juvenile release. The facility was recently retrofitted with a mechanism to transport broodstock from the adult holding pond to a level area for spawning. The primary hatchery water supply is from Foster Reservoir and the secondary water supply is from a well (primarily used for summer steelhead egg incubation from December through April). Due to high turbidity in Foster Reservoir, incubation past the eyed egg stage is completed at other hatchery facilities, primarily Willamette Hatchery. The South Santiam Hatchery is used primarily for holding, spawning, rearing, and acclimation of the USACE-funded South Santiam Spring Chinook (stock 024) and South Santiam Summer steelhead (stock 024) programs. The facility is also used for rearing Cape Cod rainbow trout (stock 072).

Figure 2-9 Foster Dam and South Santiam Hatchery near Sweet Home, Oregon.

The Action Agencies propose to continue funding 70% of the operation and maintenance of South Santiam Fish Hatchery as the primary hatchery facility used to meet its South Santiam spring Chinook mitigation requirements. Due to water quality issues, South Santiam spring Chinook are moved to Willamette Hatchery (or other facilities) for a portion of their life cycle. The Action Agencies propose to continue late rearing and incubation of South Santiam spring Chinook at South Santiam Hatchery.

2.10.3.3 Broodstock

Proposed Action: The Action Agencies would continue use of South Santiam (stock 024) spring Chinook. Timeframe: immediate/ongoing.

The Action Agencies propose to continue using South Santiam spring Chinook (stock 024) to meet its mitigation responsibilities.

Proposed Action: The Action Agencies would continue collecting all South Santiam spring Chinook broodstock at Foster Fish Facility. Timeframe: immediate/ongoing.

All broodstock for the South Santiam spring Chinook program are collected at the Foster Fish Facility located at Foster Dam (RM 37). Fish are attracted into the fish trap by a fish ladder with an entrance near the powerhouse on the south side of Foster Dam. Any changes in broodstock collection location, including collection at Lebanon Dam, would be discussed in the FPHM Committee.

Proposed Action: The Action Agencies would collect broodstock throughout the run to ensure the hatchery population is similar to the naturally spawning population, including between July 15 and August 15 when the trap has been shut down. Timeframe: immediate/ongoing.

The Foster Fish Facility is usually operated year-round (but checked less frequently) to collect summer steelhead and ESA-listed UWR winter steelhead. Adult spring Chinook are collected at the trap between mid-May and October, with the exception of an annual shut-down period between July 15 and August 15. The trap is checked approximately 3 times per week. Brood are collected throughout the run until September and held in the holding pond at South Santiam Hatchery until spawning in September or October. Broodstock are marked with a color-coded Floy® tag according to arrival date.

The Action Agencies propose to continue the current practice of collecting broodstock throughout the run between mid-May and October. However, the Action Agencies propose to also collect broodstock (and pass spring Chinook over Foster Dam) between July 15 and August 15, when the trap has typically been shut down. This would ensure collection of brood throughout the entire run, and also ensure prompt passage of unmarked spring Chinook over Foster Dam. Reconstruction of the Foster Fish Facility may warrant or enable modifications to the broodstock collection protocol to ensure that the broodstock represents the entire range of run timing. If RM&E indicates that run timing of hatchery origin and natural origin fish is substantially different, then modifications to the broodstock collection protocol should be made. Any changes in broodstock collection timing, including collection at Lebanon Dam, would be discussed in the FPHM Committee.

Proposed Action: The Action Agencies would incorporate an appropriate percentage of natural origin fish incorporated into the broodstock to ensure the hatchery population is similar to the naturally spawning population.

The Action Agencies and ODFW would increase the percentage of natural origin fish into the South Santiam spring Chinook broodstock in order to achieve the management goal of operating the program as an integrated program with a conservation-oriented genetic protocol. The percentage of non-adipose, fin-clipped fish incorporated into the brood would follow the guidance in Table 2-18 below. The Action Agencies would modify these guidelines based on recommendations from the HSRG and/or the FPHM Committee.

Table 2-18 Proposed Broodstock Collection Guidelines for the South Santiam Spring Chinook Hatchery Program.

South Santiam Spring Chinook	Hatchery Broodstock			Above Foster Dam Proportion of Wild & Hatchery Fish	
Returns of Chinook to South Santiam (hatchery & wild) as indexed by May 31 Willamette Falls Counts	**Maximum percent wild fish in hatchery broodstock (900 fish goal)**	**Corresponding maximum number of wild fish in broodstock**	**Maximum percent of wild population taken for brood**	**Wild fish**	**Hatchery fish**
<30,000 (low run)	30	300	50	Ensure wild fish incorporated into broodstock	As needed to have minimum spawning escapement of at least 500 fish
3,000-50,000 (medium run)	30	300	30	Outplant above and below Foster*	
>50,000 (high run)	30	300	20		

* All of the wild fish collected at Foster after broodstock needs are fulfilled.

2.10.3.4 Adult Transport, Holding, & Prophylactic Treatment

Proposed Action: The Action Agencies would continue to hold South Santiam spring Chinook at South Santiam Hatchery; replace with new holding facility adjacent to the Foster Fish Facility. Timeframe: Immediate/ongoing.

Fish have been anesthetized with CO_2 at the Foster Fish Facility; other approved anesthetics cannot be used due to recycling of summer steelhead and hatchery spring Chinook in the fishery below Foster Dam. From the anesthetic tank, fish are manually placed into a mechanical loading bell or slid down 10-inch plastic pipes for placement into the transport trucks and transported approximately 10 minutes to the adult holding pond at South Santiam Hatchery.

An oval concrete broodstock holding pond measuring 148-feet by 47-feet (199,000-gallon capacity) is used for all spring Chinook adult holding. Approximately 1,400 adult spring Chinook are held along with 1,300 adult summer steelhead in this pond. A center divider allows the separation of species and a cross divider allows a separation of male and female Chinook. Approximately 5,000 gallons per minute (gpm) flow through this pond during heavy loading.

Adults held for broodstock are inoculated with erythromycin and oxytetracyclene twice - first at collection and again approximately one month prior to spawning. Bacterial kidney disease and furunculosis are the diseases of concern. Flow-through treatments of formalin (prior to 2000) or hydrogen peroxide (since 2001) occur in the adult holding pond for 1 to 2 hours, 3 days per week, throughout the holding period. Spring Chinook and summer steelhead are often held together in the same holding pool.
The Action Agencies do not propose any changes to the holding protocol for broodstock unless minor improvement can be made to the existing holding pond. The Action Agencies propose modifying the Foster Fish Facility to include construction of new broodstock holding pond on the south bank of the river that simulates a natural holding environment (sinuous banks,

overhangs, and deeper water), as described in Section 6.5.8 of the South Willamette Fish Facilities Improvements Report (McMillen Engineering 2005).

2.10.3.5 Mating

Proposed Action: The Action Agencies would continue to use random spawning protocol with a 1:1 male-to-female ratio. Timeframe: immediate/ongoing.

The Action Agencies do not propose any changes to the spawning protocol, unless results of RM&E indicate that spawning is not truly random with respect to run representation, age, and size of broodstock.

2.10.3.6 Incubation & Rearing

Proposed Action: The Action Agencies would continue to incubate and rear all South Santiam spring Chinook at South Santiam Hatchery, with temporary rearing (eyed egg to fry) at Willamette Hatchery. Investigate options to allow complete rearing at South Santiam Hatchery. Timeframe: immediate/ongoing.

The Action Agencies do not propose any immediate changes to the incubation and rearing protocol.

Egg collection typically ranges from 2.1 to 2.3 million, which has allowed a surplus for BKD culling. No ponding occurs at South Santiam Hatchery. All eggs are transferred to Willamette Hatchery at the eyed stage, because the primary water source from Foster Reservoir can be turbid in the winter months. Fry are transferred back to South Santiam beginning in March. Although fingerling to smolt survival has been above 90%, it has declined in recent years. Details regarding incubation, rearing, and growth rates are described in Chapter 9 of the HGMP (ODFW 2008b).

2.10.3.7 Marking

Proposed Action: The Action Agencies would continue to adipose fin-clip and otolith mark all South Santiam spring Chinook at South Santiam Hatchery. Timeframe: immediate/ongoing.

The Action Agencies propose to continue the current practice of adipose fin-clipping and otolith marking all hatchery spring Chinook.

Proposed Action: The Action Agencies would insert coded wire tags into all juvenile hatchery fish in addition to current practice of adipose fin-clipping and otolith marking. Timeframe: Include purchase of CWTs for all South Santiam releases in FY 2009 budget request and out years.

In addition to the current practice of adipose fin-clipping and otolith marking all hatchery releases, the Action Agencies propose to insert CWTs into all hatchery releases. Tag codes should be assigned according to releases in order to evaluate alternative release strategies.

2.10.3.8 Acclimation & Release

Proposed Action: The Action Agencies would continue acclimating and releasing the majority of South Santiam spring Chinook at Foster Fish Facility; investigate options for acclimating all smolts on-site and allowing for direct release. Timeframe: immediate/ongoing.

The Action Agencies propose to continue acclimating and releasing as many smolts as possible at the Foster Fish Facility. The Action Agencies also propose to investigate operations or structural modifications that would enable acclimation and volitional release of all South Santiam releases (Table 2-19 below). The Action Agencies recommend continuing the fingerling release into Quartzville Creek, pending annual recommendation and coordination with the FPHM committee (including the USFS and BLM).

The majority of South Santiam spring Chinook releases have been into the South Santiam. In previous years, some South Santiam spring Chinook have been directly released into Thomas and Crabtree creeks in the South Santiam subbasin. Some South Santiam spring Chinook are also released into the Molalla River. The majority of South Santiam spring Chinook releases are acclimated and released at South Santiam Fish Hatchery. Prior to 2002, two groups (421,000 smolts total) were transferred from Willamette Hatchery in February and March and acclimated at South Santiam Hatchery for 1 month, before being released into the South Santiam River. Currently 153,000 are transferred from Willamette Hatchery in late February for a 3-week acclimation in the adult holding pond, and then released into the South Santiam via a 24-inch in diameter pipe. The remaining 268,000 are now trucked from Willamette Hatchery and direct released into the South Santiam. A small portion of production is released into Quartzville Creek upstream of Green Peter Reservoir and 20,000 eggs are given to the STEP program for release within the Santiam subbasin.

Table 2-19 Proposed Release Schedule for South Santiam Spring Chinook.

Life Stage	Release Location	Release Date	Number Released	Mean Size at Release	Total Pounds Released
Unfed Fry	Santiam Basin Release (STEP)	May	20,000		
Fingerling	Quartzville Creek	June	100,000	100	1000
1+ Yearling	South Santiam River	February/March	721,000	8.5	84,800
Yearling	South Santiam River	November	300,000	8.1	37,000
1+ Yearling	Molalla River	March	67,000	9.5	7,050
Yearling	Molalla River	November	33,000	8.3	3,975

2.10.3.9 Spring Chinook Reintroduction/Outplant Program & Disposition of Fish Arriving at Foster Fish Facility

Several species of fish arrive at the Foster Fish Facility throughout the year, including spring Chinook, winter steelhead, and non-native hatchery summer steelhead. In addition to collection for broodstock needs, fish are transported to various locations based on management priorities. Priorities for disposition of excess broodstock and non-hatchery species arriving at the Foster Trap are determined by balancing goals for natural production, the Spring Chinook Reintroduction/Outplant Program, hatchery management, and harvest opportunities; while ensuring that tribal obligations are satisfied. The Action Agencies and ODFW balance these goals with the physical limitations of the existing facility and the associated demands on hatchery personnel. In recent years, the majority of excess spring Chinook broodstock have been collected and transported to unseeded, historic habitat in efforts to re-establish natural production of spring Chinook (see Spring Chinook Reintroduction/Outplant Program in Section 2.10.2). In the South Santiam Basin, the Action Agencies and ODFW have transported fish collected at the Foster Fish Facility into several locations throughout the South Santiam subbasin, including Thomas Creek, Crabtree Creek, Wiley Creek, the Calapooia River, and the South Santiam River upstream of Foster Dam. Adult spring Chinook have not been transported into the Middle Santiam River or Quartzville Creek upstream of Green Peter Dam. A summary of these releases is found in Beidler and Knapp (2005).

Current general management goals for the spring Chinook reintroduction/outplant program are described in Table 2-20 below. Detailed protocols for disposition of excess hatchery broodstock, wild fish, and other species collected at Foster Fish Facility would be contained in the "Fish Disposition and Outplant Protocols" section of the Willamette FPMP. The FPMP would contain detailed, on-the-ground disposition protocols for all species of fish (clipped/unclipped) arriving at the Foster Fish Facility, including excess adult hatchery fish. Organized by date, it would specify priorities for disposition of wild/unclipped fish; and establish numerical goals (and perhaps minimum number of females) for release at each release site. These numerical goals would updated annually by the FPHM Committee.

Table 2-20 Management Goals for Fish Collected at the Foster Fish Facility.

Species	Destination	Target Number of Adult Fish *		Maximum % of Wild Run
		Clipped	Unclipped	
Spring Chinook	Broodstock	600	300	30*
	South Santiam above Foster Dam (Riverbend and Gordon Road release sites)	As needed to meet unclipped goal	800 (in excess of broodstock collection goal of 4,000 females)	10
	Recycled into South Santiam below Foster Dam		None	0
	Crabtree, Thomas, and Wiley creeks	Any excess (approx. 100 to Crabtree; 150 to Thomas)	None	0
Winter steelhead	South Santiam above Foster Dam	0	All	100
	Remove from system	All	0	0
Summer steelhead	Broodstock	1,700	0	N/A
	Recycling below Foster	Any excess to brood	0	N/A
	Remove from system	Excess to brood and recycling	All	N/A

*These numbers reflect management targets, and are not intended to provide annual on-the-ground direction to personnel operating the fish facilities.

2.10.3.10 Research, Monitoring & Evaluation Questions Specific to South Santiam Spring Chinook Salmon Hatchery Program

The following RM&E questions are specific to the South Santiam Basin and the spring Chinook program. Any RM&E recommendations must be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.

1. Are mitigation requirements for habitat upstream of Green Peter being fully realized?
2. Evaluate benefits and effects of closure of Foster Fish Facility in July for maintenance.
3. Determine spawning timing and arrival date.
4. Management of Hatchery Strays on the spawning grounds?
5. Experiment with transporting brood at outplant protocol and compare survival; could reduce incidence of disease and necessity of treatment?
6. Evaluate stray rate among facilities for fish reared at South Santiam.
7. Investigate options for complete acclimation of all releases at South Santiam – why use direct release from Willamette into the South Santiam?

8. Could mechanisms for volitional release at South Santiam be designed into the Foster Facility?

2.10.4 McKenzie Spring Chinook Program

Proposed Action: The Action Agencies would continue funding 50% of the operations and maintenance costs of McKenzie Hatchery, the primary rearing facility for the McKenzie Spring Chinook Program. The 1990 Mitigation Agreement with ODFW requires the USACE to fund production of a maximum of 80,800 pounds of juvenile spring Chinook to mitigate for the 4,060 Chinook salmon adults that spawned annually in habitat above Cougar and Blue River dams.

Currently, the McKenzie Spring Chinook Program releases about 120,000 pounds (1,199,000 smolts) of spring Chinook smolts annually. The goals of the South Santiam Spring Chinook Program are to:

- Mitigate the loss of spring Chinook catch in sport and commercial fisheries caused by construction and operation of Cougar and Blue River Dams.
- Provide adequate fish to the hatchery to maintain the broodstock to perpetuate program goals as outlined in the ODFW McKenzie Subbasin Fish Management Plan (OAR 635-500-1666).
- Maintain a suitable conservation broodstock for ongoing and future population recovery efforts throughout the subbasin, including reintroduction efforts above the Cougar Dam and Reservoir complex.

Because of the conservation role of this hatchery program, the USACE proposes to operate the McKenzie spring Chinook program as an integrated hatchery program with conservation-oriented genetic protocol. McKenzie Hatchery produces the USACE entire mitigation requirement for spring Chinook salmon in the McKenzie subbasin. The McKenzie population of Upper Willamette River spring Chinook is one of the healthiest populations in the ESU. However, hatchery fish still comprise a large percentage of the run returning to the McKenzie. Poor attraction of adults to McKenzie Hatchery and poor trapping facilities at the Eugene Water & Electric Board's (EWEB) Leaburg Dam limit the USACE ability to prevent hatchery fish from spawning in the "wild fish sanctuary" established upstream of Leaburg Dam. The operation of the program is described in detail in the McKenzie spring Chinook HGMP (ODFW 2007a)

2.10.4.1 McKenzie Hatchery

Proposed Action: The Action Agencies would operate and maintain McKenzie Hatchery. Timeframe: Immediate/ongoing.

The Action Agencies propose to continue funding 50% of the operation and maintenance of McKenzie Hatchery as the primary hatchery facility used to meet its McKenzie spring Chinook mitigation requirements.

The majority of the broodstock for the McKenzie spring Chinook program is collected at McKenzie Hatchery, located on 16 acres adjacent to the McKenzie River near Leaburg, Oregon (Figure 2-10 below). The fish ladder at McKenzie Hatchery is located on the north bank of the McKenzie River. Broodstock enter the McKenzie Hatchery fish ladder from the river and enter a collection channel located at the downstream end of the holding ponds. From the holding ponds, the fish are crowded into the spawning building using a power crowder. A lift brings the fish up to two anesthetic tanks. The fish then can be handled for sorting, inoculation, transport, or placement into the holding ponds for broodstock. The adult holding ponds consist of two concrete ponds that are divided into two separate holding areas with aluminum fencing.

Figure 2-10 McKenzie Hatchery on the McKenzie River near Leaburg, Oregon.

2.10.4.2 Leaburg Dam (EWEB)

Proposed Action: **The Action Agencies would develop and carry out alternatives to using the existing fish trap in the left bank ladder of Leaburg Dam as the primary means of reducing the incidence of spring Chinook on the spawning grounds. Alternatives include increasing homing and attraction back to McKenzie Hatchery; working with EWEB, ODFW, and other entities to construct a fish trap at Leaburg Dam, and consideration of reducing hatchery production in the McKenzie subbasin to reduce the number of returning hatchery fish. The Action Agencies would undertake this analysis within the context of the Phase III System Configuration Study for the McKenzie subbasin (see Section 2.12). Timeframe: Develop a strategy for reducing the incidence of hatchery strays on the spawning grounds within 6 months of issuance**

The 2000 Willamette Hatchery Opinion (NMFS 2000a) required the USACE and ODFW to remove all adults that swim past the McKenzie Hatchery ladder at the Leaburg Dam fish ladder, which is owned by EWEB. However, the trap at Leaburg Dam consists of a blocked-off pool in the left bank ladder and does not meet ESA handling requirements. All fish have been manually netted out of the ladder, and during the peak of the passage season this trapping method results in unacceptable levels of take of natural origin adult UWR spring Chinook. Thus during peak

passage, all Chinook have been allowed to pass over Leaburg Dam. EWEB recently constructed a new fish ladder on the right bank without a fish trap. This allows all fish to pass unimpeded over Leaburg Dam via this ladder throughout the run. A fish trap is needed on both ladders in order to achieve the objective of removing 100% of the hatchery fish at Leaburg Dam.

2.10.4.3 Broodstock

Proposed Action: The Action Agencies would continue use of McKenzie (stock 023) spring Chinook. Timeframe: Ongoing/immediate.

The Action Agencies propose to continue using McKenzie spring Chinook (stock 023) to meet its mitigation responsibilities.

Proposed Action: The Action Agencies would collect the majority of McKenzie spring Chinook broodstock at McKenzie Hatchery; supplement the unclipped portion with fish from Leaburg Dam, if necessary. Timeframe: Ongoing/immediate.

The majority of spring Chinook for the McKenzie spring Chinook program is collected at McKenzie Hatchery. Fish are attracted into the fish ladder on the left bank of the McKenzie River. There is no channel-spanning barrier to guide fish into the ladder. In 2006, implementation of new protocols for incorporation of unmarked fish into the brood required that ODFW collect a portion of the unclipped broodstock at Leaburg Dam.

The Action Agencies propose to continue collecting McKenzie spring Chinook (stock 023) broodstock at the McKenzie Hatchery, and potentially at Leaburg Dam to ensure incorporation of natural-origin fish into the brood. Any changes in broodstock collection location, including collection at Cougar Dam, would be discussed in the FPHM Committee.

Proposed Action: The Action Agencies would continue to collect broodstock throughout the run to ensure the hatchery population is similar to the naturally spawning population. Timeframe: Ongoing/immediate.

Spring Chinook adults returning to McKenzie Hatchery are collected throughout the entire run between May and October and mixed in the dividable holding pond where they are held until ripening.

Proposed Action: The Action Agencies would incorporate an appropriate percentage of natural-origin fish incorporated into the broodstock to ensure the hatchery population is similar to the naturally spawning population.

The Action Agencies and ODFW would increase the percentage of natural origin fish into the McKenzie spring Chinook broodstock in order to achieve the management goal of operating the program as an integrated program with a conservation-oriented genetic protocol. In the short-term, NMFS recommends incorporating more natural origin fish into the broodstock as possible, approaching 20% natural origin fish (NMFS 2000a). The percentage of non-adipose, fin-clipped fish incorporated into the brood would follow the guidance in Table 2-21 below. The Action

Agencies would modify these guidelines based on recommendations from the HSRG and/or the FPHM Committee.

Table 2-21 Proposed Broodstock Collection Guidelines for the McKenzie Spring Chinook Hatchery Program.

McKenzie Spring Chinook	Hatchery Broodstock			Above Cougar and Trail Bridge Dams	
Returns of Chinook to South Santiam (H & W) as indexed by May 31 Willamette Falls Counts	**Maximum percent wild fish in hatchery broodstock (900 fish goal)**	**Corresponding maximum number wild fish in broodstock**	**Maximum percent of wild population taken for brood**	**Wild fish**	**Hatchery fish**
<30,000 (low run)	20	160	10-20	Ensure wild fish incorporated into broodstock	As needed to have minimum spawning escapement of at least 500 fish
3,000-50,000 (medium run)	30	240	10-20	No outplanting of wild fish, pass over Leaburg Dam	
>50,000 (high run)	40	320	10-20		

2.10.4.4 Adult Transport, Holding, & Prophylactic Treatment

Proposed Action: The Action Agencies would continue to hold and spawn McKenzie spring Chinook on-site at the McKenzie Hatchery. Timeframe: Ongoing/immediate.

Spawning and mating occurs on site at McKenzie Hatchery; no transport of brood is necessary. Broodstock are held in the dividable adult holding pond at McKenzie Hatchery until spawning. Brood are injected with antibiotics and treated with hydrogen peroxide for fungus control. The Action Agencies do not propose any changes to the holding protocol for broodstock unless minor improvement can be made to the existing holding pond.

2.10.4.5 Mating

Proposed Action: The Action Agencies would continue to use random spawning protocol with a 1:1 male-to-female ratio. Timeframe: Ongoing/immediate.

Adults used for brood are mixed as they return to the hatchery and are randomly selected for each spawn. The Action Agencies do not propose any changes to the spawning protocol, unless results of RM&E indicate that spawning is not truly random with respect to run representation, age, and size of broodstock.

2.10.4.6 Incubation & Rearing

Proposed Action: The Action Agencies would continue to incubate and rear all McKenzie spring Chinook at the McKenzie Hatchery. Timeframe: Ongoing/immediate.

The Action Agencies do not propose any changes to the incubation and rearing protocol, with the exception of changes necessary to accommodate experimental changes in release size or timing. All fish are reared from egg to smolt at McKenzie Hatchery. Button up happens at 1500-1550 TUs, and ponding normally occurs from mid-December through January. About 2.2 million eggs are taken annually. Fry to smolt survival is typically greater than 96%.

2.10.4.7 Marking

Proposed Action: The Action Agencies would continue to adipose fin-clip and otolith mark all McKenzie spring Chinook at the McKenzie Hatchery. Timeframe: Ongoing/immediate.

The Action Agencies propose to continue the current practice of adipose fin-clipping and otolith marking all McKenzie Hatchery spring Chinook.

Proposed Action: The Action Agencies would insert coded wire tags into all juvenile hatchery fish in addition to current practice of adipose fin-clipping and otolith marking. Timeframe: Purchase CWTs for all fish released in experimental releases in FY 2008. Include purchase of CWTs for all McKenzie releases in FY 2009 budget request and out years.

In addition to the current practice of adipose fin-clipping and otolith marking all hatchery releases, the Action Agencies propose to insert CWTs into all hatchery releases. Tag codes should be assigned according to releases in order to evaluate alternative release strategies.

2.10.4.8 Acclimation & Release

Proposed Action: The Action Agencies would continue releasing all McKenzie spring Chinook at McKenzie Hatchery, experiment with acclimation techniques that could improve homing to McKenzie Hatchery. Timeframe: Ongoing/immediate.

The Action Agencies propose to continue releasing smolts from McKenzie Hatchery and allowing for volitional release (Table 2-22). There is no acclimation procedure, as all fish are reared at McKenzie Hatchery. The Action Agencies support ODFW's fingerling release into Mohawk River, pending annual recommendation and coordination with the FPHM committee.

Table 2-22 Proposed Release Schedule for McKenzie Spring Chinook.

Life Stage	Release Location	Release Date	Mean Size at Release (fish per lb)	Number of Fish Released	Total Pounds Released
Fingerling	Mohawk River	June	100	75,000	750
Yearling	McKenzie Hatchery	November	8	350,000	43,750
1+ Yearling	McKenzie Hatchery	February	12	400,000	33,333
1+ Yearling	McKenzie Hatchery	March	11	449,000	40,818
TOTALS				1,199,000	118,651

Proposed Action: The Action Agencies would examine the potential impacts of reducing production at McKenzie Hatchery to decrease the incidence of hatchery fish spawning in the area above Leaburg Dam, which is a wild fish sanctuary. Timeframe: Examine alternatives with ODFW within 1 year of issuance.

Should reintroduction efforts above Cougar Dam produce a self-sustaining population of spring Chinook, then the Action Agencies would propose to further reduce mitigation production.

2.10.4.9 Spring Chinook Reintroduction/Outplant Program & Disposition of Fish Arriving at McKenzie Hatchery

Several species of fish arrive at McKenzie Hatchery throughout the year, including spring Chinook and non-native hatchery summer steelhead. In addition to collection for broodstock needs, fish are transported to various locations based on management priorities. Priorities for disposition of excess broodstock and non-hatchery species arriving at the McKenzie Hatchery are determined by balancing goals for natural production, the Spring Chinook Reintroduction/ Outplant Program, hatchery management, and harvest opportunities; while ensuring that tribal obligations are satisfied. The Action Agencies and ODFW balance these goals with the physical limitations of the existing facility and the associated demands on hatchery personnel. In recent years, the majority of excess spring Chinook broodstock have been collected and transported to unseeded, historic habitat in efforts to re-establish natural production of spring Chinook (see Spring Chinook Reintroduction/Outplant Program in Section 2.10.2). In the McKenzie subbasin, the Action Agencies and ODFW have transported fish collected at the McKenzie Hatchery into several locations throughout the McKenzie subbasin, including the Mohawk River, the McKenzie River upstream of Trail Bridge Dam (owned by EWEB), and the South Fork McKenzie River upstream of Cougar Dam. A summary of these releases is found in Beidler and Knapp (2005).

Current general management goals for the spring Chinook reintroduction/outplant program are described in Table 2-23 below. Detailed protocols for disposition of excess hatchery broodstock, wild fish, and other species collected at McKenzie Hatchery (and Cougar Dam) would be contained in the "Fish Disposition and Outplant Protocols" section of the Willamette FPMP. The FPMP would contain detailed, on-the-ground disposition protocols for all species of fish (clipped/unclipped) arriving at McKenzie Hatchery, including excess adult hatchery fish. Organized by date, it would specify priorities for disposition of wild/unclipped fish; and establish

numerical goals (and perhaps minimum number of females) for release at each release site. These numerical goals would updated annually by the FPHM Committee.

Table 2-23 Management Goals for Fish Collected at McKenzie Hatchery.

Species	Destination	Target Number of Adult Fish *		Maximum % of Wild Run
		Clipped	Unclipped	
Spring Chinook	Broodstock	640	160	10-20
	South Fork above Cougar Dam	3,000 (short-term goal of 2,000)	None at this time given downstream survival uncertainty; long-term goal is to use wild fish.	0
	McKenzie above Trailbridge	120 *	None at this time	
	Mohawk River	100	0	0
	Remove from system	Excess to brood and outplanting	0	0
Summer steelhead	Recycling below Leaburg	All	0	N/A
	Remove from system	Excess to brood and recycling	All	N/A

* Future outplants would come from fish passed over Trailbridge via ladder or trap and haul by EWEB.

2.10.4.10 Research, Monitoring & Evaluation Needs Specific to McKenzie Spring Chinook Salmon Hatchery Program

The following RM&E questions are specific to the McKenzie Basin and the spring Chinook program. Any RM&E recommendations must be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.

1. Experiment with acclimation procedures (chemical/scent tracers) at McKenzie Hatchery to increase homing and decrease straying onto spawning grounds.
2. Evaluate production levels at McKenzie Hatchery to decrease the incidence of hatchery spawners on the spawning grounds.

2.10.5 Middle Fork Willamette Spring Chinook Hatchery Program

Proposed Action: **The Action Agencies would propose to continue funding 83.75% of the operations and maintenance costs of Willamette Hatchery, the primary rearing facility for the Middle Fork Willamette spring Chinook program. The 1990 Mitigation Agreement with ODFW requires the USACE to fund production of a maximum of 235,000 pounds of juvenile spring Chinook and steelhead to mitigate for lost production above Dexter, Lookout Point, and Hills Creek Dams.**

Currently, the Middle Fork Willamette spring Chinook program releases about 120,000 pounds (1,199,000 smolts) of spring Chinook smolts annually. The goals of the Middle Fork spring Chinook program are to:

- Mitigate the loss of spring Chinook catch in sport and commercial fisheries caused by construction and operation of Dexter, Lookout Point, and Hills Creek Dams.
- Provide adequate fish to the hatchery to maintain the broodstock to perpetuate program goals as outlined in the Middle Fork Willamette chapter of the FPMP (OAR 635-500-1666).
- Maintain a suitable conservation broodstock for ongoing and future population recovery efforts throughout the subbasin, including reintroduction efforts above the Dexter, Lookout Point, and Hills Creek Dams.

Because of the conservation role of this hatchery program, the USACE proposes to operate the Middle Fork Willamette spring Chinook program as an integrated hatchery program with conservation-oriented genetic protocol. Willamette Hatchery produces the USACE's entire mitigation requirement for spring Chinook salmon in the Middle Fork Willamette. Very few natural-origin adults have returned to the Middle Fork Willamette (i.e., less than 100 fish), and the hatchery program in the Middle Fork Willamette subbasin would be used to rebuild the naturally-spawning population. The operation of the program is described in detail in the Middle Fork Willamette spring Chinook HGMP (ODFW 2007a) and would be described in the Willamette FPMP (see Section 2.7).

2.10.5.1 Dexter Pond Fish Facility

Proposed Action: **The Action Agencies would operate, maintain, and possibly rebuild the Dexter Pond Fish Facility. Timeframe: Immediate/ongoing. Preliminary designs for rebuilding the facility were completed in 2005 and are described in the South Willamette Valley Fish Facilities Improvements Report (McMillen Engineering 2005). The conceptual timeline for reconstruction of Dexter Ponds Fish Facility is described in Section 2.12.**

The Dexter Pond Facility, located at the base of Dexter Dam, is a satellite facility associated with Willamette Hatchery and is used to capture adult fish, provide juvenile rearing capacity, and serve as an acclimation facility for juvenile releases (Figure 2-11). In addition, both summer and winter steelhead are reared at this facility for a short period of time. All Middle Fork Willamette spring Chinook salmon broodstock are collected at Dexter Pond and transported to a holding pond at Willamette Hatchery until spawning.

Figure 2-11 Dexter Pond Fish Facility and Adult Pre-sort Holding Pond.

The facility was designed as a collection and acclimation facility and was not designed to accommodate sorting adult fish that would be later released to spawn naturally. Migrating adults are blocked by Dexter Dam and guided to the fish ladder entrance. The broodstock collection facility consists of a fish ladder, pre-sort holding pool, two fish locks and brails, an anesthetic tank, and a sorting table. Sorted fish are routed via PVC tubes to various locations.

The Action Agencies would possibly build a new fish collection facility at Dexter Pond that complies with NMFS criteria for upstream passage/collection facilities. The facility would provide adequate attraction of fish into the trap, automated sorting (when possible), and water-to-water transfer of fish into transport trucks. The facility would also serve as an effective juvenile acclimation facility that allows for volitional release. In the short term, the USACE proposes to continue operating Dexter Pond in its current condition while it completes designs for a new facility.

2.10.5.2 Willamette Hatchery

Proposed Action: The Action Agencies would operate and maintain the Willamette Hatchery. Timeframe: Immediate/ongoing.

The Willamette Hatchery is situated on 75 acres near the town of Oakridge, Oregon. The hatchery is composed of the original trout hatchery, situated near the entrance and the old salmon hatchery which is immediately adjacent to the trout facility (Figure 2-12). Willamette Hatchery is also used for rearing South Santiam spring Chinook, summer steelhead, and rainbow trout. Willamette Hatchery has 1,005 total incubators, which allow for the incubation of 9 million eggs. All incubators are equipped with alarms. All adult spring Chinook are spawned under a covered deck adjacent to the earthen channel adult holding pond at Willamette Hatchery

Figure 2-12 Willamette Hatchery Near Oakridge, Oregon.

2.10.5.3 Broodstock

Proposed Action: The Action Agencies would continue use of Middle Fork (stock 022) spring Chinook. Timeframe: ongoing/immediate. Timeframe: ongoing/immediate.

Broodstock for the Middle Fork spring Chinook (stock 022) were derived from the local wild population. Because the Middle Fork spring Chinook Program is both a mitigation and conservation hatchery program, this is the most suitable stock to propagate.

Proposed Action: The Action Agencies would continue collecting all Middle Fork spring Chinook broodstock at Dexter Pond Fish Facility. Timeframe: ongoing/immediate.

Dexter Ponds is the only location in the Middle Fork for obtaining Middle Fork Willamette Spring Chinook. Fall Creek Dam is located on Fall Creek, a tributary of the Middle Fork Basin.

Proposed Action: The Action Agencies would collect broodstock throughout the run (including the early part of the season) to ensure the hatchery population is similar to the naturally spawning population. Timeframe: Develop plan for initiating early season collection for 2008 brood year. Annual review by the FPHM Committee.

The Action Agencies propose opening the trap periodically at the Dexter Pond Fish Facility in the early part of the season to ensure collection of broodstock and fish for outplanting during the early part of the season (Table 2-24). Currently, fish are held in the Middle Fork Willamette River downstream of Dexter Dam until the trap opens in mid-June. These fish are assumed to mix while holding, such that that when the trap is opened in June, the sample is representative. However, this assumption has never been tested.

Proposed Action: The Action Agencies would incorporate an appropriate percentage of natural origin fish incorporated into the broodstock to ensure the hatchery population is similar to the naturally spawning population. Timeframe: ongoing/immediate.

The percentage of non-adipose, fin-slipped fish incorporated into the brood would follow the guidance in Table 2-24 (below). Returning adults are collected and spawned for broodstock. At this time the program goal is to spawn 835 females and 835 males (or about 1,670 fish total), as needed for egg production. Acclimation and volitional release at Dexter Pond minimizes the risk of returning hatchery adults straying onto the spawning grounds or into other subbasins.

Table 2-24 Proposed Broodstock Collection Guidelines for the Middle Fork Spring Chinook Hatchery Program.

Middle Fork Spring Chinook	Hatchery Broodstock			Above Dexter, Lookout Point and Hills Creek Dams	
Returns of Chinook to Dexter Pond (hatchery & wild) as indexed by May 31 Willamette Falls Counts	Maximum percent wild fish in hatchery broodstock (1600 fish goal)	Corresponding maximum number wild fish in broodstock	Maximum number of wild pop. taken for brood	Wild fish	Hatchery fish
<30,000 (low run)	30	480	100*	Ensure wild fish incorporated into broodstock	As needed to have minimum spawning escapement of at least 500 fish
3,000-50,000 (medium run)	30	480	100*	All after brood needs fulfilled	
>50,000 (high run)	30	480	100*		

*Wild fish production is so poor that if all of the wild fish captured are taken for broodstock, it would be far less than the 30% wild fish in the broodstock. This criterion would be reevaluated if and when wild fish returns increase due to reintroduction efforts.

2.10.5.4 Adult Transport, Holding, & Prophylactic Treatment

Proposed Action: The Action Agencies would continue to transfer adult Middle Fork spring Chinook collected at Dexter Ponds to Willamette Hatchery for holding and spawning. The Action Agencies would investigate improvements to the collection/crowding location at Dexter Dam. Timeframe: immediate/ongoing.

The original adult holding ponds at Dexter Pond are no longer used. All adults collected at Dexter are hand-loaded onto trucks to be recycled downstream into the fishery, released upstream of Lookout Point Dam, or transported to Willamette Hatchery where they are held until spawning. The adult Chinook holding facility at Willamette Hatchery was constructed in 1940 in a former side channel of Salmon Creek and still resembles a cobble-bottomed river channel. It

is shaded by trees and is an excellent adult Chinook holding facility. Flow rate through the channel is approximately 1,500 gpm. The collection of adults initially at Dexter Dam (before transporting to Willamette hatchery) is difficult in its present configuration.

2.10.5.5 Mating

Proposed Action: The Action Agencies would continue to use random spawning protocol with a 1:1 male-to-female ratio. Timeframe: immediate/ongoing.

The Action Agencies do not propose any changes to the spawning protocol, unless results of RM&E indicate that spawning is not truly random with respect to run representation, age, and size of broodstock.

2.10.5.6 Incubation & Rearing

Proposed Action: The Action Agencies would continue to incubate and rear all Middle Fork spring Chinook at the Willamette Hatchery. Timeframe: immediate/ongoing.

The Action Agencies do not propose any changes to the incubation and rearing protocol, with the exception of changes necessary to accommodate experimental changes in release size or timing.

About 4 million eggs are collected annually at Willamette Hatchery. The majority of production is reared at the hatchery before being transferred to Dexter Ponds (1.3 million fish at 100/pound in June and 207,000 fish at 25/pound in November); 90,000 are retained at Willamette Hatchery until release into Fall Creek in February. Button up happens at 1700 TUs (approximately 1,400 fish/pound), and ponding normally occurs in late December. Eyed to ponding survival is typically greater than 96%. Willamette Hatchery also rears South Santiam spring Chinook, summer steelhead, and rainbow trout.

2.10.5.7 Marking

Proposed Action: The Action Agencies would continue to adipose fin-clip and otolith mark all Middle Fork Willamette spring Chinook at Willamette Hatchery. Timeframe: immediate/ongoing.

The Action Agencies propose to continue the current practice of adipose fin-clipping and otolith marking all Middle Fork spring Chinook.

Proposed Action: The Action Agencies would insert coded wire tags into all juvenile hatchery fish in addition to current practice of adipose fin-clipping and otolith marking. Timeframe: include purchase of CWTs for all Middle Fork releases in FY 2009 budget request and out years.

In addition to the current practice of adipose fin-clipping and otolith marking all hatchery releases, the Action Agencies propose to insert CWTs into all hatchery releases. Tag codes should be assigned according to releases in order to evaluate alternative release strategies.

2.10.5.8 Acclimation & Release

Proposed Action: The Action Agencies would continue acclimating and releasing the majority of Middle Fork Willamette spring Chinook at Dexter Pond Fish Facility. Timeframe: immediate/ongoing.

The Action Agencies propose to continue acclimating and releasing the majority of smolts at Dexter Pond and allowing for volitional release (Table 2-25 below). The Action Agencies would provide flows that allow acclimation and volitional release whenever possible until a new facility is built that functions throughout a wider range of river levels. The Action Agencies support continuing the release of fingerlings in Fall Creek to mitigate for failed downstream passage at Fall Creek Dam.

Table 2-25 Proposed Release Schedule for Middle Fork Spring Chinook.

Life Stage	Release Location	Release Date	Mean Size at Release (fish per lb)	Number of Fish Released	Total Pounds Released
Unfed Fry	Various STEP locations	Dec		10,000	
Yearling	MF Willamette at Dexter Ponds	Nov	8	300,000	37,500
1+ Yearling	MF Willamette at Dexter Ponds	Feb	11	538,000	48,909
	MF Willamette at Dexter Ponds	Mar	9	657,240	73,027
1+ Yearling	Below Fall Creek Reservoir	Feb	9	90,000	10,000
1+ Yearling	*Columbia River**	*March*	*12*	*855,000**	*71,250**
TOTALS	---	---	---	1,595,240	169,436

* Refer to the spring Chinook HGMP for more information, not included in total.

2.10.5.9 Spring Chinook Reintroduction/Hatchery Outplant Program

Several species of fish arrive at the Dexter Ponds Facility throughout the year, including hatchery and wild UWR spring Chinook and non-native hatchery summer steelhead. In addition to collection for broodstock needs, fish are transported to various locations based on management priorities (Table 2-26 below). Priorities for disposition of excess broodstock and non-hatchery species arriving at the Dexter Trap are determined by balancing goals for natural production, the Spring Chinook Reintroduction/ Outplant Program, hatchery management, and harvest opportunities; while ensuring that Tribal obligations are satisfied. The Action Agencies

and ODFW balance these goals with the physical limitations of the existing facility and the associated demands on hatchery personnel. In recent years, the majority of excess spring Chinook broodstock have been collected and transported to unseeded, historic habitat in efforts to re-establish natural production of spring Chinook (see Spring Chinook Reintroduction/Outplant Program in Section 2.10.2). In the Middle Fork subbasin, adult spring Chinook have been released in the North Fork Middle Fork upstream of Lookout Point Reservoir, the Middle Fork Willamette upstream of Hills Creek Reservoir, and Salt Creek. Some Chinook salmon have been released into the Coast Fork Willamette Basin. A summary of these releases is found in Beidler and Knapp (2005).

Table 2-26 Management Goals for Fish Collected at Dexter Ponds Fish Facility.

Species	Destination	Target Number of Adult Fish *		Maximum % of Wild Run
		Clipped	Unclipped	
Spring Chinook	Broodstock	1,200	500	100 *
	North Fork, Middle Fork Willamette	2,000	Any in excess of broodstock	
	Salt Creek	1,000	0	
	Middle Fork above Hills Creek Dam	3,000	0	
Summer Steelhead	Recycle – Middle Fork Willamette below Dexter Dam	All	0	N/A
	Remove from system	Excess to brood and recycling	All	N/A

Detailed protocols for disposition of excess hatchery broodstock, wild fish, and other species collected at Dexter Pond would be contained in the "Fish Disposition and Outplant Protocols" section of the Willamette FPMP. The FPMP would contain detailed, on-the-ground disposition protocols for all species of fish (clipped/unclipped) arriving at the Dexter Pond Fish Facility, including excess adult hatchery fish. Organized by date, it would specify priorities for disposition of wild/unclipped fish and establish numerical goals (and perhaps minimum number of females) for release at each release site. These goals would updated annually by FPHM Committee.

2.10.5.10 Research, Monitoring & Evaluation Needs for the Middle Fork Spring Chinook Salmon Hatchery Program

RM&E related to the Middle Fork Chinook salmon hatchery program must be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.

2.10.6 Upper Willamette Summer Steelhead Hatchery Program

The Upper Willamette Summer Steelhead Hatchery Program is managed to provide fish for sport fisheries and to replace lost fisheries caused by habitat and passage loss/degradation in the Willamette Basin and other lower Columbia basins. Summer steelhead are not native to the Willamette Basin upstream of Willamette Falls, and winter steelhead were historically not found in the Willamette Basin upstream of the Santiam River subbasin. ODFW first introduced summer steelhead into the upper Willamette Basin in the latter 1960s. Initially summer steelhead were brought into the South Santiam River as mitigation for lost winter steelhead production in areas inundated by the Foster and Green Peter reservoirs. This hatchery program was expanded to include annual smolt releases into the North Santiam, McKenzie, Middle Fork Willamette, and Molalla rivers as well, with the Molalla summer steelhead program being discontinued in 1997.

Winter steelhead were not used for mitigation in the South Santiam system for several reasons: (1) constraints on the ability to raise a quality smolt in the hatchery environment within the necessary timeframe; (2) because trap-and-haul and bypass facilities were incorporated into the dams, it was believed that UWR (winter) steelhead production above the reservoirs would continue to occur as it had in the past; and (3) fisheries managers wanted to develop expanded steelhead angling opportunities.

Summer steelhead are reared at a variety of hatchery facilities throughout the state. Production of summer steelhead in the Willamette Basin is funded from many other sources, including ODFW's Sport Fish Restoration Program and general fund, NMFS, Portland General Electric, and BPA. Details regarding funding allocations are provided in Section 1.3 of the Upper Willamette Summer Steelhead HGMP (ODFW 2004a).

Proposed Action: **The Action Agencies would continue current operations, production schedules, and releases as described in the Upper Willamette Summer Steelhead HGMP (ODFW 2004a) and in this section below. However, the Action Agencies propose to work with ODFW and the FPHM Committee of WATER to develop potential changes in the release strategies or production levels that could reduce impacts of the summer steelhead program on wild winter steelhead, such as scatter-planting smolts to increase harvest opportunities.**

Proposed Action: **The Action Agencies would, to the extent feasible (given infrastructure constraints), remove "non-migrants" from hatchery release groups to reduce residualism of fish that do not volitionally emigrate and potentially reduce adverse interactions with rearing winter steelhead.**

Proposed Action: **Beginning no later than 2008, the Action Agencies would scale back summer steelhead recycling efforts in the North Santiam Basin where the potential for adverse interactions with ESA-listed UWR winter steelhead are most significant. This would include incorporating the recycling protocol into the North Santiam/Minto Pond FPMP.**

Proposed Action: **The Action Agencies would assess the recycling program in the South Santiam basin to determine the extent to which early cessation of the recycling program would alleviate impacts to winter steelhead populations and impact fishery opportunities. The Action Agencies would incorporate the current recycling protocol into the South Santiam/Foster Dam FPMP. The Action Agencies would incorporate any changes in recycling protocol into the FPMP and carry out such changes beginning in 2009.**

Proposed Action: **Conduct short-term RM&E (in collaboration with other funding entities) to further define effects of the Upper Willamette Summer Steelhead Program on ESA-listed species. RM&E activities would focus on the following objectives:**

- **Determine the extent of natural production of summer steelhead (potentially by collecting genetic sampled from juvenile steelhead).**
- **Determine the extent to which juvenile summer steelhead and winter steelhead compete for resources, and ultimately determine if naturally produced summer steelhead are impacting productivity of winter steelhead.**
- **Continue monitoring returns of summer steelhead and the incidence of summer steelhead spawning in the wild.**
- **RM&E activities would be incorporated into the overall RM&E plan.**

Proposed Action: **Convene an interagency Summer Steelhead Working Group (as a subcommittee of the WATER FPHM Committee) to discuss options for long-term management of the summer steelhead program in light of ESA requirements and harvest goals. This group should seek input from non-governmental entities, such as sport fishing groups, and contain representation from other funding entities. This effort should also be informed by the Columbia Basin Hatchery Reform Project. The Summer Steelhead Working Group would:**

- **Discuss feasibility of implementing changes to the program as identified in the HGMP.**
- **Review results from the Columbia Basin Hatchery Reform Project.**
- **Review additional RM&E results that would inform priorities for shifts in management.**
- **Prioritize implementation of hatchery reform actions.**
- **Strive to develop a reform implementation plan that all funding entities agree to implement. If the entities cannot agree, then the USACE would propose reform actions for its portion of the production and reinitiate consultation.**

- **The Action Agencies would begin programming funding for hatchery reform efforts according to the implementation plan and implement actions as fund become available.**

Proposed Action: **The Action Agencies would set a 5-year check-in evaluation to verify with the Services that the implementation plan meets the requirements of the ESA. Should the plan (and any activities conducted to date) not be sufficient to avoid jeopardy to the UWR winter steelhead and spring Chinook ESUs, then the Action Agencies would reinitiate consultation. The following section summarizes the current program, which is described in detail in the Upper Willamette Summer Steelhead HGMP (ODFW 2004a).**

2.10.6.1 Current Summer Steelhead Hatchery Program: Broodstock, Production & Release

Broodstock

The Upper Willamette Summer Steelhead Program uses Skamania summer steelhead (stock 024), originating with eggs collected on the Washougal River. Beginning in 1973, all brood have been collected at the Foster Dam Fish Facility associated with South Santiam Hatchery. Only known hatchery fish are used for broodstock propagation.

Fish Disposition

Surplus hatchery fish are recycled through the downstream fishery until October when fish arriving at the collection facilities are removed from the system.

Collection Goals

Adult collection goals vary depending upon annual broodstock needs. To satisfy a cumulative smolt production goal of approximately 900,000, the current green-egg take goal is approximately 1.8 million (2003-2004 ODFW Hatchery Production schedules) from returning hatchery fish. From 1994 to 2002, the average number of broodstock collected annually was 455 males and 550 females, resulting in an average egg take of 1,849,000 (see Table 7.4.2 in the South Santiam HGMP (ODFW 2008b)).

Rearing Strategies

While all broodstock collection occurs at South Santiam Hatchery, summer steelhead are reared at several hatcheries throughout Oregon. The USACE-funded hatcheries include South Santiam, Marion Forks, McKenzie, Leaburg, and Willamette (see Table 1.5 in the South Santiam HGMP (ODFW 2008b) fish are often moved throughout their lifecycle.

Acclimation & Release

Acclimation and release procedures vary among basins and are described in Chapters 9 and 10 of the HGMP. All releases are adipose-fin clipped. Table 2-27 below summarizes the release levels for each major subbasin in the Willamette Basin as described in the HGMP (ODFW 2007a, 2008a, 2008b).

Table 2-27 Proposed Annual Fish Release Levels by Life Stage and Location.

Life Stage	Release Location	Annual Release Level (maximum number)
Yearling	North Santiam River/Minto Pond (April Release)	161,500
	South Santiam River (April Release)	144,000
	Willamette River at Eugene (April Release)	42,000
	Middle Fork Willamette (April Release)	115,000
	McKenzie River (April Release)	108,000

2.10.6.2 Hatchery Management Goals

Specific adult summer steelhead harvest goals are established in ODFW subbasin management plans and are listed in Table 1.7 of the Upper Willamette Summer Steelhead HGMP (ODFW 2004a). The summer steelhead program is managed as a segregated program (or isolated harvest), with the intent that summer steelhead would not spawn in the wild or adversely interact with ESA-listed species, such as UWR winter steelhead and UWR spring Chinook.

2.10.7 Rainbow Trout Mitigation Program

The goal of this program is to mitigate for trout harvest opportunities lost as a result of the construction and operation of Big Cliff, Detroit, Green Peter and Foster in the Santiam River subbasin, Fern Ridge in the Long Tom River subbasin, Blue River and Cougar in the McKenzie River subbasin, and Fall Creek, Lookout Point, Dexter, Dorena, Cottage Grove and Hills Creek in the upper Willamette River subbasin. The mitigation agreement calls for the production of no more than 277,000 pounds of *Oncorhynchus mykiss* (rainbow trout and steelhead) and *O. clarki* (cutthroat trout) annually. Rainbow trout comprise approximately 243,300 pounds of this amount. A stock of cutthroat that originated from the Long Tom River was discontinued because of poor performance. Cutthroat trout are no longer produced as part of the mitigation agreement.

Proposed Action: The Action Agencies would continue current operations, production schedules, and releases as described in the Upper Willamette Rainbow HGMP (ODFW 2005a) and summarized in Section 2.10.8.1.

Proposed Action: The Action Agencies would work with ODFW to develop a strategy for long term production of fish to meet the USACE's mitigation responsibility (i.e., including addressing Infectious Haematopoietic Necrosis (IHN) virus outbreaks at Leaburg Hatchery). Alternatives include installation of an ultraviolet filtration system at Leaburg, shifting production of rainbow trout to other facilities, and purchasing a portion (or all) of the fish required to meet the mitigation requirement.

Proposed Action: The Action Agencies would conduct short-term RM&E (in collaboration with other funding entities) to further define effects of the Upper Willamette Rainbow Trout Program on ESA-listed species. RM&E activities would focus on the following objectives:

- **Determine the spatial distribution of rainbow trout after release. Angler evidence indicates that releases migrate within basins to areas used heavily by rearing UWR spring Chinook.**
- **Determine the impact of rainbow trout predation on juvenile ESA-listed species in 2008. The original study involved several assumptions that were likely invalid. Combine this study effort with results regarding the spatial and temporal distribution of rainbow trout. Use these results to develop changes in management strategy for rainbow trout, including potential changes to harvest regulations.**
- **RM&E activities would be incorporated into the overall RM&E plan.**

Proposed Action: **The Action Agencies would convene an interagency Rainbow Trout Working Group (as a subcommittee of the WATER FPHM Committee) to discuss options for long-term management of the rainbow trout program in light of ESA-requirements and harvest goals. This group should seek input from non-governmental entities, such as sport fishing groups, and contain representation from other funding entities. The group would:**

- **Discuss feasibility of implementing changes to the program as identified in the HGMP or to change the type and species of release to meet the USACE mitigation responsibility.**
- **Review results from the Columbia Basin Hatchery Reform Project.**
- **Review additional RM&E results that would inform priorities for shifts in management.**
- **Prioritize implementation of reform actions, including changes to harvest regulations.**
- **The Action Agencies would begin programming funding for hatchery reform efforts according to the implementation plan and implement actions as fund become available.**

Proposed Action: **The Action Agencies would set a 5 year check-in evaluation to verify with the Services that the implementation plan meets ESA requirements. Should the plan (and any activities conducted to date) not be sufficient to avoid jeopardy to the UWR winter steelhead and spring Chinook ESUs, then the Action Agencies would reinitiate consultation. The following section summarizes the current program, which is described in detail in the Upper Willamette Rainbow Trout HGMP (ODFW 2005a).**

2.10.7.1 Current Rainbow Trout Hatchery Program: Production Levels, Rearing & Releases

Broodstock

The program uses Cape Cod stock (072) rainbow trout, an out-of-basin stock that was selected because of its spawn timing. The Cape Cod stock differs from native rainbow trout in the Willamette Basin in that the Cape Cod stock spawn in the fall (November-December), whereas native rainbow trout spawn in the spring (March-May). Also, it has been theorized that the genetic tendency for migration is more suppressed in the Cape Cod stock (Moring 1975) than in natural stocks. The broodstock is composed entirely of hatchery fish; all brood are maintained at Roaring River Hatchery. No wild trout are included in the broodstock.

Rearing and Incubation

Rainbow trout are currently raised primarily at two USACE-funded hatcheries – Leaburg Hatchery on the McKenzie River and Willamette Hatchery in the Middle Fork Willamette Basin. Rainbow trout are also reared at Roaring River Hatchery, which is funded by ODFW.

Release

Rainbow trout are released throughout the entire Willamette Basin, primarily at a size of three to four fish per pound (Table 2-28). Section 10 of the HGMP describes the releases in more detail (ODFW 2005a). All fish released into water bodies inhabited by ESA-listed species are adipose fin-clipped. Excess fish are released as fingerlings into lakes.

Table 2-28 Releases of Rainbow Trout and Presence of ESA-listed Species in Release Areas.

South Willamette Area						
Waterbody	**ODFW Waterbody Code**	**ESA-listed Fish Present [2]**	**Mark**	**Legal-size releases [3]**	**Fingerling Releases [4]**	**Total Releases**
Alton Baker Canal	0200100000	ChS		17000		17000
Big Cliff Res.	0270600000	ChS		5500		5500
Blue River	0201520000	BuT, ChS		6500		6500
Blue River Res.	0271600000	---		13000		13000
Breitenbush R.	0201110000	ChS		20000		20000
Carmen Res.	0270900000	---		24000		24000
Clear Lk.	0208600000	---		29000		29000
Cottage Grove Pd.	0263900000	---		5000		5000
Cottage Grove Res.	0270000000	---		16500		16500
Creswell Pd.	0250000000	---		4500		4500
Detroit Res.	0270200000	ChS		124500	300000	424500
Dexter Res. [1]	0270500000	ChS		19800		19800
Dorena Res. [1]	0270100000	---		18300		18300
E E Wilson Pd.	0251200000	---		12125		12125
Fall Cr.	0200310000	ChS		10000		10000

South Willamette Area						
Waterbody	**ODFW Waterbody Code**	**ESA-listed Fish Present [2]**	**Mark**	**Legal-size releases [3]**	**Fingerling Releases [4]**	**Total Releases**
Foster Res.	0271400000	ChS. StW	ad	43500		43500
Freeway Lk. E.	0230400000	ChS		4350		4350
Green Peter Res.	0271500000	ChS		22000		22000
Hatchery Outlet	0200410000	---		1500		1500
Hills Cr.	0200430000	ChS		1500		1500
Hills Creek Res.	0270200000	BuT, ChS			200000	200000
Junction City Pd. [1]	0276200000	---		14725		14725
Leaburg Lk.	0271700000	BuT, ChS	ad	28000		28000
McKenzie R-1	0201500000	BuT, ChS, OC	ad	35750		35750
McKenzie R-2	0201600000	BuT, ChS	ad	79500		79500
Quartzville Cr.	0201310000	---		12000		12000
Roaring R Park Pd.	0277700024	---		1080		1080
Salmon Cr.	0200410000	ChS		12000		12000
Salt Cr.	0200420000	ChS		3000		3000
Santiam R, N Fk.	0201100000	ChS		33000		33000
Smith Res.	0271000000	---		15000		15000
Timber Linn Lk.	0246900000	---		1725		1725
Trail Br Res.	0271100000	BuT, ChS	ad	14085		14085
Walling Pd. [1]	0261500000	---		5700		5700
Walter Wirth Lk. [1]	0255000000	---		24600		24600
Waverly Lk.	0246500000	---		910		910
Willamette R, Coast Fk.	0200200000	ChS, OC		2700		2700
Willamette R, Middle Fk.	0200300000	BuT, ChS	ad	6335		6335
TOTALS				688,685	500,000	1,188,685

1 Some or all of the fish stocked in this waterbody come from Desert Springs Trout Farm instead of, or in addition to, an ODFW hatchery.

2 BuT = bull trout, ChS = Willamette spring Chinook, OC =Oregon chub, StW = Willamette winter steelhead.

3 Legal sized releases vary from 0.5 to 3 fish/pound.

4 Fingerling sized releases vary from 30 to 100 fish/pound.

2.10.7.2 Hatchery Management Goals

The hatchery rainbow trout program is a segregated, or "isolated harvest" program, where the fish are produced for harvest and are not intended to spawn in the wild or be genetically integrated with any specific natural population.

2.10.8 Hatchery Mitigation Program Research, Monitoring & Evaluation

Proposed Action: **The Action Agencies, in coordination and collaboration with the Services and the WATER FPHM Committee, would develop and implement a RM&E program to determine compliance with, and effectiveness of, the hatchery-related actions described in Section 2.10. The RM&E program is intended to evaluate the effectiveness of the mitigation program in meeting legal mitigation requirements, supporting natural production of ESA-listed fish, and related effects on ESA listed fish species. The recommendations must be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.**

The Action Agencies envision a comprehensive Hatchery Mitigation RM&E Program. The framework includes a set of strategic planning questions and key RM&E program elements.

2.11 HABITAT RESTORATION & MANAGEMENT ACTIONS

This section describes measures ongoing and proposed by the Action Agencies to address management and restoration of habitat directly or indirectly used by ESA-listed species. The measures are broken down into the following categories:

- Habitat actions conducted onsite (on USACE-administered project lands).
- Habitat actions offsite (off of USACE-administered project lands) upstream and downstream of the basin dams and reservoirs.
- Measures to address habitat restoration associated with potential removal or modification of bank revetments and other forms of protection constructed and managed by the USACE under the Willamette Bank Protection Program.
- Ongoing and proposed research, monitoring and evaluation efforts by the Action Agencies related to aquatic habitat conditions.

2.11.1 Onsite Habitat Restoration & Resource Stewardship Actions

Proposed Action: **The USACE would continue to use existing authorities and programs for land and water resource stewardship on USACE-administered lands at the 13 Willamette projects to manage onsite habitat to benefit and protect ESA-listed species.**

Section 2.1 of the 2000 BA (USACE 2000) describes habitat management and natural resource stewardship actions undertaken by the Action Agencies on lands owned by the Federal Government and managed by the USACE and other entities at the 13 Willamette dams. In summary, within the Willamette Basin the USACE administers over 30,000 acres of project lands. In accordance with USACE regulations, those lands are managed for authorized project purposes within a system of land use allocation and classification. The USACE land use classifications define resource management and development practices, which may be either appropriate or inappropriate for that parcel of land. There are five land use categories into which lands at USACE projects may be classified: Project Operations, Recreation, Mitigation, Environmental Sensitive Areas, and Multiple Resource Management. The latter can be further subdivided into Low-density Recreation Use, General Wildlife Management, Vegetative Management, Inactive and/or Future Recreation Areas, and Easement Lands. The extent of these lands on each of the projects is summarized in Table 2-10 of the 2000 BA. There have been no changes in land use classification at any of the projects since the 2000 BA.

However, since 2000 the USACE has undertaken some changes in specific habitat management and resource stewardship practices that are directly or indirectly related to ESA-listed wildlife and plant species at a number of projects. These changes in management practices, which do not directly or indirectly affect ESA-listed fish species, are described in Section 3.5.1 of the Supplemental BA (USACE 2007a).

2.11.2 Offsite Habitat Restoration Actions

Proposed Action: **For offsite river reaches upstream and downstream of USACE project lands, the USACE would use its existing authorities under the General Investigations (GI) and Continuing Authorities Program (CAP) to undertake habitat restoration projects in the Willamette River Basin. Under these programs, the USACE has standing authorities to evaluate and implement aquatic ecosystem restoration projects throughout the basin. These programs do require cost-sharing and other forms of support from qualified non-Federal sponsors. They also are not currently a high budgetary priority of the administration, and Federal funds can be difficult to obtain. However, these programs are the only vehicle available to the USACE for undertaking habitat restoration off of USACE project lands.**

Section 1.6.1 of the 2000 BA (USACE 2000) includes a description of the GI and CAP programs, and included the projects underway at that time. The GI and CAP programs are the normal USACE mechanism for planning, designing, and constructing new projects and updating existing ones. Both programs include procedures for obtaining Congressional authorization and funding for project construction.

The habitat restoration projects in the Willamette Basin under development by the Action Agencies and their partners vary in size, design, scope, and location. In general, all habitat and bank protection-related restoration projects are intended to improve stream banks and adjacent river reaches by moving the trajectory of associated principle constituent elements of critical habitat within them toward a properly-functioning condition. Restoration projects are expected to improve hydrogeomorphic dynamics, large wood and sediment processes, floodplain forest

recovery and connectivity, sediment transport processes, and channel complexity by replacing hardened (e.g., rip rap) bank structures that provide little geomorphic or biological benefit with more natural bank treatments containing large wood, riparian vegetation, and natural bank material. Additionally, some bank protection-related restoration projects may involve removal of a structure to reconnect off-channel habitat, providing additional rearing and holding habitat to improve abundance and productivity of UWR Chinook salmon and steelhead. Physical and biological monitoring is important in determining the effects of each project on geomorphic and biological processes within the project area. Results of the monitoring efforts would be important for designing and implementing future restoration projects, and for evaluating the response of listed species, their prey base, and habitat to the projects implemented.

2.11.2.1 General Investigations Program

The GI program is used by the USACE and non-Federal sponsors to generally address complex, large-scale, multiple purpose water resource projects that are specifically authorized by Congress. Projects under this authority can look at a broad and complex range of activities and have no authorized funding cap or limit. The GI study is conducted in two phases. The first phase, called the reconnaissance phase, is designed to identify water resource problems and opportunities in which there is a Federal interest in conducting a more detailed feasibility phase study. The feasibility study is conducted with 50/50 cost-sharing by a non-Federal sponsor. Feasibility studies are generally intended to lead toward recommendations for Federal water resource projects. The recommendations contained in feasibility studies are submitted forward for administration approval and Congressional authorization and approval. Implementation by the USACE requires both Congressional authorization and approval.

There are currently three ongoing feasibility studies in the Willamette Basin in which ecosystem restoration is a primary objective: (1) Willamette Floodplain Restoration Study; (2) Eugene/Springfield Metropolitan Area Watershed Study; and (3) Lower Willamette Ecosystem Restoration Study. Individually and collectively, these GI efforts have the potential to lead to future ecosystem restoration projects that could significantly benefit habitat requirements for ESA-listed aquatic and terrestrial species. However, none of these studies is expected to lead to project implementation prior to FY 2010.

Willamette River Floodplain Restoration Study

The 2000 BA (USACE 2000) described the Willamette River Floodplain Restoration Study, which was in the reconnaissance phase at the time. The feasibility study began in 2003 when the USACE executed a Feasibility Cost-sharing Agreement with the non-Federal Sponsor, the Willamette Partnership.

The purpose of the Willamette River Floodplain Restoration Study is to evaluate opportunities to modify existing floodplain features in the Willamette Valley to reduce flood damages while restoring natural wetlands and promoting ecosystem restoration.

After evaluating a number of alternative reaches of the Willamette mainstem and other subbasins, the Middle and Coast Forks were chosen as priority focus areas. These reaches were selected based on the potential for restoring floodplain and related habitat complexity and diversity, the availability of public lands on which to initiate restoration projects, and a high degree of interest by watershed councils and other local stakeholders. Efforts to date have

focused on technical analysis of the study area reaches, including inventory and analysis of site conditions, development of baseline ecological and physical data, evaluation of historic and ongoing hydrogeomorphic conditions and processes, and preparation of hydraulic and ecological models. Preliminary analysis identified five reaches within the two rivers in the study area with high potential for ecosystem restoration. Depending on available funds, the USACE and non-Federal sponsor intend to continue with more detailed evaluation of the one or two highest priority reaches.

A key element of the study is evaluation of potential modifications of flow releases on the Coast and Middle Fork dams. This element of the study is being conducted by the USACE in partnership with The Nature Conservancy under the nationwide Sustainable Rivers Project (SRP). The Willamette SRP would build on the floodplain restoration study by developing environmental flow recommendations for the reaches downstream of the USACE dams and linking those flows to opportunities for stream channel and floodplain restoration, and improvement in operation of the dams. Given the existing floodplain restoration study, the initial SRP efforts is focusing on the Coast and Middle Forks and the mainstem Willamette River immediately downstream of these tributaries, as a pilot study that can be replicated in the rest of the Willamette system.

Possible outcomes and alternatives that might be recommended for implementation as a result of the Willamette Floodplain Restoration Feasibility Study include:

- Criteria and priorities for floodplain restoration activities.
- Conservation of floodplain lands.
- Removal and/or modification of bank revetments.
- Restoration of riparian corridors.
- Agricultural levee set-backs.
- Increased natural flood storage.
- Bio-sensitive channel bank and floodplain protection.
- Modification of reservoir operation.

The feasibility study is scheduled for completion in FY 2008. It is intended to be a pilot reach study; the tools, processes, and projects developed as a result of the Middle and Coast Fork studies would be exported to other reaches and subbasins in the Willamette Basin, although additional Federal and non-Federal funding would be required to expand the study beyond its current scope.

Eugene-Springfield Metropolitan Area Watershed Feasibility Study

The purpose of this study is to develop comprehensive water-resource improvement projects in four western watersheds within the urban metropolitan area – with benefits for multiple water resource objectives. These objectives include flood damage reduction, aquatic ecosystem restoration, water quality improvement, public use, waterway improvements and integrated watershed management. The study is initially focusing on two priority-planning corridors, Amazon and Cedar creeks. The USACE and non-Federal sponsors are currently developing cost estimates for conceptual alternatives along each creek. The study would eventually focus on

practically all the waterways located in the metropolitan area of Eugene-Springfield, including the mainstem Willamette River and the McKenzie River.

Lower Willamette Ecosystem Restoration Feasibility Study

This study was initiated in FY 2004. The non-Federal sponsor is the City of Portland. The study would assess the feasibility of ecosystem restoration, including remediation of contaminated sediments over a portion of a 25-mile reach of the Willamette River in Portland. The feasibility study area encompasses the lower Willamette River watershed from Willamette Falls to its confluence with the Columbia River. The study objectives are to assess opportunities to: (1) increase the number of interconnected, active channels and open slack water areas; (2) increase shallow-sloped and less reinforced shoreline areas, and bank vegetation; (3) improve access to tributary streams; (4) increase emergent wetlands and riparian forest; and (5) improve sediment and water quality.

Under the current Federal funding environment, the feasibility study is scheduled for completion by FY 2011. In FY 2006, the USACE completed the without-project condition report, which identified numerous conceptual projects as shown in Table 2-29. This list is provided as an example of the types of restoration projects that may ultimately be implemented as a result of the feasibility study.

Table 2-29 Initial Screening of Potential Lower Willamette Ecosystem Restoration Projects

Project	Water Body	Potential Ecosystem Restoration Projects
Alsop-Brownwood	Johnson Creek	Create off-channel habitat for salmonids and water quality improvements. Create flood storage to mitigate nuisance flooding.
Arnold Creek Culvert	Tryon Creek	Retrofit Tryon Creek culvert to provide passage to lower Arnold Creek Bell Station. Create off-channel habitat. Purchase frequently flooded properties and create flood storage to mitigate nuisance flooding. Address exposed sewer pipe crossing creek.
Bell Station	Johnson Creek	Create off-channel habitat. Purchase frequently flooded properties and create flood storage to mitigate nuisance flooding. Address exposed sewer pipe crossing creek.
St. John's Landfill Boat Launch	Columbia Slough	Pull back banks and create wetland benches, create off-channel wetland habitat, and plant vegetation to create wildlife habitat.
BES Treatment Plant Banks	Columbia Slough	Lay back banks, increase amount and quality of vegetation, add anchored wood. Create small off-channel wetlands (if site uses and existing habitat can be protected).
Blind Slough	Columbia Slough	Valuable off-channel habitat with good existing riparian canopy and shrub vegetation. Habitat values can be increased by improving channel structure by adding large woody debris (LWD), increasing area of off-channel habitat, and minor revegetation.
Boones Ferry Culvert Retrofit	Tryon Creek	Retrofit culvert to provide passage from Tryon Creek State Natural Area to Marshall Park and Upper Tryon Creek.
Cathedral Park	Willamette Mainstem	Revegetate banks; retrofit parking lot and existing swale; create off-channel wetland habitat (includes increase in shallow water habitat), LWD placement.

Project	Water Body	Potential Ecosystem Restoration Projects
Centennial Mills	Willamette Mainstem	Demolition or redevelopment of this site provides the opportunity to improve banks and floodplain. Daylight Tanner Creek and create off-channel cool water confluence habitat.
City Banks opposite Kelley Point	Columbia Slough	Pull back banks and create small alcoves. Location at major confluence provides important connections to both Willamette and Columbia River fish populations.
Crystal Springs Culvert Replacements	Johnson Creek	Replace culverts at Tacoma and Tenino Streets and improve passage under private carport to improve access to restored habitat at Westmoreland Park.
Eastbank Crescent	Willamette Mainstem	Regrade and revegetate banks; increase shallow water habitat; incorporate stormwater treatment.
Elk Rock/Spring Park	Willamette Mainstem	Add wood, increase vegetation and enhance good existing habitat. Acquire property from willing sellers to increase complexity of off-channel habitat.
Freeway Land Company/East Lents	Johnson Creek	Create off-channel habitat for salmon and water quality improvement. Create flood storage to mitigate nuisance flooding. Purchase homes to move residents out of floodplain.
Kelley Point Park	Willamette Mainstem	Remove invasive plants and plant native species; create off-channel habitat
Kenton Cove	Columbia Slough	Add wood to enhance habitat complexity in this off-channel habitat.
Lower Powell Butte	Johnson Creek	Purchase frequently flooded properties from willing sellers. Restore floodplain and create off-channel habitat.
Marshall Park Channel Restoration	Tryon Creek	Improve channel conditions along Marshall Park by stabilizing banks with bio-engineering and adding instream complexity to improve habitat and water quality.
Middle TCSNA Habitat Enhancement	Tryon Creek	Enhance habitat by controlling erosion along the tributaries to protect mainstem habitat, replacing culverts, and increasing instream complexity along the mainstem.
Oaks Bottom Wildlife Refuge	Willamette Mainstem	Restore off-channel habitat; control invasive plant species; improve banks.
Oaks Crossing/Sellwood Riverfront Park	Willamette Mainstem	Improve amount and quality of vegetation in floodplain. Create off-channel and additional shallow water habitat that are consistent with park uses.
Oxbow at Errol Heights	Johnson Creek	Purchase frequent flooded properties and create flood storage to mitigate flooding. Rehabilitate wetlands. Create off-channel habitat.
Powers Marine Park	Willamette Mainstem	Remove invasive plant species, revegetate, establish wood jams, create off-channel habitat at the confluences of the seasonal streams flowing off the hillside.
Ramsey Refugia	Columbia Slough	Restore 5 acres of floodplain forest and backwater slough habitat by restoring hydrologic connectivity between Ramsey Lake Wetland and the Columbia Slough.
Smith and Bybee Lakes	Willamette Mainstem	Revegetate areas along the lakes. Upgrade water control structure to allow more natural hydrology and salmon access (in progress).
Stephens Creek Mouth	Willamette Mainstem	Maintain off-channel habitat; expand on existing high quality functions.

Project	Water Body	Potential Ecosystem Restoration Projects
Swan Island Beach South	Willamette Mainstem	Maintain habitat values at this site. Pull back banks, increase vegetation and wood, and restore floodplain.
Tryon Creek Confluence	Tryon Creek	Pull back steepened banks, improve composition of floodplain and frequency of inundation, vegetate banks, improve complexity of channel, add wood.
Tryon Highway 43 Culvert	Tryon Creek	Improve passage and channel conditions to improve access to one of the largest contiguous high quality habitats in the city, Tryon Creek State Natural Area.
Waterfront Park Bowl	Willamette Mainstem	Remove rip rap, plant native vegetation, create shallow water habitat, and increase bank complexity. Provide moorage to discourage anchoring on banks.
West Lents	Johnson Creek	Create off-channel habitat. Create flood storage to mitigate nuisance flooding. Purchase frequently flooded properties to move people out of the floodplain.
Westmoreland Park	Johnson Creek	Improve fish and wildlife habitat and fish passage in Crystal Springs and Westmoreland Park.
Willamette Cove	Willamette Mainstem	Restore consistent with site master plan. Create off-channel habitat. Remove riprap and regrade banks to expand shallow water habitat and floodplain. Increase vegetation on banks and floodplain.
Willamette Park	Willamette Mainstem	Improve over-steepened and hardened banks; revegetate, protect and enhance shallow water habitat; create off-channel habitat.
Wright and Moore Islands	Columbia Slough	Enhance good existing habitat by adding wood and looking for opportunities to excavate off-channel wetland habitat. Lay back banks at Heron Lakes to create wetland benches.

2.11.2.2 Continuing Authorities Program

The CAP generally includes smaller, single-purpose water resource projects for which Congress has delegated authority to the USACE to construct without specific authorization. Two of these authorities specifically allow ecosystem restoration projects, including restoration of habitat critical for recovery of ESA-listed species. Section 1135 authorizes the USACE to modify existing projects for ecosystem restoration, and the Section 206 authority is used to restore degraded aquatic ecosystems.

There have been no significant changes in these authorities from the descriptions contained in the 2000 BA (USACE 2000). They remain potentially valuable tools for the USACE and other Action Agencies to use to restore aquatic habitat conditions in the Willamette Basin. Provided below is an updated list of Willamette Basin projects currently in the Section 1135 and 206 programs.

Lower Amazon Creek Wetlands Section 1135
This project was constructed in partnership with City of Eugene. Construction was initiated in 1999 and substantially completed in 2004. The project removed approximately 24,000 linear feet of levee along Amazon Creek (a tributary to the Long Tom River) and restored floodplain connectivity between Amazon Creek and approximately 400 acres of wet prairie wetlands.

Eugene Delta Ponds Section 206
Construction was initiated in 2005 in partnership with City of Eugene. The project is providing floodplain and hydrologic connectivity to the Willamette River mainstem through a series of old gravel pits. After initial hydrologic connections were installed in 2006, juvenile salmonids were found using the restored rearing habitat almost immediately.

Springfield Millrace Section 206
The feasibility study is completed and design has been initiated. The project would protect, enhance, and create habitat for native wildlife and fish, including ESA-listed species by constructing a permanent water intake structure for the millrace; ensuring adequate water delivery to the millrace, millpond, and associated wetlands; placing fish screens to prevent fish entrapment; creating a main channel through the millpond and lowering the dam to increase water velocity through the pond; constructing a 20-acre wetland and swales in the millpond to increase wildlife habitat diversity and filter run-off into the millrace; and restoring riparian vegetation along the banks of the millpond. The project is currently on-hold due to lack of funding but would be resumed when funding becomes available.

Springwater Wetlands Complex Section 206
The feasibility study for this project is scheduled for completion in FY 2008. If implemented, the project would improve habitat for a wide variety of wildlife species, including neotropical migratory birds, waterfowl, shorebirds, amphibians, reptiles, and mammals. The ecosystem restoration project would include up to 40 acres of wetland and riparian restoration. Although the feasibility study itself is likely to be completed, implementation would be contingent upon Congressional approval and funding. NMFS therefore considers this a possible action.

Westmoreland Park Section 206
The feasibility study was completed in partnership with the City of Portland. The project would provide juvenile fish passage from Johnson Creek up to the upper end of Westmoreland Park; significantly improve aquatic habitat for ESA-listed salmonid rearing and refuge; provide a significant riparian corridor and wetland habitat for wildlife species; and significantly improve water quality conditions by eliminating the duck pond (which currently causes significant heating of the water), reducing excessive waterfowl use of the park, and reducing runoff of other contaminants by providing a buffer for the creek and wetlands. The project is currently on-hold due to lack of funding. The project would be resumed when funding becomes available.

Oaks Bottom 206
The feasibility study was completed in partnership with the City of Portland. The project would relocate culverts, restore lands north of the existing reservoir through excavation of channels, and restore critical habitat for ESA-listed salmonids. The project is part of the City of Portland's "River Renaissance Project" that aims to restore the health of the Willamette River. Oaks Bottom is part of this larger initiative and is important to help restore native vegetation, improve water quality, and restore habitat for threatened and endangered fish species. The project is

currently on-hold due to lack of funding, but would be resumed when funding becomes available.

2.11.3 North Santiam Gravel & Large Wood Restoration Study

Proposed Action: The Action Agencies, working in collaboration with the North Santiam Watershed Council and other project partners, would undertake a study to determine the potential for improvement of habitat conditions for ESA-listed species and other aquatic species through a well-planned gravel augmentation and large wood restoration project.

USACE met with technical representatives from NMFS, USFWS, ODFW, and the North Santiam Watershed Council in 2006 to discuss the potential for improving salmonid spawning through gravel augmentation and related habitat restoration activities, including large wood restoration. The team concluded that potential does exist but identified a number of research questions that should be addressed before a restoration project or projects can be designed. Research would consider gravel composition, gravel placement, hydrology effects on gravel transport, and estimates of habitat benefits.

The proposed study would be designed to address these questions. The objectives of the study are to: (1) define the problem; (2) identify potential solutions/alternatives; and (3) analyze costs, benefits, and environmental impacts of alternatives. The goal of the study is to identify gravel augmentation and/or large wood projects that can be carried out in the North Santiam basin to restore habitat. The Action Agencies assume that the North Santiam study results can also be applied to similar situations in other subbasins.

2.11.4 Willamette River Bank Protection Program

Proposed Action: The Action Agencies would possibly undertake a comprehensive evaluation of the habitat and biological impacts of revetments placed or funded by the USACE Willamette River Bank Protection Program. The objectives of the study would be to: (1) inventory and analyze the status of existing bank protection sites in the basin; (2) identify bank protection sites where removal or modification may be feasible to restore natural river functions; (3) evaluate the cumulative effects of bank protection on the river and riparian zone; (4) provide an estimate of areas threatened by future erosion and bank protection work; (5) reexamine procedures and criteria for justifying new bank protection projects; (6) identify and evaluate current and alternative bank protection measures; and (7) recommend and establish criteria for future bank protection works, including maintenance, repair and rehabilitation of existing sites. The study would be undertaken in close coordination with the Services.

Section 2.12 of the 2000 BA (USACE 2000) described the Willamette River Bank Protection Program. The USACE constructed about 100 miles of bank protection projects on the Willamette River and its tributaries. The USACE has not undertaken any new bank protection

works nor repaired or replaced any of the existing project sites since the 2000 BA was completed.

A source of funding and a time frame for conducting the proposed study has not been identified. The USACE would place a priority on attempting to program funds and initiating the study as soon as possible.

The proposed study would include all USACE revetments in the Willamette Basin. There are approximately 330 revetments (those constructed by the USACE as well as by other entities) to be included in this review. The scope of the study would be developed in coordination with the Services. However, as a preliminary proposal the Action Agencies recommend the study encompass the following tasks:

1. Establish biological and physical goals and objectives.
2. Develop biological and physical criteria.
3. Perform complete inventory of bank protection sites.
4. Perform preliminary site evaluations.
5. Prepare conceptual designs and preliminary river hydraulics/channel-stability analysis.
6. Prepare final report.

2.11.4.1 Future Actions to Remove or Modify Revetments

Out of the 138 bank protection sites constructed by the USACE in the Willamette Basin, the USACE retains maintenance responsibility for only those 88 sites constructed prior to 1951; the remaining sites are maintained by a non-Federal sponsor. The USACE may be able to use operations and maintenance funding to modify sites for which the USACE does retain maintenance responsibility. However, those funds are likely to remain highly constrained.

It is more likely that the USACE would seek funds to implement the recommendations of the bank protection study through the GI and CAP Section 1135 and 206 authorities. In particular, the Willamette Floodplain Restoration Study is currently evaluating the potential for restoring floodplain restoration function on the reaches of the Coast and Middle Forks downstream of the USACE dams. The study would consider the potential for removing or modifying some of the approximately 30 bank revetments in the study area. As previously noted, non-Federal sponsorship would be required to implement project modification under CAP and GI authorities. Detailed design and hydraulic analysis necessary to undertake any bank revetment modifications would need to be done for any sites chosen for revetment modification or removal.

Despite the USACE's ongoing maintenance responsibility at some sites, the USACE is not authorized to remove or modify existing bank protection sites without first obtaining landowner approval and a non-federal sponsor. The sponsor must provide part of the funding for project construction and is responsible for maintaining the project when construction is complete. Before the USACE can remove or modify any of these projects, it must reach agreement with the project sponsor about the action. Even for those projects constructed prior to 1950 for which there is no local sponsor, the bank improvements are located on private lands, and thus landowner is required for any revetment removal or modification.

2.11.5 Habitat-Related Research Monitoring & Evaluation

Proposed Action: The Action Agencies would undertake certain habitat-related research, monitoring and evaluation measures in conjunction with the previously described existing authorities for land and water resource protection and management on USACE-administered lands, the CAP and GI programs, and the Willamette Bank Protection project. The RM&E program would be developed as part of the larger RM&E program described in Section 2.14, and would be coordinated through the RM&E Committee of WATER, described in Section 2.6.

Action Agency funding for RM&E activities is limited. The USACE has a national policy limiting expenditures for RM&E associated with ecosystem restoration projects to 1% of total project costs. The USACE would apply this policy to all restoration projects developed under the CAP and GI programs unless a waiver is granted by USACE headquarters. Likewise, funding available for RM&E in the USACE operations and maintenance budget is also constrained.

2.11.5.1 Aquatic Habitat Assessments

Proposed Action: By the end of FY 2007, the Action Agencies would complete ongoing surveys of aquatic habitat availability and condition in the Willamette River mainstem and major tributaries. The Action Agencies would distribute copies of the final report to the Services and would make the report and GIS format available on the internet.

The Action Agencies believe that accurate and current survey and assessment of aquatic habitat conditions in the Willamette River and tributaries would be necessary in order to compare and evaluate the entire range of ESA-related conservation measures under consideration by the Action Agencies in this revised proposed action as well as by others in the Willamette Basin.

In 2005, the USACE contracted with R2 Resource Consultants to prepare an inventory of all habitat surveys that had been completed to date. R2 Resource Consultants compiled a thorough list of all existing habitat surveys in the Willamette Basin, organized by river reach. The results of this inventory are described in the Willamette Valley Anadromous Fish and Bull Trout Habitat Assessment (R2 Resource Consultants 2005). Based on recommendations in the report, in 2006 and 2007 the USACE again contracted with R2 Resources to develop an appropriate protocol and complete a thorough habitat survey upstream and downstream of USACE dams. Approximately 157 miles of habitat were surveyed above the dams and 55 miles below dams in the North Santiam, South Santiam, Middle Fork, and McKenzie subbasins. As of April 2008, the subject report has not been completed.

2.12 STRUCTURAL MODIFICATIONS: FISH PASSAGE, TEMPERATURE CONTROL & HATCHERIES

This section deals with Action Agency proposed measures to address structural modifications at USACE dams in the Willamette River Basin that may be needed for improving the survival and productivity of ESA-listed species. The measures are broken down into the following categories:

- Modification of Willamette Temperature Control Project to add adult fish collection facilities at Cougar and defer construction of Blue River Temperature Control Facilities.
- Continued operation of the Cougar Water Temperature Control Facility.
- Evaluation of existing adult fish traps and potential modifications.
- Proposed strategy to comprehensively study project facilities and operations to improve survival and productivity of ESA-listed aquatic species.

2.12.1 Cougar Dam Adult Fish Collection Facility & RME Program

Proposed Action: **The Action Agencies would complete a Post-authorization Change (PAC) report for the Willamette River Temperature Control Project that would seek approval for modifying the authorized project to (1) add fish passage facilities at Cougar Dam; (2) undertake a detailed post-construction monitoring and evaluation program; and (3) defer construction of Blue River selective withdrawal capability. If approved, construction of the proposed fish passage facilities would be initiated in FY 2008.**

This section deals with recent and proposed structural modifications at Cougar Dam on the South Fork McKenzie River. This is the only location in the Willamette Project where significant structural modifications associated with ESA-listed species have occurred since the 2000 BA (USACE 2000) was completed.

At the time the 2000 BA was written, construction of selective withdrawal towers at Cougar and Blue River Dams was authorized under the Willamette River Temperature Control Project. The purpose of the project was to improve fish habitat conditions and increase productivity in the mainstem McKenzie River, South Fork McKenzie River, and Blue River by restoring a more normative temperature regime below the dams. Construction of the selective withdrawal tower at Cougar Dam was completed in December 2004. Although the Blue River Dam tower was anticipated to begin in 2002, construction has not been initiated. This was partially the result of cost overruns in the construction of the Cougar selective withdrawal tower. However, the USACE, state, and Federal resource agencies agreed that providing fish passage at Cougar Dam may be a more cost-effective means for increasing productivity for spring Chinook than the inclusion of temperature control at Blue River. The USACE prepared a PAC report to evaluate and recommend alternatives including constructing fish passage facilities at Cougar Dam in lieu of selective withdrawal at Blue River.

Construction of the Cougar Dam WTC facility was covered under a separate Biological Opinion (NMFS and USFWS 2000). However, continued operation of the facility as an integral part of Cougar Dam and the Willamette System is addressed under this Section 7 consultation for the Willamette Project. A separate Biological Opinion has been prepared addressing construction of the proposed fish passage facilities at Cougar Dam (NMFS 2007a).

In the PAC, the USACE proposes to construct a permanent fish trap-and-haul facility to restore connectivity between fish populations located above and below the Cougar project. Additionally, the USACE proposes to fund an extended biological monitoring and evaluation program of the downstream ecosystem and of fish entrainment in the tower to determine and insure the most effective protocol for implementation of water temperature control and of the trap-and-haul program, and to document the biological benefits realized from these protective and restorative measures. The USACE proposes to reduce the operating hatchery mitigation program when the monitoring and evaluation program and other studies demonstrate successful natural production of juveniles and of adult return rates leading to a self-sustaining population of Chinook salmon above Cougar Dam. Finally, the USACE proposes to defer construction of the Blue River WTC structure indefinitely.

2.12.2 Willamette Valley Fish Handling & Transport Facilities Improvements

Proposed Action: The Action Agencies would evaluate Willamette Valley fish handling and transport facilities associated with the dams and possibly carry out modifications determined to be necessary to meet requirements for ESA-listed species as soon as programmed funds can be made available.

Subsequent to completion of the 2000 BA, the USACE undertook initial efforts to evaluate facility needs for listed fish species at collection facilities at Willamette dams and selected hatchery facilities. The South Willamette Valley Fish Facilities Improvements Conceptual Design Report (McMillen Engineering 2005) reviewed existing fish trapping facilities at Minto Pond on the North Santiam River, Foster Dam on the South Santiam River, Dexter Pond on the Middle Fork Willamette, and Fall Creek Dam on Fall Creek. This report evaluated the existing condition of each fish facility and determined that the existing trapping facilities do not have adequate collection, sorting, holding, and transport capabilities to handle ESA-listed fish or meet the demands of current hatchery operations. The report also presented conceptual design alternatives for improving the existing facilities to (1) meet updated criteria for reducing stress, injury, and mortality of ESA-listed species, including hatchery fish; and (2) to allow safe and efficient sorting of hatchery and wild fish, as necessary for current hatchery operations. Table 2-30 summarizes the recommended improvements for each of the fish handling facilities, as well as preliminary cost estimates. The Action Agencies would seek input from the Services regarding the most appropriate design features for each facility and hope to incorporate common design elements into each facility to facilitate ease of operation, maintenance, and repair.

Table 2-30 Recommended Improvements to Fish Handling Facilities as Described in the Conceptual Design Report.

Facility	Existing System Modifications*	New Facility Components*	Estimated Project Cost
Minto Pond	Raise barrier dam crest with Obermeyer spillway gate. Upgrade existing access road.	Intake with fish screen. Fish ladder Pre-sort holding ponds. Elevated sorting facility including sorting area, post-sort raceways, crowding channel, & truck loading. Complete electrical system.	$10,003,000
Foster Dam Trap	Tie to existing fish ladder entrance and AWS.	Fish ladder. Pre-sort holding pond. Elevated sorting facility including sorting area, post-sort raceways, crowding channel, & truck loading. Broodstock holding and spawning facility.	$7,546,000
Dexter Pond	Install intake screen on existing intake. Install new fish entrance barrier panel. Install new floor diffusers for existing pre-sort holding pond. Install new fish crowder on existing pre-sort holding pond. Upgrade electrical system/controls.	Fish lock. Elevated sorting facility including sorting area, post-sort raceways, crowding channel, & truck loading.	$5,748,000
Fall Creek Dam Trap	Inspect and repair/replace existing gates and pumps. Replace electrical system and control panels. Install gravity water supply pipe from fish horns to elevated sorting facility.	Fish lock. Elevated sorting facility including sorting area, post-sort raceways, crowding channel, &truck loading.	$3,751,000

* These proposed modifications and new design features are recommended by the Conceptual Design Report and describe the types of modifications (or reconstruction) necessary at each facility. However, the USACE would work with the Services as it develops more detailed designs, which may include changes to some of these features. Source: McMillen Engineering 2005.

The Action Agencies consider upgrading these facilities a high priority. The USACE is seeking funding through the operations and maintenance budget's Critical Infrastructure Program. The USACE believes that the highest priority among the four sites evaluated is the Minto Pond Fish Collection Facility below Big Cliff Dam on the North Santiam River.

The President's FY 2008 budget includes $200,000 for developing a Detailed Design Report from the Minto Trap initial conceptual design. The Action Agencies would continue to seek program funds for completion of design and construction of the Minto Pond facility in the out years. The Action Agencies would work with the Services and other resource agencies to establish priorities among the other fish handling facilities. Evaluation of those alternatives would be integrated into the system review studies described in Section 2.12.3.

Proposed Action: The Action Agencies would develop post-construction maintenance, monitoring, and evaluation plans for the each of the four fish collection and handling sites listed in Table 2-30 (above), starting with the Minto Fish Collection Facility. The plans would include the following elements:

Post-construction Hydraulic Evaluation Plan & Report

The Action Agencies would develop a plan to document that the collection and transport features of the facility were constructed and operate as designed and intended. Verify that hydraulic conditions (e.g., water velocities, barrier heights) are consistent with the design criteria developed collaboratively with the Services and with WATER. If deficiencies are identified, develop and implement solutions in collaboration with the Services and WATER. Prepare a post-construction hydraulic evaluation project report that summarizes the results.

Post-construction Biological Evaluation Plan & Report

The Action Agencies would develop a plan to verify the effectiveness of fish collection, guidance, and/or exclusion devices (i.e., ensure the facility is collecting/guiding fish with minimal delay and injury and identify injury and mortality associated with each component of the facility and with associated release procedures, if applicable). If deficiencies are identified, the Action Agencies would develop and implement solutions in collaboration with the Services and WATER. The Action Agencies would prepare a post-construction biological evaluation project report that summarizes the results.

Maintenance Plan & Annual Maintenance Reports

The Action Agencies would develop a protocol for regularly inspecting all fish passage facilities to ensure continual operation with minimal potential for injury and mortality throughout the duration of the fish passage season. The plan would include a procedure for reporting, addressing, and correcting any deficiencies including seeking input from WATER and the Services regarding possible solutions. The plan would allow for the Action Agencies to correct any deficiencies identified to a properly functioning condition within a reasonable period of time after deficiencies are identified, consistent with the scope and nature of the deficiency and the availability of funds needed for correcting the deficiency. Provide an annual maintenance report summarizing the results of monitoring and maintenance activities. It would include identification of any deficiencies noted or solutions implemented to correct them.

Development and Implementation of an Operational Protocol & a Monitoring and Evaluation Plan & Annual Monitoring Reports

The Action Agencies, in collaboration with WATER, would develop an operational protocol for the fish trapping and handling facilities and a plan for monitoring all operations associated with the facilities, including the number of each species passing through the facility, species-specific injury and mortality rates, any modifications or special operations of the fish passage facilities, any unusual problems or events related to the facilities and local fish populations handled, and plans to correct any problems that are identified. The Action Agencies would prepare an annual monitoring report that summarizes the above information.

2.12.3 Willamette System Review Study

Proposed Action: **The Action Agencies would undertake a series of studies looking first comprehensively at the entire basin and then systematically at the key subbasins to evaluate the feasibility and relative benefits of structural and related operational modifications to the Willamette dams designed to improve survival and productivity of ESA-listed aquatic species. Collectively called the Willamette System Review Study, these studies would include evaluation of (1) the technical feasibility; (2) biological justification; and (3) cost-effectiveness of these and other potential proposed measures so that the relative effectiveness and efficiency of potential Federal actions can be compared. In addition to addressing the ESA issue, the System Review Study would also address structural and operational needs associated with CWA compliance. The studies would be conducted in close coordination with the Services and other appropriate state and Federal resource agencies and tribes. The studies would result in decision documents stating agency positions on individual measures. For those measures determined to be feasible and recommended, the Action Agencies would seek authorization and appropriation for implementation through normal budget and program procedures.**

The following potential structural modifications would be evaluated as part of the System Review Study:

- Improving existing adult fish collection and handling facilities at Dexter Dam, Fall Creek Dam, Foster Dam, and Minto Fish Collection Facility below Big Cliff Dam (see Section 2.12.2).
- Upgrading and updating adult and juvenile fish passage facilities at those projects where passage was authorized and constructed as part of the original project, including Foster, Green Peter, Cougar and Fall Creek Dams.
- Evaluating the potential for providing adult and juvenile fish passage at those dams in the basin where passage facilities were not constructed as part of the original project, including Big Cliff, Detroit, Blue River, Lookout Point, Hills Creek, Dorena, Cottage Grove and Fern Ridge Dams (including adult volitional passage as a potential long-term alternative solution).
- Modifying and/or replacing existing fish hatchery facilities constructed to mitigate for the impacts of the projects (see Section 2.10).
- Providing selective withdrawal capacity or other alternative methods to achieve more normative downstream water temperature regimes.

The Action Agencies state in the Supplemental BA (USACE 2007a):

> "decisions to implement the proposed structural modifications should be based on an agreed upon set of criteria that include a full lifecycle analysis of the listed species that would take into account the comprehensive beneficial

> effect of proposed Federal mitigation actions, in the context of all the environmental factors affecting the survival and fitness of the species."

In most cases, the USACE and Reclamation do not have existing authority and/or the funding necessary to implement them. The Action Agencies are required to work through the necessary Federal planning, program and budget process to evaluate project modifications and seek necessary authorization and funding.

Figure 2-13 (below) presents a conceptual diagram of the proposed steps or phases in the Willamette System Review Study process. The Action Agencies envision the study being conducted in phases:

Phase I: Reconnaissance Study

Phase II: Systemwide Feasibility Phase Study

Phase III: Subbasin System Configuration Studies

Phase IV: Detailed Preconstruction Engineering and Design

Phase V: Implementation.

Plate 1 (located at the end of the Supplemental BA) presents a conceptual schedule for the system configuration studies. The intent is to show a possible logical progression of efforts based on the assumption that resources to undertake the studies would be limited. Completion of the studies and ultimate implementation of recommended projects is dependent on the Action Agency's receipt of adequate funds and necessary authorization. If funds are available, it would be possible to expedite the schedule by conducting more overlapping phases.

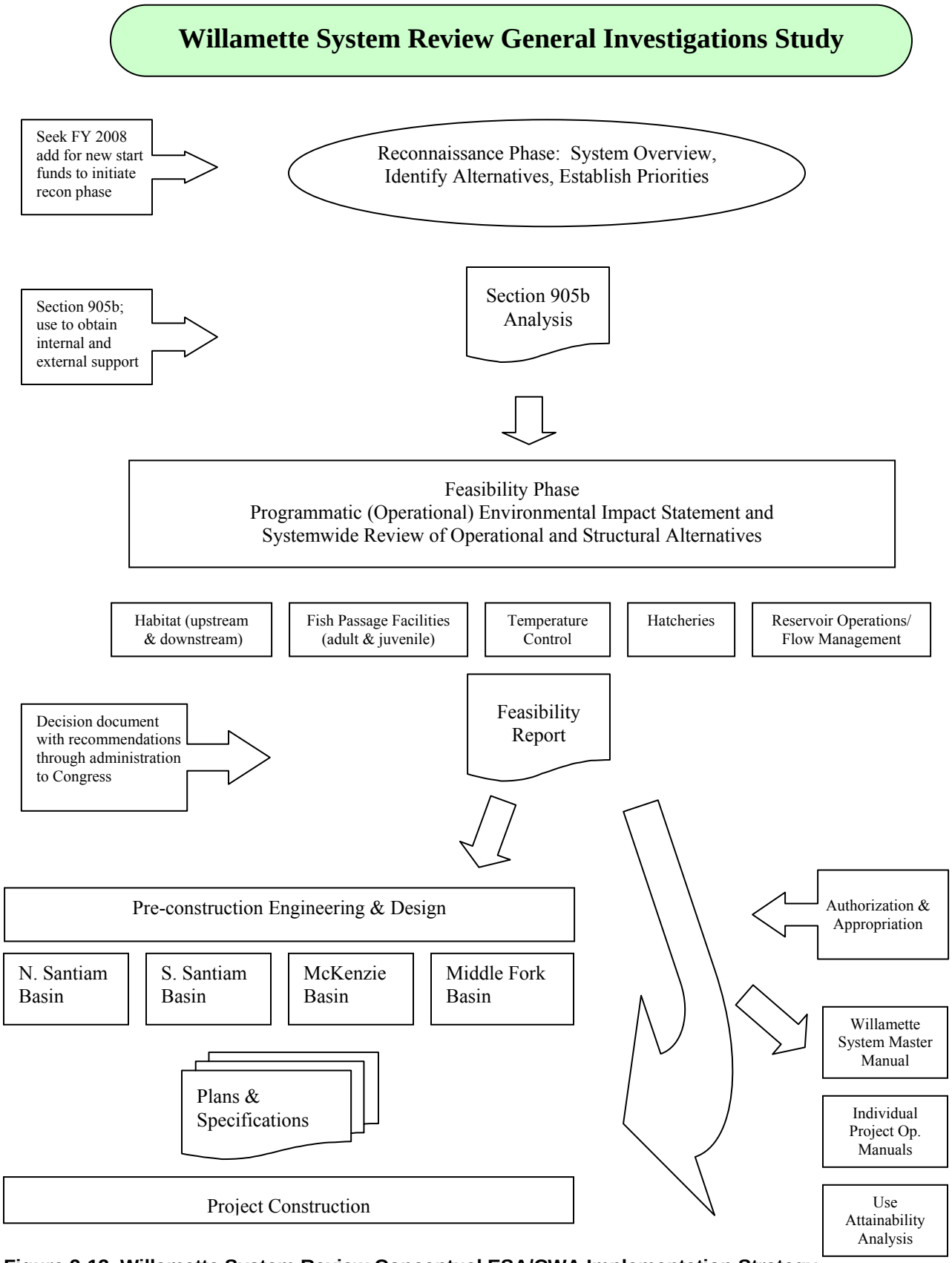

Figure 2-13 Willamette System Review Conceptual ESA/CWA Implementation Strategy.

The major steps and phases of the proposed Willamette System Review Study are described below.

2.12.3.1 Phase I: Reconnaissance Phase Study

The initial phase of the Willamette System Review would be a reconnaissance phase study. The reconnaissance study would be used primarily to establish a basis for moving forward into more detailed feasibility studies in Phase II. The reconnaissance study would:

- Include a regional (basin-wide) overview of structural problems and opportunities related to ESA and CWA compliance that would set the stage for the more detailed subbasin studies that would follow;
- Identify and describe the full range of potential structural and related operational measures and alternatives that would be evaluated in the more detailed feasibility studies to follow;
- Address integration of potential Action Agency measures with ongoing NMFS and ODFW Recovery Planning efforts for ESA-listed salmonids in the Upper Willamette ESU;
- Provide initial definition of detailed evaluation criteria to be used for determining technical feasibility, biological merit, and cost-effectiveness of the measures to be evaluated. Criteria developed in Phase I would be applied to the detailed studies conducted in Phase II;
- Establish initial priorities for evaluating structural and operational alternatives and for the order in which subbasins would be evaluated; and,
- Provide the basis to scope the more detailed feasibility phase studies to follow.

The reconnaissance report completed at the end of this phase would be used to communicate the scope and purpose of the feasibility studies and to seek support and consensus from stakeholders (including the State of Oregon, other Federal and state agencies, tribes, and others) regarding the proposed approach. The Action Agencies would seek funding to initiate the reconnaissance study during FY 2008. It is expected to take approximately 1 year to complete.

2.12.3.2 Phase II: Comprehensive Systemwide Feasibility Study

Phase II of the Willamette System Review Study would be a systemwide feasibility study. The final feasibility report would be a decision document that would make recommendations through review and approval chains within the Action Agencies, and where necessary the administration and Congress, in regard to measures thought to be justified. Where shown to be justified, the Action Agencies would seek the necessary authorization and appropriation for implementation. The feasibility report would include the necessary National Environmental Policy Act (NEPA) documentation for implementation of proposed actions. Public involvement and outreach would need to be part of the feasibility study process. The systemwide feasibility report may also provide the foundation for the USACE to move forward on updating individual project operating manuals and possibly developing an operations master manual.

The systemwide feasibility study would include a preliminary evaluation of structural alternatives, including:

- Fish handling and passage facilities (such as ladders, screens, juvenile bypass systems, spillway modifications, stilling basin improvements, etc).
- Temperature control facilities (selective withdrawal towers and other alternatives).
- Hatcheries
- Modification of revetments bank protection sites.

The feasibility study is not intended to be an evaluation of a full range of operational alternatives. However, it would include a preliminary study of operational alternatives to the extent that they are related to structural alternatives, such as:

- Operational changes that should be considered as alternatives to structural modifications; or
- Operational changes that may be needed to fully realize the benefits associated with structural modifications.

The Action Agencies expect to begin the Phase II study no earlier than FY 2009 and complete it within approximately 30 months.

2.12.3.3 Phase III: Subbasin Detailed System Configuration Study

Phase III would consist of a series of detailed feasibility level system configuration studies conducted for each of the major subbasins in the Willamette Basin on which USACE projects are located. The order in which the subbasin studies would be conducted would be based on priorities determined in Phases I and II and may be reordered as more knowledge of problems and solutions is obtained. The Action Agencies would initiate the first Phase III study (North Santiam) concurrently with Phase II and complete them simultaneously so that the Phase II decision document can be submitted forward for necessary authorization or approval of specific measures for implementation in the highest priority subbasin as expeditiously as possible.

The Phase III studies would include detailed evaluation of potential structural and operational alternatives at individual USACE dams in the Willamette Basin within their respective subbasins. The primary objective of the Phase III studies would be to recommend for implementation those measures shown to be technically feasible, biologically justified, and cost-effective. Adequate NEPA compliance and documentation would be included in the scope of each of the subbasin studies to ensure that recommended measures may be implemented.

Phase III studies would include the following:

- Technical Feasibility: the Action Agencies would plan, design and engineer the alternatives to a sufficient level of detail (10% to 30% design, depending upon the complexity and uniqueness of the facility) to make a determination of technical feasibility and to estimate costs of alternative measures.
- Biological Justification: the Action Agencies would carry out a detailed evaluation of the environmental baseline of habitat conditions and potential future condition of habitat upstream and downstream of Willamette dams. This would allow a comparison of current

and expected future environmental conditions both with and without the proposed alternative measures. Additionally, the Action Agencies would develop, test, calibrate, and use widely accepted biological life-cycle models (e.g., the COMPASS model used for supporting decisions on the Columbia River) or other tools to estimate and forecast survival and productivity of listed species under baseline conditions and under various alternative measures and strategies. Decisions regarding which model or models to use and the metrics they measure would be developed in coordination with NMFS, USFWS, and other stakeholders, and agreed upon within the region through the conduct of the feasibility study. Input parameters for any population models developed and used for this purpose would need to be based on collected site- or reach-specific field data. In order to achieve these objectives, the Action Agencies propose substantial biological RM&E in conjunction with the Phase III (and Phase II) studies. Section 2.12.3.6 describes a framework of RM&E proposed by the Action Agencies in conjunction with the system review studies.

- Cost-effectiveness: the Action Agencies would undertake a cost effectiveness/incremental cost analysis (CE/ICA) process to evaluate projects where the primary outputs are ecological rather than monetary. To accomplish this analysis, the Action Agencies would need to produce quantifiable estimates of ecological outputs as well as accurate estimates of costs to construct, operate, and maintain the proposed measures, as well as other related costs such as benefits foregone to other authorized project purposes (flood control, hydropower, irrigation, recreation, etc) as a result of implementation.

2.12.3.4 Phase IV: Pre-construction Engineering & Design Study

Phase IV consists of detailed pre-construction engineering and design necessary to award contracts and construct structural measures recommended for implementation. The scope and schedule of pre-construction engineering and design would depend on the type and extent of measures proposed for implementation following Phase III.

2.12.3.5 Phase V: Implementation

The Action Agencies would implement structural and operational measures following project approval by Action Agency higher authority and Congressional authorization and appropriation where necessary.

2.12.3.6 Research, Monitoring & Evaluation Program for the Willamette System Review Study

The Action Agencies note that substantial biological RM&E would need to be conducted in conjunction with the proposed Phase I, II, and III studies. The RM&E would provide the basis for comparing and evaluating alternatives and for demonstrating effectiveness (performance measures) and to determine the feasibility of implementing fish passage, temperature control, and other related measures. In the Supplemental BA (USACE 2007a), the Action Agencies list numerous questions regarding fish passage and water temperature control that should be addressed by the RM&E program. The recommendations for a RM&E Program would be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.

2.12.4 Construction Projects Environmental Coordination & Management

Proposed Action: Working through the Technical Coordinating Committee of WATER described in Section 2.6, the Action Agencies would collaborate with the Services on the design, construction, and operation of all potential structural modifications to the dams and associated facilities, including fish collection and handling facilities, fish passage improvements, and water temperature control facilities designed to improve conditions for ESA-listed species.

In the Supplemental BA (USACE 2007a), the Action Agencies recognize that there is a high degree of uncertainty regarding the types, locations, and extent of structural modifications that may ultimately be implemented through the System Review Study (Section 2.12.3). In order to reduce the uncertainties surrounding these potential modifications, the Action Agencies propose to collaborate with the Services on planning, designing, and constructing the potential facilities.

As proposed in Section 2.6, one of the proposed committees of WATER is the CPEC Committee. The CPEC Committee would be a standing committee established to assist in review of all future construction projects in the Willamette Basin related to ESA recovery actions including improvements for fish passage, collection and handling, hatcheries, and WTC facilities. Responsibilities of the CPEC Committee are described in detail in the Supplemental BA (USACE 2007a), and include the following: facility planning and design, developing standard operating plans and procedures, effects assessment, and reviewing biological monitoring and evaluation plans.

Proposed Action: The Action Agencies would adopt and follow best management practices (BMPs) for construction of all potential structural modifications to the dams and associated facilities including fish collection and handling facilities, fish passage improvements, and water temperature control facilities designed to improve conditions for ESA-listed species.

The CPEC Committee would assist the Action Agencies in development of construction BMPs. At a minimum, the Action Agencies would adopt the basic BMPs outlined in the Biological Opinion for the Cougar Dam Fish Collection Facility (NMFS 2007a) to avoid or minimize unavoidable effects on ESA-listed species or critical habitat. These may consider but are not limited to:

- Timing of in-water work periods.
- Confinement of construction work areas.
- Preconstruction activities: marking and flagging to minimize impacts to prevent ground disturbance to critical riparian vegetation, wetlands, and other sensitive habitat.
- Cessation of work causes and protocols.
- Use of fish screen and other protective devices.

- Pollution and Erosion Control Plans: erosion controls such as temporary in-place controls, emergency controls and materials, and inspection; construction discharge water control such as water quality collection and treatment, discharge velocity, pollutants, and drilling discharge; and stormwater management plan.
- Restrictions on heavy equipment use.
- Vehicle and materials staging and inspection.
- Conservation of native materials and site restoration.
- Minimization of earthwork impacts: drilling, sampling and site stabilization
- Treated wood: piling installation and removal.

2.12.5 Conceptual Implementation Schedule

Proposed Action: The Action Agencies would, within 5 years of completion of the final Biological Opinion for the Willamette Project, do the following:

- Complete a PAC Report on the Willamette Temperature Control Project; assuming that the draft recommendations in PAL are approved, construct and initiate operation of fish passage facilities at Cougar Dam; and, undertake a detailed monitoring and evaluation program of the operational selective withdrawal tower and fish passage facilities.
- Possibly construct upgraded fish collection, handling, and transport facilities at the Minto location on the North Santiam River and completed detailed design analysis on other high priority sites.
- Completed Phase II of the Willamette System Review Study, including processing the initial Phase III decision document through the Action Agency review and approval process, establishing Action Agency position and recommendations regarding implementation of other potential structural modifications such as fish passage and temperature control at the highest priority locations in the basin.

2.13 WATER QUALITY ACTIONS

This section describes Action Agency existing and proposed measures for improving water quality conditions associated with operating the USACE Willamette projects including:

- An update on operation, monitoring and evaluation of the Cougar Dam WTC tower (proposed actions for evaluating the potential for implementing additional WTC facilities at other dams in the basin are described in Section 2.12).
- Measures to address the TMDL for temperature and other water quality parameters in the basin.
- Existing and proposed water quality research, monitoring and evaluation.

2.13.1 Cougar Dam Temperature Control Project

Proposed Action: In coordination with the WATER Flow Management and Water Quality/Temperature committees, the USACE would continue to operate the Cougar Water Temperature Control project to meet downstream water temperature targets required for protection of Chinook salmon and other aquatic species.

2.13.1.1 Continued Operation of the Cougar WTC Facility

The 2000 BA (USACE 2000) described the planned construction of the selective WTC tower at Cougar Dam. Construction was initiated in 2000, completed in December 2004, and was fully operational by May 2005. Operation for temperature control requires selectively withdrawing water from different elevations in the pool to meet target outflow temperatures. Operational decisions on the flow distribution are based on the outflow and data from temperature instrumentation on the face of the structure. Gates can be "throttled" at different levels to control the proportion of flow from different levels. During construction of the WTC, the electrical generation system at Cougar Dam was upgraded to include replacement of turbine runners with "fish friendlier" runners that utilize minimum gap technology.

The Cougar WTC tower would continue to be operated as an integral element of the Willamette system of reservoirs. The Action Agencies would operate the Cougar WTC and the other elements of the system in close coordination with the FM Committee of WATER, as described in Section 2.6. Because of Cougar Dam's status as the only dam in the Willamette system with WTC capability, USACE operations would be coordinated with the WQTC Committee of WATER.

2.13.1.2 Cougar Dam WTC Research, Monitoring & Evaluation

Section 2.12.1 describes the Action Agencies' proposed action to complete a PAC report for the Willamette River Temperature Control Project that would seek approval for modifying the authorized project to: (1) add fish passage facilities at Cougar Dam; (2) defer construction of the Blue River selective withdrawal capability; and, (3) undertake a detailed post-construction monitoring and evaluation program. The current post-construction biological monitoring and evaluation program for the Cougar WTC is very limited and is expected to end with conclusion of construction. As part of this proposed action, the Action Agencies would carry out an extensive RM&E program to evaluate the biological effectiveness of the Cougar WTC, as well as fish passage at Cougar Dam.

2.13.2 TMDL Water Quality Management Plan

Proposed Action: The Action Agencies would coordinate with ODEQ, USEPA, USFWS, and NMFS to prepare a WQMP for the Willamette Project that would address the Willamette TMDL for temperature and other water quality parameters consistent with the needs of ESA-listed aquatic species. The Willamette WQMP should be completed no later than March 2008.

2.13.2.1 Background

In September 2006, ODEQ released and USEPA approved a final TMDL for the Willamette Basin that was developed by ODEQ under the requirements of the CWA. A TMDL is a pollution analysis conducted with the primary purpose of determining how much a pollutant must be reduced in order to meet state water quality criteria. Temperature and TDG are the two pollutants or particular relevance to the USACE dams and the life cycle requirements of ESA-listed aquatic species. The Willamette TMDL established temperature load allocations in the form of target temperatures for each USACE dam in the Willamette Basin. The load allocations were based on estimates of "natural thermal potential" (NTP) of the individual streams under a "without dam" condition.

The USACE expressed concern with the temperature load allocations placed on USACE dams, because even if selective withdrawal facilities were constructed, the USACE dams would not be able to meet the TMDL targets (USACE 2007a). The USACE also noted that even at Cougar Dam, where WTC facilities have been installed, actual flow releases cannot meet TMDL targets, although releases are generally meeting the biologically-driven temperature targets established in conjunction with NMFS, USFWS, and ODFW.

While ODEQ did not adjust the final estimates of NTP or temperature load allocations in response to USACE concerns, ODEQ indicated a willingness to work with the USACE and others to further refine load allocations and NTP and possibly undertake a Use Attainability Analysis that could result in modified targets.

The final TMDL identified the USACE dams as "non-point sources" for temperature. The USACE is identified as a Designated Management Agency for temperature, and as such the ODEQ expects the USACE to prepare a TMDL WQMP. The Action Agencies stated in the Supplemental BA (USACE 2007a) that despite legal and policy uncertainties regarding the role of the Clean Water Act with respect to Federally-owned and operated facilities, the USACE had agreed to coordinate with ODEQ on development of a WQMP to address the Willamette TMDL.

2.13.2.2 Water Quality Management Plan

Proposed Action: The Action Agencies would coordinate with ODEQ, USEPA, and the Services to prepare a WQMP for the Willamette Project that would address the Willamette TMDL for temperature and other water quality parameters consistent with the needs of aquatic species listed under ESA.

The WQMP would address the following five major topics.

1. Participate in an Interagency Management Process for temperature-related improvements in the Willamette Basin. The Action Agencies propose that the WATER regional forum described in Section 2.6, specifically the WQTC Committee, would be the interagency forum for integration of temperature and other water quality-related improvements associated with the Willamette Project.

2. Assist with collection and analysis of data necessary to support ODEQ revisions of load allocations for each of the 13 dams and reservoirs. Section 2.13.3 describes ongoing and potential water quality-related RM&E activities associated with operation and maintenance of the Willamette Project. Additionally, the Action Agencies propose an extensive RM&E program associated with the Cougar WTC, as described in Section 2.13.1.2. This evaluation of the effectiveness of the Cougar WTC would inform decisions for addressing temperatures and related ESA needs at other Willamette project dams.
3. Demonstrate compliance and consistency with the Biological Opinion for the Willamette Project. The Action Agencies would work with the members of the WQTC Committee, including the Services, to ensure that the WQMP is consistent with and complies with the requirements of this ESA Section 7 consultation.
4. Develop a temperature management plan that would show temperature improvements needed to achieve load allocations. The Action Agencies propose to analyze and address temperature issues at Project dams through the System Review Study described in Section 2.12. Additionally, the Action Agencies propose to work with ODEQ, NMFS, and USFWS to demonstrate that they are doing everything possible to manage for temperatures within the existing structural limitations of the projects. This may include performing additional modeling of operational alternatives.
5. Develop a data and information strategy that may be used for future use attainability analyses for the dams. The Use Attainability Analysis is a process authorized under the CWA for changing a state-approved water quality standard if it can be shown that the standard cannot be attained. The Action Agencies indicate in the Supplemental BA (USACE 2007a) that the Use Attainability Analysis may be the appropriate action in the case of many of the Willamette Basin dams and propose to coordinate with ODEQ to determine when and where a Use Attainability Analysis process should be applied.

2.13.3 Water Quality Research Monitoring & Evaluation

2.13.3.1 Ongoing Willamette Water Quality Monitoring Programs

Proposed Action: The Action Agencies will continue to collect and analyze water quality data at Project dams, including upstream and downstream of dams and in the reservoirs.

In the Supplemental BA (USACE 2007a), the Action Agencies note that official USACE policy requires water quality monitoring at Federal projects. Although water temperature data was historically collected at USGS gage stations upstream and downstream of nearly all of the USACE Willamette dams, budget cuts over the years resulted in some sites being dropped. However, because of TMDL and ESA issues, the USACE recently restored funding for water temperature and TDG data collection at inflow and outflow sites. Also, the USACE is now collecting in-lake water temperature profiles from surface to bottom at Willamette projects that need water quality temperature models.

Proposed Action: If funding is available, the Action Agencies will continue to conduct site-specific water quality studies when new water quality issues arise at a project.

Recent examples of site-specific water quality studies include harmful algae blooms at Hills Creek Reservoir and mercury loading from an abandoned mine at Cottage Grove reservoir. When this happens the USACE conducts studies (funding permitting) to evaluate the problem. For instance, phytoplankton and water samples were collected at Hills Creek Reservoir to identify potentially toxic blue-green algae and to determine the concentrations of toxic chemicals produced by the algae. Mercury studies were conducted at Cottage Grove and Dorena Reservoirs to characterize mercury dynamics in these reservoirs.

Proposed Action: The USACE proposes as a goal to develop temperature models for all of the Willamette projects so that project operations and improvements can be evaluated in relation to TMDL and ESA requirements.

The USACE has recently begun collecting inflow, in-lake, and outflow temperatures at the projects to populate temperature models, particularly those that do not have temperature models in place. Temperature models have been developed for the large storage projects – Hills Creek, Lookout Point/Dexter, Cougar, Blue River, Green Peter/Foster, and Detroit. The smaller, lower elevation projects – Cottage Grove, Dorena, Fall Creek, and Fern Ridge – need temperature models developed. These models may also be useful in determining whether to modify TMDLs, in developing the Willamette WQMP and Use Attainability Analysis.

Proposed Action: The USACE proposes to complete a Water Quality Program Management Plan to guide future water quality staffing, monitoring, and evaluation activities and to provide managers with estimates of funding requirements.

This program planning activity would be conducted by the Portland District's Reservoir Regulation and Water Quality Section. The need to meet USACE water quality monitoring policy and the impact of TMDL and ESA issues would play an important role in shaping the Water Quality Program Management Plan.

2.13.3.2 Potential Framework for Water Quality RM&E

Proposed Action: The Action Agencies would work with the WQTC Committee to develop and carry out a comprehensive water quality/temperature RM&E program. The recommendations for a water quality RM&E program would be integrated into the comprehensive program overseen by the RM&E Committee (see Section 2.14) and follow the principles and strategic questions developed by the committee.

As described in the Supplemental BA (USACE 2007a), the RM&E program would address the respective needs for CWA compliance under the temperature TMDL and life cycle requirements for ESA-listed aquatic species. It would integrate the existing and ongoing RM&E activities conducted by ODEQ and others in development of the temperature TMDL with ongoing water

quality monitoring and evaluation by the USACE and others. It would need to be a central element of the proposed system configuration studies evaluating the feasibility of temperature control and other potential structural and operational alternatives described in Section 2.12.

The Action Agencies do not currently have a clearly established source of funding available for a comprehensive water quality monitoring and evaluation program in the Willamette Basin. Funding for the water quality/temperature RM&E program would need to be derived from a variety of sources, including ongoing operations and maintenance funding, Cougar Dam/Willamette Temperature Control Project and from funding for the system configuration studies. The earliest that significant funding may be available for this program is FY 2009.

2.14. RESEARCH, MONITORING & EVALUATION PROGRAM

Proposed Action: The Action Agencies would collaborate closely with the Services, ODFW, and others in developing and managing the comprehensive Willamette Basin RM&E program. The coordinating mechanism would be the WATER RM&E Committee described in Section 2.6.

Throughout the preceding sections of this Section 2, the proposed action includes RM&E measures to evaluate respective elements of the proposed action. General RM&E recommendations are made in Section 2.8, Flow Management; Section 2.10, Hatchery Operations and Reform Actions; Section 2.11, Habitat Restoration and Management Actions; and Section 2.13, Water Quality Improvements. In each of these cases, the proposed RM&E activities can be characterized primarily as effectiveness monitoring tied to individual elements of the proposed actions. The overall intent of the RM&E program in those cases would be to determine whether or not measures and activities implemented to protect and restore ESA-listed species and their habitats are having the desired results and to make adaptive management adjustments to the measures as needed.

The Action Agencies propose a more comprehensive RM&E program as part of the system configuration feasibility studies described in Section 2.12, Structural Modifications. In that case adequate RM&E would be conducted to develop a life-cycle biological model that can be used to quantitatively evaluate the effects of a variety of different operational and structural alternatives against the baseline condition.

The Action Agencies do not have a single unified source of funding for implementation of a comprehensive RM&E program in the Willamette Basin. Funding for RM&E activities would be drawn from a variety of sources consistent with allocation of funding for the individual action areas. In all cases, the funding available for RM&E activities would be constrained.

The details of the program would be established in coordination with the Services in development of the WATER Charter. However, the Action Agencies describe a proposed process and framework in Section 3.8 of the Supplemental BA (USACE 2007a).

2.14.1 Coordination with the FCRPS RM&E Plan

Proposed Action: The Action Agencies would coordinate the Willamette Project RM&E program activities with those of the FCRPS RM&E actions and results through participation in the USACE's Anadromous Fish Evaluation Program, Northwest Power and Conservation Council's Fish and Wildlife Program, Pacific Northwest Aquatic Monitoring Program, and Northwest Environmental Data network.

As described in the Supplemental BA (USACE 2007a), the Action Agencies have developed an RM&E plan as part of their Proposed Action for continued operation of the FCRPS. The Willamette Project and FCRPS RM&E plans are interrelated in that proposed FCRPS Estuary and Ocean RM&E would provide information on the effects of FCRPS habitat and predator management actions on Willamette Chinook and steelhead ESUs. In addition, the FCRPS RM&E plan proposes other activities that may be directly applicable to Willamette Project RM&E, including standardization of tagging and monitoring methods, and development of a regionally coordinated information system. Lessons learned from other FCRPS RM&E actions, such as tributary and hatchery RM&E, may also be obtained. Coordination across the two RM&E efforts is needed to ensure that duplication of research does not occur, relevant results are shared, and lessons are learned.

2.14.2 Guiding Principles & Strategic Questions for RM&E Needs

Proposed Action: The Action Agencies would work with the Services, ODFW, and others to articulate a clear and mutually supportable set of guiding principles and strategic questions to be used in developing, evaluating, and integrating RM&E needs associated with components of the Supplemental BA's revised proposed action and associated Biological Opinions related to the continuing operation of the Willamette Project.

In the Supplemental BA (USACE 2007a), the Action Agencies propose guiding principles for the Willamette RM&E Program. The purpose of, and intended use for the guiding principles is to stimulate and guide cooperative thinking in identifying critical RM&E needs. This is an initial effort by the Action Agencies to lay the ground rules or framework for the future Willamette RM&E Program.

2.15 Description of the Action Area

Based on the description of the proposed action in the preceding sections, the action under consideration affects a large area of the Willamette River Basin and lower Columbia River Basin, termed the "action area." An action area is defined in NMFS' regulations (50 CFR 402.02) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." Direct effects may extend upstream or downstream based on the potential for impairing fish passage, flow, hydraulics, sediment and pollutant discharge, and the extent of riparian and instream habitat modifications. Indirect effects may occur throughout the watershed where the proposed action leads to additional activities or affects ecological functions that contribute to habitat degradation.

Willamette Project dams and reservoirs directly affect the channels and valley floodplains downstream as well as portions of upstream channels and valleys that are impounded. The Project indirectly affects stream reaches upstream that are or could otherwise be accessed and used by anadromous fish. The Willamette Project could have an indirect effect on the amount of marine derived nutrients returning to spawning and rearing areas due to a reduction in the number of adult fish returning to spawn and die.

- Therefore, for purposes of this consultation, the action area includes:
- All river reaches, riparian zones, and floodplain areas located downstream of the 13 Willamette Project dams, including the mainstem Willamette River and the tributaries on which these facilities are located (i.e., mainstem reaches of the North Santiam River, South Santiam River, Santiam River, McKenzie River, South Fork McKenzie River, Blue River, Fall Creek, Middle Fork Willamette River, Row River, Coast Fork Willamette River, and the Long Tom River), and the lower Columbia River from the confluence of the Willamette to the mouth of the Columbia River, including estuarine habitat in which listed salmonids and green sturgeon are affected by the Willamette Project (USACE 2000). This action area also encompasses the 42 miles of streambank revetments maintained by the USACE and the adjacent stream reaches affected by those revetments.
- The Molalla River from RM 20.2, the Calapooia River from approximately RM 0.5, and the Clackamas River from RM 20.1 to the confluence with the Willamette. These stream reaches include some of the 42 miles of streambank revetments maintained by the USACE.
- Stream reaches and land areas permanently or seasonally inundated by Willamette Project reservoirs in dry, average, and wet years.
- All reaches of tributaries located upstream of Willamette Project dams that are presently or were historically accessible to listed fish before construction of the 13 dams in the Willamette Project.
- Areas off the Pacific Coast where salmonid species from the Columbia River, which are affected by the Willamette Project, are available as prey for listed Southern Resident Killer Whales; generally within 50 km of the coast from the river's mouth and plume south to southern Oregon and north to the Queen Charlotte Islands.

Chapter 3
Rangewide Status

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3 RANGEWIDE STATUS

In step 1 of its analysis, NMFS defines the biological requirements and current status of each affected listed species and the conservation role and current function of any designated critical habitat. For salmon and steelhead species, this involves comparing the status of each ESU and its component populations and major population groups (MPGs), or strata, 1 to available viability criteria. Viability at the population scale is evaluated based on the viable salmonid population parameters of abundance, productivity, spatial structure, and diversity, which are used to assess population extinction risk (McElhany et al. 2000). At the MPG scale, viability is evaluated based on guidelines regarding how many and which populations should be at low risk for the MPG to be considered low risk. ESU or DPS viability is similarly evaluated based on guidelines that each MPG should be at low risk (WLCTRT and ODFW 2006, ICTRT 2007).

In assessing status, NMFS starts with the information used in its most recent decision to list for ESA protection the species considered in this Opinion, and also considers any more recent data that are relevant to the species' rangewide status. This step of the analysis tells NMFS how well the species is doing over its entire range in terms of trends in abundance and productivity, spatial distribution, and diversity and identifies potential causes of the species' decline.

The following sections briefly describe the current status of the species (listing status, general life history, and population dynamics) in a manner relevant to each species' biological requirements.

3.1 RANGEWIDE STATUS OF THE SPECIES

Thirteen ESA-listed salmon and steelhead species (Table 3-1) are likely to be affected by this proposed action. In addition, green sturgeon and killer whales may be affected. Of these species, NMFS has determined that Upper Willamette River (UWR) Chinook salmon and UWR steelhead are likely to be most substantially affected by the proposed action because their spawning and rearing habitat, along with portions of their migratory habitat, are, and were historically, in close proximity to the Willamette Project dams, whereas the habitat of other

[1] The ESA defines a *species* to include any species, sub-species, or distinct population segment (ESA section (3)(15)). NMFS defines distinct population segments as Evolutionarily Significant Units (ESUs) for listing Pacific salmon (and previously used the term ESU for West Coast steelhead as well) (Waples 1991). An ESU is a group of Pacific salmon that is (1) substantially reproductively isolated from other groups and (2) represents an important component of the evolutionary legacy of the species. Recently, NMFS revised its species determinations for West Coast steelhead under the ESA, delineating anadromous, steelhead-only "distinct population segments" (DPS). Rainbow trout, the resident form of *O. mykiss*, are under the jurisdiction of the U.S. Fish and Wildlife Service. The Federal Register notice (71 FR 834) contains a more complete explanation of the listing decision and of previous ESA actions related to steelhead.

Each ESU or DPS is composed of a number of demographically independent populations. Independent populations are grouped into strata, or major population groups (MPGs), based on ecoregions and life history types. MPGs are thus groups of populations that share similar environments, life history characteristics, and geographic proximity (WLCTRT and ODFW 2006).

species affected is not in proximity to the dams. The following descriptions of rangewide status are thus most detailed for UWR Chinook salmon and UWR steelhead.

Table 3-1 shows listing status and date, date of critical habitat designation, and relevant Federal Register notices, for the 13 species of salmon and steelhead likely to be affected by the actions considered in this consultation. NMFS includes listing information for the green sturgeon and Southern Resident killer whale, but has determined that the Proposed Action and the RPA are not likely to adversely affect either species or critical habitat designated for the Southern Resident killer whale. Critical habitat has been designated for all these species except LCR coho salmon and the Southern DPS of green sturgeon.

Table 3-1 Listing status and critical habitat designations for species considered in this opinion. (Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered.)

SPECIES	LISTING STATUS	CRITICAL HABITAT
Chinook salmon (*Oncorhynchus tshawytscha*)		
Lower Columbia River	T: 6/28/05 (NMFS 20005c)	09/02/05 (NMFS 2005d)
Upper Willamette River	T: 6/28/05 (NMFS 2005c)	09/02/05 (NMFS 2005d)
Upper Columbia River spring-run	E: 6/28/05 (NMFS 2005c)	09/02/05 (NMFS 2005d)
Snake River spring/summer run	T: 6/28/05 (NMFS 2005c)	10/25/99 (NMFS 1999c)
Snake River fall-run	T: 6/28/05 (NMFS 2005c)	12/28/93 (NMFS 1993)
Chum salmon (*O. keta*)		
Columbia River	T: 6/28/05 (NMFS 2005c)	09/02/05 (NMFS 2005d)
Coho salmon (*O. kisutch*)		
Lower Columbia River	T: 6/28/05 (NMFS 2005c)	Not yet designated
Sockeye salmon (*O. nerka*)		
Snake River	E: 6/28/05 (NMFS 2005c)	12/28/93 (NMFS 1993)
Steelhead *(O. mykiss)*		
Lower Columbia River	T: 1/5/06 (NMFS 2006b)	09/02/05 (NMFS 2005d)
Upper Willamette River	T: 1/5/06 (NMFS 2006b)	09/02/05 (NMFS 2005d)
Middle Columbia River	T: 1/5/06 (NMFS 2006b)	09/02/05 (NMFS 2005d)
Upper Columbia River	E: 6/13/2007 (NMFS 1997)	09/02/05 (NMFS 2005d)
Snake River Basin	T: 1/5/06 (NMFS 2006b)	09/02/05 (NMFS 2005d)
Green Sturgeon *(Acipenser medirostris)*		
Southern DPS of Green Sturgeon	E: 4/7/06 (NMFS 2006c)	Not yet designated
Killer Whales *(Orcinus orca)*		
Southern Resident DPS Killer Whales	E: 11/18/05 (NMFS 2005e)	11/29/06 (NMFS 2006d)

3.2 Life Histories, Factors for Decline & Population Trends

The biological requirements, life histories, historical abundance, current viability, and factors contributing to the decline of salmon and steelhead species have been well documented. The following sections summarize relevant information from recent documents, most of which are available on the NMFS Northwest Regional or Northwest Fisheries Science Center websites (e.g., see Good et al. 2005; NMFS 2005c and 2006b; Myers et al. 2006; WLCTRT 2003 and 2004; WLCTRT and ODFW 2006; and McElhany 2007.

3.2.1 Upper Willamette River (UWR) Chinook Salmon

3.2.1.1 ESU Description

The UWR Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River and its tributaries above Willamette Falls, Oregon, as well as UWR Chinook from seven artificial propagation programs (NMFS 2005c). The seven artificial propagation programs considered part of the ESU are the McKenzie River Hatchery (Oregon Department of Fish and Wildlife (ODFW) stock # 24), Marion Forks/North Fork Santiam River (ODFW stock # 21), South Santiam Hatchery (ODFW stock # 23) in the South Fork Santiam River, South Santiam Hatchery (ODFW stock # 23) in the Calapooia River, South Santiam Hatchery (ODFW stock # 23) in the Mollala River, Willamette Hatchery (ODFW stock # 22), and Clackamas hatchery (ODFW stock # 19) spring-run Chinook hatchery programs (NMFS 2005c).

The Willamette/Lower Columbia Technical Recovery Team (WLCTRT) identified seven independent populations within this ESU, as shown in Table 3-2 and Figure 3-1, below (Myers et al. 2006); all populations are part of the same stratum, or major population group (WLCTRT 2003).

Table 3-2 Historical populations in the UWR Chinook salmon ESU (Myers et al. 2006).

STRATUM	POPULATION*
Upper Willamette	Clackamas (C)
	Molalla
	North Fork Santiam (C)
	South Fork Santiam
	Calapooia
	McKenzie (C)(G)
	Middle Fork Willamette (C)

*The designations "C" and "G" identify Core and Genetic Legacy populations, respectively. Core populations historically represented the centers of abundance and productivity for a major population group. Genetic legacy populations have had minimal influence from nonendemic fish due to artificial propagation activities or exhibit important life history characteristics no longer found throughout the ESU (WLCTRT 2003).

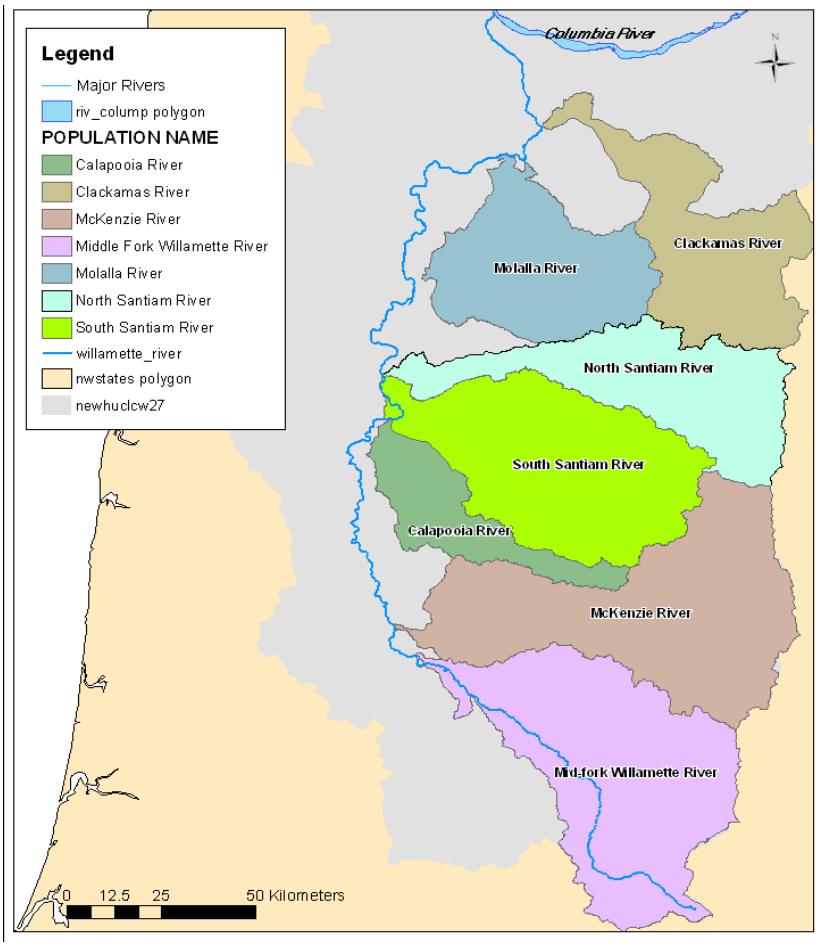

Figure 3-1 Map of historical populations in the UWR Chinook ESU (Myers et al. 2006)

UWR Chinook salmon are one of the most genetically distinct groups of Chinook salmon in the Columbia River Basin. Historically (before the laddering of Willamette Falls), passage by returning adult salmonids over Willamette Falls (RKm 37) was possible only during the winter and spring high-flow periods. The early run timing of Willamette River spring-run Chinook salmon relative to other lower Columbia River spring-run populations is viewed as an adaptation to flow conditions at the falls. Since the Willamette Valley was not glaciated during the last epoch, the reproductive isolation provided by the falls was probably uninterrupted for a considerable time and provided the potential for significant local adaptation relative to other Columbia River populations (Myers et al. 2006). UWR Chinook salmon still contain a unique set of genetic resources compared to other Chinook stocks in the W/LC Domain (Figure 3-2; also see Myers et al. 1998 and Myers et al. 2006).

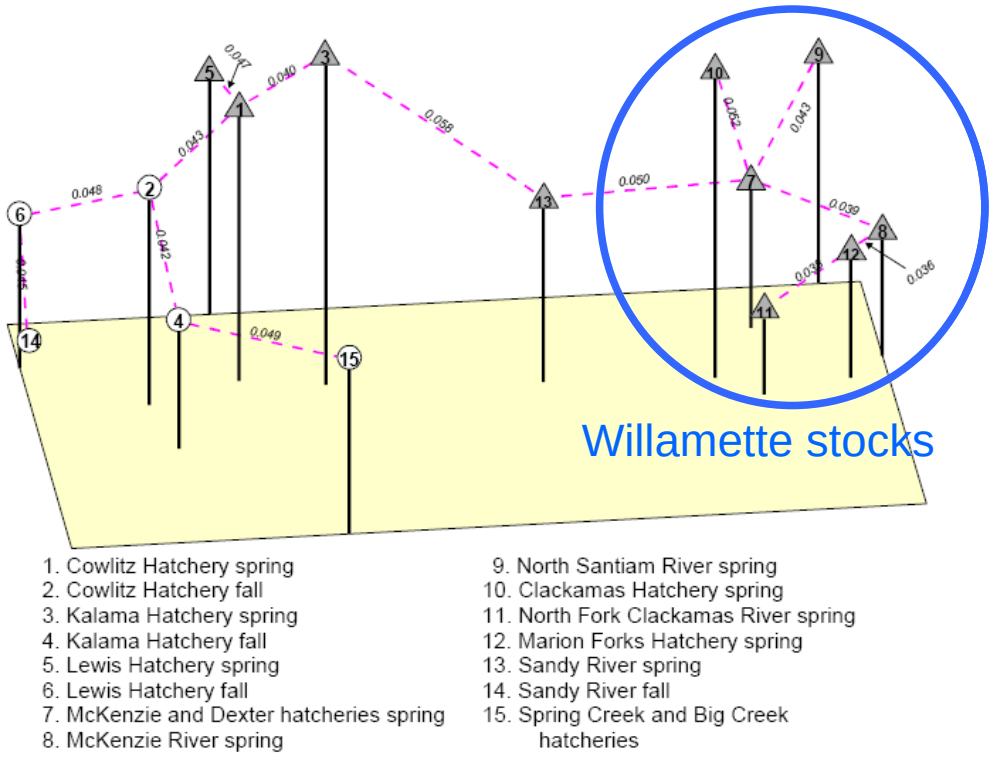

Figure 3-2 Three-dimensional representation of genetic difference, showing similarity of UWR Chinook stocks (indicated by proximity in the diagram) and their distinctness from Lower Columbia Chinook stocks (indicated by distance in the diagram). Figure adapted from Myers et al. 2006.

3.2.1.2 Life History

While adult UWR Chinook salmon begin appearing in the lower Willamette River in January, the majority of the run ascends the falls in April through May (Myers et al. 2006). Mattson (1963) discusses the existence of a late spring-run Chinook salmon that ascended the falls in June. These fish were apparently much larger and older (presumably 6 year olds) than the earlier part of the run. Mattson (1963) speculated that this portion of the run intermingled with the earlier-run fish on the spawning grounds and did not represent a distinct run. The disappearance of the June run in the Willamette River in the 1920s and 1930s was associated with a dramatic decline in water quality in the lower Willamette River.

Juvenile emigration patterns of the UWR Chinook salmon include traits from both ocean- and stream-type life histories. Smolt emigrations occur both as subyearlings, consistent with ocean-type life histories, and as yearlings, consistent with stream-type life histories, in the fall and spring (Schroeder and Kenaston 2004). While data are not available for all populations, available data indicate that the Clackamas, McKenzie, and Middle Fork Willamette populations have the greatest percentage of yearling migrants (Table 3-3).

Table 3-3 Percentage of returning adult spring Chinook salmon that emigrated to saltwater as yearlings (adapted from Schroeder and Kenaston 2004).

	RUN YEAR	
Basin	**2002**	**2003**
Middle Fork Willamette*	94	
McKenzie	74	83
South Santiam	20	9
North Santiam	48	60
Clackamas	68	85

* Note that sample size for the Middle Fork Willamette was very small (18 fish), which could have resulted in a biased estimate.

Ocean distribution of this ESU is consistent with an ocean-type life history, with the majority of spring Chinook being caught off the coasts of British Columbia and Alaska. Spring Chinook from the Willamette River have the earliest return timing of all Chinook stocks in the Columbia Basin, with freshwater entry beginning in February. At present, adults return to the Willamette River primarily at ages 3 through 5 (ODFW 2008c), with age 4 fish being most abundant. Historically, age 5 fish were most abundant, and spawning occurred between mid-July and late October. The current spawn timing of both hatchery and natural-origin UWR Chinook is September and early October (Schroeder and Kenaston 2004). Table 3-4 shows generalized life history timing for UWR Chinook salmon.

Table 3-4 UWR Chinook salmon life history timing. Light shading represents low-level abundance and dark shading represents higher abundance (after USACE 2007a, Table 4-2). (Upstream migration in this table refers to adult presence in the mainstem Willamette and tributaries).

Month:	J	F	M	A	M	J	J	A	S	O	N	D
Upstream Migration												
Spawning in Tributaries												
Intragravel Development												
Juvenile Rearing												
Juvenile Out-migration												

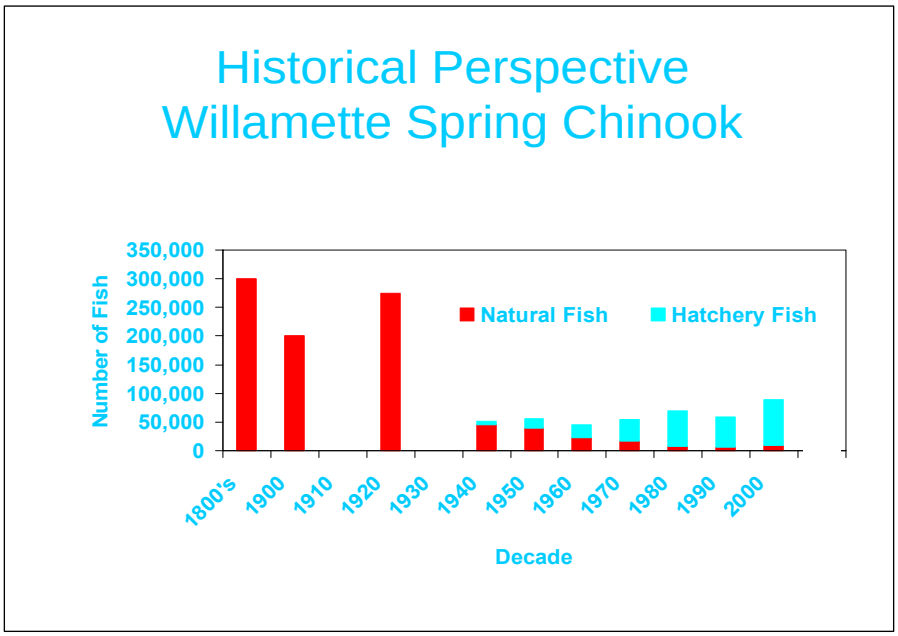

Figure 3-3 Historical abundance of wild spring Chinook salmon returns to the Willamette River. Abundances are aveaged by decade (Meyers et al. 2006).

3.2.1.3 Current Viability

Historically the Upper Willamette supported large numbers (perhaps exceeding 275,000 fish) of Chinook salmon (Figure 3-3; Myers et al. 2006). While counts of hatchery- and natural-origin adult spring Chinook salmon over Willamette Falls since 1946 have increased (Figure 3-4), approximately 90 percent of the return is now hatchery fish. Current abundance of wild fish is estimated to be less than 10,000, with significant natural production occurring only in two populations - and the McKenzie (McElhany et al. 2007). The Clackamas and McKenzie are the only two watersheds in the ESU where sufficient habitat is still accessible and of sufficient quality to produce significant numbers of natural-origin spring Chinook.

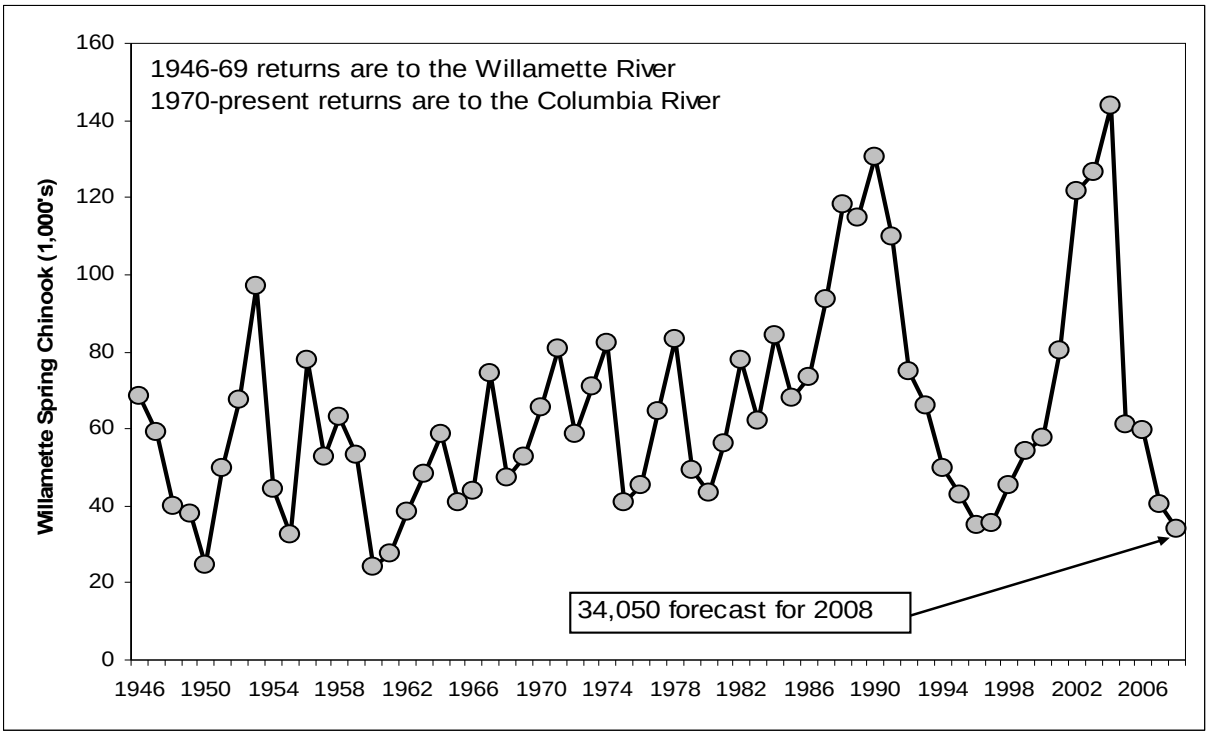

Figure 3-4 Total Willamette spring Chinook returns, (hatchery and wild fish combined) 1946-2007 and 2008 forecast[2] (ODFW 2008c).

The majority of the natural-origin populations in this ESU have very low current abundances (less than a few hundred fish), and high proportions of hatchery-origin spawners. Quantitative estimates of trends in abundance and adult returns per spawner are available only for the Clackamas and McKenzie Chinook populations. In both cases, as shown in Table 3-5, while the long-term trend in abundance is slightly higher than 1.0, long-term median population growth rates (lambda) are negative, as are recruits per spawner (Table 3-5) (McElhany et al. 2007).

[2] Figure uses 2 datasets. Prior to 1970, estimates are for fish returning to the Willamette (do not include fish harvested in ocean and Columbia). For 1970 – present, estimates are for Willamette fish entering the Columbia River (do not include fish harvested in ocean).

Table 3-5 Abundance, productivity, and trends of UWR Chinook populations (source: McElhany et al. 2007). 95% confidence intervals are shown in parentheses.

Population	Recent Natural Spawners			Long-Term Trend		Median Growth Rate		Recruits/spawner	
	Years[1]	No. [2]	pHOS[3]	Years	Value[4]	Years	λ[5]	Years	Value[6]
Clackamas	90-05	1656 (1122-2443)	47%	58-05	1.04 4 (1.033-1.055)	58-05	0.967 (0.849-1.102)	58-05	0.888 (0.667-1.182)
Molalla	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NF Santiam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SF Santiam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calapooia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
McKenzie	90-05	2104 (1484-2983)	33%	70-05	1.017 (0.994-1.04)	70-05	0.927 (0.761-1.129)	70-05	0.705 (0.485-1.024)
MF Willamette	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: Reported time series correspond to reported values in available information.
1 Years of data for recent means.
2 Geometric mean of natural-origin spawners.
3 Average recent proportion of hatchery-origin spawners
4 Long-term trend of natural-origin spawners (regression of log-transformed natural-origin spawner abundances against time).
5 Long-term median population growth rate after accounting for the relative reproductive success of hatchery-origin spawners compared to those of natural origin. The statistic is corrected for hatchery fish to model the growth rate of the natural population if there had been no hatchery supplementation (McElhany et al. 2007).
6 Geometric mean of recruits per spawner using all brood years in the analysis period.
N/A = not available

STRATUM	POPULATION	EXTINCTION RISK CATEGORY
Upper Willamette	Clackamas	Low
	Molalla	Very High
	NF Santiam	Very High
	SF Santiam	Very High
	Calapooia	Very High
	McKenzie	Moderate
	MF Willamette	Very High

Table 3-6 Risk of extinction categories for populations of UWR Chinook (source: McElhany et al. 2007).

Extinction risk for each population over a 100-year time frame (Table 3-6 and Figure 3-5) was estimated qualitatively, based on criteria identified by the WLCTRT (McElhany et al. 2007). The rating system categorized extinction risk as very low, low, moderate, high, and very high based on abundance, productivity, spatial structure, and diversity characteristics. Based on the results for each population, McElhany et al. (2007) determined that the risk of extinction for the ESU was "high."

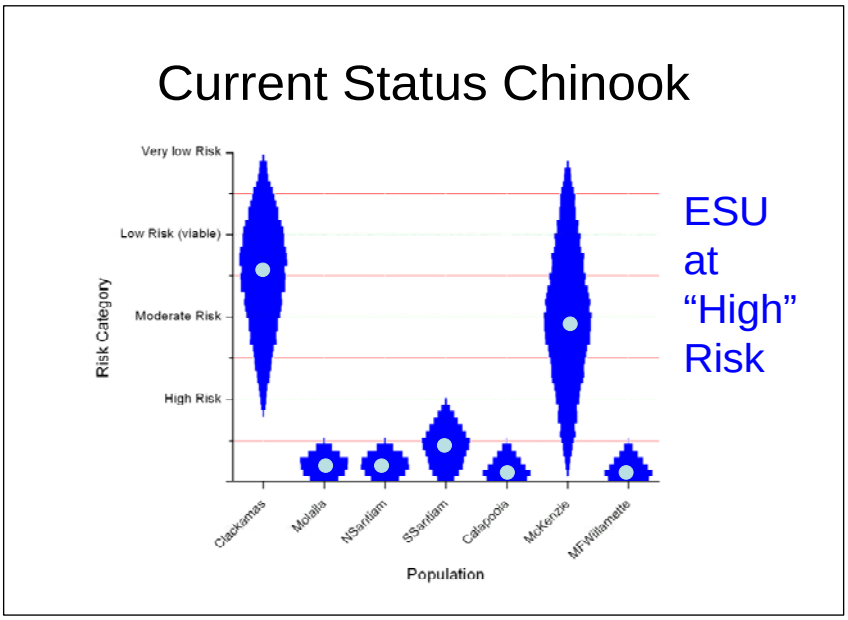

Figure 3-5 Current risk status of UWR spring Chinook salmon populations. Width of diamond corresponds with likelihood that the population is at status shown (McElhany et al. 2007).

All three of these metrics evaluate whether a population is maintaining itself, declining, or growing. A long-term trend > 1.0 indicates that population abundance is increasing over time, while a trend of <1.0 indicates abundance is decreasing. A median population growth rate (lambda) of 1.0 indicates a stationary population, lambda > 1.0 indicates that the population is growing, and lambda < 1.0 indicates a declining population. Similarly, recruits per spawner of 1.0 indicates that 100 parental spawners would produce 100 progeny that survive and spawn

successfully, while values above and below 1.0 indicate that each parental spawner produces less than one successful spawner, or more than one successful spawner, respectively. The long-term trend calculation may be elevated by the way in which it includes the progeny of hatchery-origin spawners, whereas the lambda and recruits per spawner values assess how a population would perform in the absence of continued hatchery production (NMFS 2008a; McElhany et al. 2007).

Spatial structure, or geographic distribution, of the North Fork Santiam, South Fork Santiam, McKenzie, and Middle Fork Willamette populations has been substantially reduced by the loss of access to the upper portions of those tributary basins due to flood control and hydropower development, including dams owned and operated by the Corps. It is likely that genetic diversity has also been reduced by this habitat loss. The habitat conditions conducive to salmon survival in the Molalla and Calapooia subbasins have been reduced significantly by the effects of land use, including forestry, agriculture, and development. Spatial structure of the Clackamas population remains relatively intact (McElhany et al. 2007).

The diversity of some populations has been further eroded by hatchery and harvest influences and degraded habitat conditions in lower elevation reaches, all of which have contributed to low population sizes (McElhany et al. 2007). As described above, historically UWR Chinook had diverse life history types, with greater variation in the age structure and timing of both returning adults and out-migrating juveniles. At present, the life history diversity of all UWR Chinook populations has been significantly simplified because there is less variation in ages and run timing. The healthiest populations (Clackamas and McKenzie) still have life history characteristics representative of historical runs, although interbreeding with hatchery fish has likely resulted in genetic introgression over the last 50 years.

3.2.1.4 Limiting Factors

The factors that have caused the decline of this ESU to its threatened status and that are limiting the ESUs' ability to recover include multipurpose dams, hatcheries, harvest, habitat degradation (tributary, mainstem, and estuarine), predation, and ocean and climate conditions. These factors are summarized briefly below. Of these factors, harvest is believed to have been reduced to a point where it is no longer limiting recovery, based on assessments by the ODFW as part of its recovery planning process. Additional information on limiting factors is described for individual populations in the environmental baseline section of this Biological Opinion.

3.2.1.4.1 Tributary and Willamette River Mainstem Habitat

Habitat in the Willamette River mainstem and lower reaches of all the tributaries to the Willamette River is moderately to severely degraded. Specific habitat concerns vary by subbasin but include reduced habitat complexity, reduced access to off-channel habitat, reduced floodplain function and connectivity, loss of holding pools, elevated water temperatures, insufficient stream flows, toxic water pollutants, and altered substrate compositions. Some tributaries have numerous passage barriers. Habitat downstream of the dams has become the only area available for natural reproduction because so much of the ESU's historic habitat has been blocked by the Willamette Project dams. Habitat conditions above the dams in most of the upper tributaries, although not pristine, represent the best available habitat for spawning, incubation, and early rearing by spring Chinook (NMFS 2008a).

3.2.1.4.2 Estuary Habitat

Alterations in flow and diking have resulted in the loss of shallow water, low velocity habitats used extensively by subyearling juvenile migrants. The ocean survival of yearling juveniles can be affected by estuary factors such as changes in food availability and the presence of contaminants. Characteristics of the plume are also thought to be significant to yearling migrants during transition to the ocean phase of their lifecycle; yearling migrants appear to use the plume as habitat, in contrast to sub-yearlings, which stay closer to shore (Fresh et al. 2005). Estuary limiting factors and recovery actions are addressed in detail in the estuary module of the comprehensive regional planning process (NMFS 2007c). Although it is highly unlikely that fish from this ESU encounter FCRPS mainstem projects, water management operations in the upper Columbia basin affect habitat and flow in the lower Columbia River, estuary, and plume (NMFS 2008a).

3.2.1.4.3 Multipurpose Dams

The Corps operates 13 dams in the largest five Willamette tributaries for multiple authorized and incidental purposes, including flood control, irrigation water supply, municipal and industrial water supply, navigation, flow augmentation, hydroelectric power, recreation, fish and wildlife conservation, and system operation. Impacts of these dams include blocked passage, poor downstream water quality, entrapment and stranding due to flood control and power peaking operations, and degraded functioning of downstream habitat. These effects are discussed extensively in the environmental baseline section. Adult and juvenile UWR Chinook also migrate past several smaller hydropower projects located below the Corps dams, which are licensed by the Federal Energy Regulatory Commission (FERC). These projects, which either have recently or are currently undergoing relicensing, are described in more detail in the environmental baseline section.

3.2.1.4.4 Harvest

UWR Chinook salmon are caught in ocean fisheries off southeast Alaska and northern Canada and in fisheries in the mainstem Columbia and Willamette rivers, and in Willamette River tributaries. The harvest rate on UWR Chinook salmon in ocean fisheries has averaged 11% in recent years. The total allowable harvest rate of unmarked Chinook in all freshwater fisheries is 15%, as specified in the Fisheries Management and Evaluation Plan (FMEP) for Willamette spring Chinook NMFS approved under ESA §4(d).[3] Only hatchery-origin Chinook (ODFW 2001a), which can be harvested in all freshwater fisheries affecting Willamette spring Chinook. Actual freshwater harvest on natural-origin Chinook has ranged from 9 to 12% in recent years.

3.2.1.4.5 Hatcheries Management

Hatcheries have been used as a management tool in the Willamette River basin for over 100 years, including use as mitigation for production lost due to dams. Hatchery-origin fish now outnumber natural-origin spawners in nearly all populations. All six of the Chinook populations above Willamette Falls and, to a lesser degree, the Clackamas population, are at risk for genetic introgression due to the high proportions of hatchery-origin fish on the spawning grounds (NMFS 2008a).

[3] Significant reductions in fishing rates below 15% do not appreciably affect wild escapement or long-term probabilities of survival and recovery because fishing no longer affects significant numbers of wild fish, especially at low run sizes (ODFW 2001a)

3.2.1.4.6 Predation

Yearling smolts are vulnerable to bird predation in the estuary (Fresh et al. 2005). In addition, spring Chinook are subject to pinniped predation when they return to the estuary as adults (NMFS 2008a). Pikeminnows are significant predators of both yearling and subyearling juvenile migrants (Friesen and Ward 1999).

3.2.1.4.7 Ocean & Climate

The analyses of UWR salmon and steelhead status in this Opinion generally assumed that future ocean and climate conditions will approximate the average conditions that prevailed during the recent base period used for status assessments. However, until recently, conditions have been poor for most Columbia River salmonids than the long-term average, and future trends are unclear. Further reductions in salmon production due to long-term ocean and climate trends will need to be addressed through implementation of additional recovery actions.

3.2.1.5 Summary of Rangewide Status for UWR Chinook Salmon

The UWR Chinook salmon ESU is currently at a high risk of extinction. Five of the seven populations in the ESU are currently at very high risk of extinction, with one population (the McKenzie) at moderate risk, and one (the Clackamas) at low risk. Natural production in these populations averages a couple thousand fish annually. Limiting factors for this ESU have come from multiple sources, including tributary dams, hydropower development, habitat degradation, hatchery effects, past harvest management, and predation.

The Willamette Project dams have blocked access to major portions of historical spawning habitat for four populations (the McKenzie, North Santiam, South Santiam, and Middle Fork), and downstream affects of the dams have also adversely affected these populations. Spring Chinook return to freshwater several months prior to spawning and require cool stream temperatures and adequate holding pools as they spend the summer maturing to eventually spawn in September and October. This over-summering habitat has been dramatically altered by the Willamette Project dams because they (1) block access to the cooler, headwater habitat that was used historically by adult Chinook and (2) expose Chinook confined to areas below Project dams to unnatural temperature regimes, which increase both adult and egg mortality.

3.2.2 Upper Willamette River (UWR) Steelhead

3.2.2.1 DPS Description

The UWR steelhead distinct population segment (DPS) includes all naturally spawned anadromous winter-run steelhead populations in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River (inclusive). There are no hatchery programs included in this ESU (NMFS 2006b). The hatchery summer-run steelhead that occur in the Willamette Basin are an out-of-basin stock and not considered part of the DPS.

The WLCTRT identified four historical independent populations within this DPS, all of which are part of one major population group, as shown in Table 3-7 and Figure 3-6 (Myers et al. 2006).

Table 3-7 Historical populations in the UWR steelhead DPS (Myers et al. 2006).

Stratum	Population*
Upper Willamette	Molalla
	North Santiam (C*), (G)
	South Santiam (C), (G)
	Calapooia

*The designations "C" and "G" identify Core and Genetic Legacy populations, respectively. Core populations historically represented the centers of abundance and productivity for a major population group. Genetic legacy populations have had minimal influence from nonendemic fish due to artificial propagation activities or exhibit important life history characteristics no longer found throughout the ESU (WLCTRT 2003).

Although spawning winter steelhead have been reported in the west-side tributaries to the Willamette River, these tributaries are not considered to have constituted an independent population historically (Myers et al. 2006). These tributaries may, however, serve as a population sink for the DPS, meaning that, although they do not sustain (and are not believed to have historically sustained) an independent population, winter steelhead may intermittently utilize them for spawning or rearing.

3.2.2.2 Life History

Generalized life-history timing for UWR steelhead is shown in Table 3-8. Winter-run steelhead enter the Willamette River beginning in January and February but do not ascend to their spawning areas until late March or April. Spawning takes place from April to early June (Myers et al. 2006).

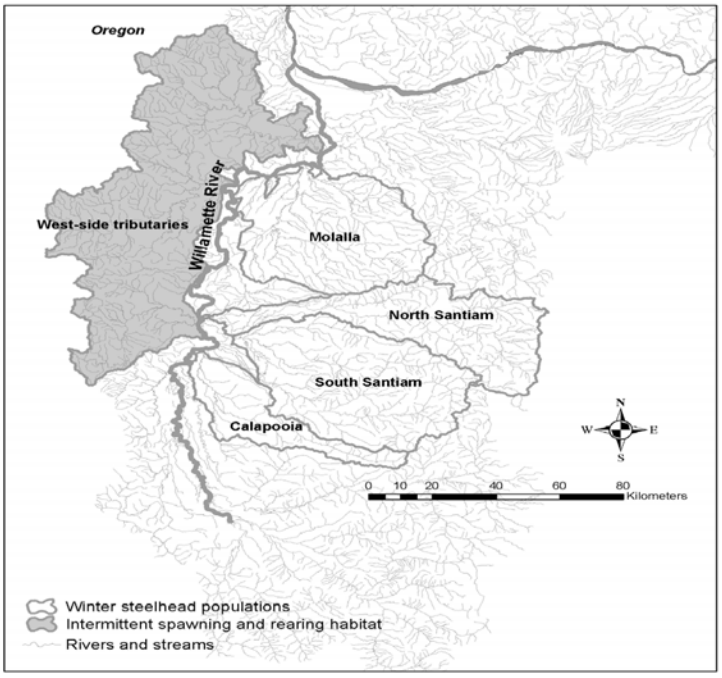

Figure 3-6 Historical populations in the UWR steelhead DPS. The west-side tributaries were not designated as an independent population but are included because of their importance to the DPS as a whole (Myers et al. 2006).

Table 3-8 UWR steelhead life history timing. Light shading represents low-level abundance and dark shading represents higher abundance (after USACE 2007a, Table 4-4).

MONTH:	J	F	M	A	M	J	J	A	S	O	N	D
Upstream Migration												
Spawning in Tributaries												
Intragravel Development												
Juvenile Rearing												
Juvenile Out-migration												

3.2.2.3 Current Viability

Numbers of steelhead in this DPS are depressed from historical levels, but to a much lesser extent than spring Chinook in the Willamette basin (McElhany et al. 2007). All of the historical populations produce moderate numbers of returning adults each year. While long-term trends are less than one (Table 3-9), short-term trends are 1.0 or higher (McElhany et al. 2007), indicating that, in the short-term (i.e., 1990-2005), abundance is increasing on average and the populations are growing.

Table 3-9 Abundance, productivity, and trends of UWR steelhead populations. 95% confidence intervals are shown in parentheses (source: McElhany et al. 2007).

POPULATION	RECENT NATURAL SPAWNERS			LONG-TERM TREND		MEDIAN GROWTH RATE		RECRUITS/SPAWNER	
	Years[1]	No. [2]	pHOS[3]	Years	Value[4]	Years	λ[5]	Years	Value[6]
Molalla	90-05	914 (655-1275)	0%[7]	80-05	0.966 (0.931-1.002)	80-05	0.988 (0.79-1.235)	80-05	0.985 (0.64-1.517)
North Santiam	90-05	2109 (1485-2994)	0%[7]	80-05	0.98 (0.946-1.014)	80-05	0.983 (0.786-1.231)	80-05	0.886 (0.59-1.331)
South Santiam	90-05	2149 (1618-2853)	0%[7]	68-05	0.984 (0.965-0.998)	68-05	0.976 (0.855-1.114)	80-05	0.962 (0.714-1.295)
Calapooia	90-05	339 (206-560)	0%[7]	80-05	0.987 (0.94-1.037)	80-05	1.023 (0.743-1.409)	80-05	1.126 (0.617-2.055)

Note: Reported time series correspond to reported values in available information.
1 Years of data for recent means.
2 Geometric mean of total spawners.
3 Average recent proportion of hatchery origin spawners
4 Long-term trend of natural spawners (regression of log-transformed spawner abundances against time); indicates rate of return of adults to spawners.
5 Long-term median population growth rate after accounting for the relative reproductive success of hatchery-origin spawners compared to those of natural origin (in this analysis, equal reproductive success was assumed).
6 Geometric mean of recruits per spawner using all brood years in the analysis period.
7Current hatchery fractions reflect termination of hatchery winter steelhead releases into natural production areas in the 1990s.
N/A = not available

Table 3-10 Risk of extinction categories for populations of UWR steelhead (source: McElhany et al. 2007).

STRATUM	POPULATION	EXTINCTION RISK CATEGORY
Upper Willamette	Molalla	Moderate
	North Santiam	Moderate
	South Santiam	Moderate
	Calapooia	Moderate

Extinction risk for each population over a 100-year time frame (Table 3-10 and Figure 3-7) was derived qualitatively, based on criteria identified by the WLCTRT (2004). The rating system categorized extinction risk probabilities as very low, low, moderate, high, and very high based on abundance, productivity, spatial structure and diversity characteristics. The risk assessment was based on a qualitative analysis of the best available data and anecdotal information for each population. Based on these results, McElhany et al. (2007) determined that the risk of extinction for the DPS was "moderate."

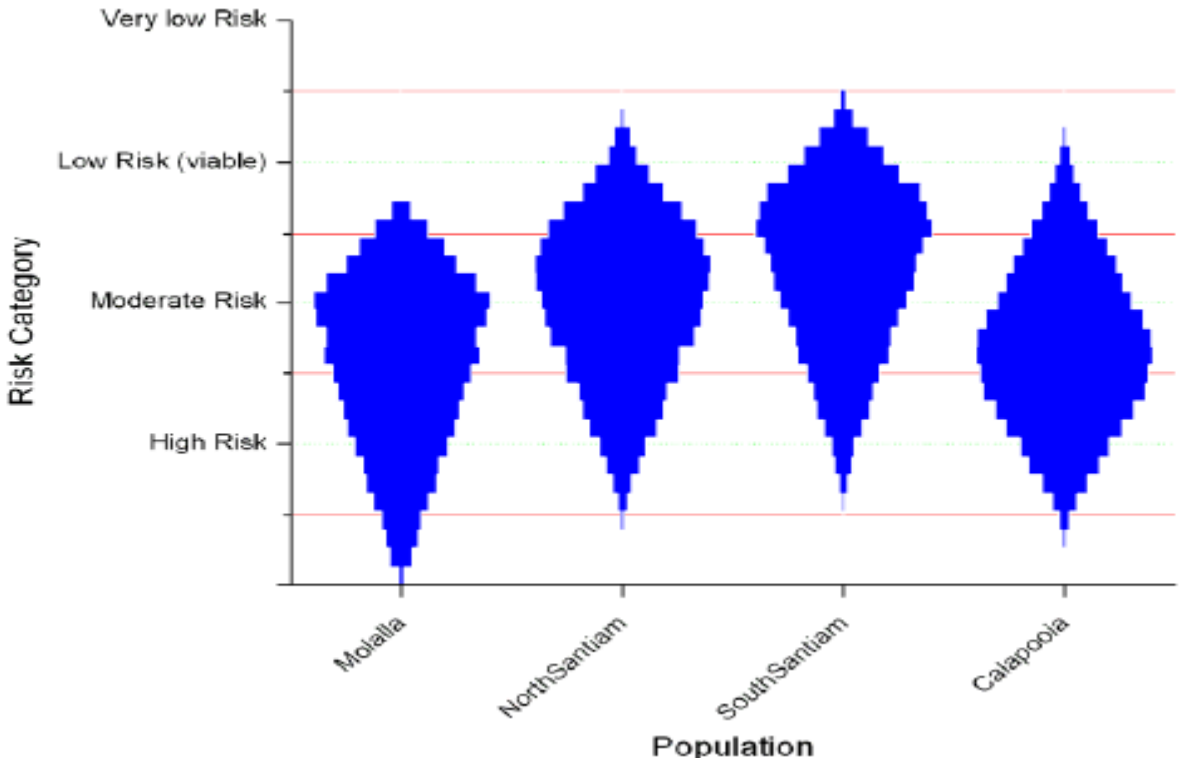

Figure 3-7 Current risk status of UWR steelhead populations. Width of diamond corresponds with likelihood that the population is at that particular status (McElhany et al. 2007).

Spatial structure for the North and South Santiam populations has been substantially reduced by loss of access to the upper North Santiam basin and the Quartzville Creek watershed in the South Santiam subbasin due to construction of the Corps dams (McElhany et al. 2007). Spatial structure in the Molalla subbasin has been reduced significantly by habitat degradation and in the Calapooia by habitat degradation and passage barriers (WLCTRT 2004).

The diversity of all four populations has been eroded by various factors including small population size, the loss of access to historic habitat, long-term effects of past winter-run hatchery releases, and the ongoing release of summer steelhead (McElhany et al. 2007).

3.2.2.4 Limiting Factors

The factors that have caused the decline of this DPS to its threatened status and that are limiting the DPS's ability to recover include multipurpose dams, hatcheries, harvest, habitat degradation (tributary, mainstem, and estuarine), predation, and ocean and climate conditions. These factors are summarized briefly below. Of these factors, harvest is considered reduced to a point where it is no longer limiting recovery, based on assessments done by the Oregon Department of Fish and Wildlife as part of its recovery planning process. Additional information on limiting factors is described for individual populations in the environmental baseline section of this Biological Opinion.

3.2.2.4.1 Tributary & Willamette Mainstem Habitat

Habitat in the lower reaches of all the tributaries to and in the mainstem of the Willamette River is moderately to severely degraded. Specific habitat concerns vary by subbasin but include impaired access in small streams, fine sediments in spawning gravel, reduced habitat complexity, reduced access to off-channel habitat, reduced floodplain function and connectivity, elevated water temperatures, water pollutants, and insufficient stream flows. Some tributaries have numerous small passage barriers. Habitat downstream of the dams has become more significant to the viability of the UWR steelhead DPS since significant portions of its historic habitat has been blocked by the Willamette Project dams. Conditions above the dams in most tributary subbasins, although not pristine, are adequate for steelhead production (NMFS 2008a).

3.2.2.4.2 Estuary Habitat

The ocean survival of yearling juveniles can be affected by estuary factors such as changes in food availability and the presence of contaminants. Characteristics of the plume are also thought to be significant to yearling migrants during transition to the ocean phase of their lifecycle, because yearling migrants appear to use the plume as habitat, in contrast to sub-yearlings, which stay closer to shore (Fresh et al. 2005). Although it is highly unlikely that fish from this DPS encounter FCRPS mainstem projects, water management operations in the upper Columbia basin affect habitat and flow in the lower Columbia River, estuary, and plume (NMFS 2008a). Estuary limiting factors and recovery actions are addressed in detail in the estuary module of the comprehensive regional planning process (NMFS 2007c).

3.2.2.4.3 Multipurpose Dams

The Corps operates 13 dams in the largest five Willamette tributaries for multiple authorized and incidental purposes, including flood control, irrigation water supply, municipal and industrial water supply, navigation, flow augmentation, hydroelectric power, recreation, fish and wildlife conservation, and system operation. Impacts of these dams include blocked passage, poor downstream water quality, entrapment and stranding due to flood control and power peaking operations, and degraded functioning of downstream habitat. These effects are discussed extensively in the environmental baseline section. UWR steelhead also pass several smaller hydropower projects licensed by FERC. These projects, which either have recently or are

currently undergoing relicensing, are described in more detail in the environmental baseline section.

3.2.2.4.4 Harvest

Ocean fishing mortality on UWR steelhead is assumed to be zero. Incidental by-catch of steelhead in ocean fisheries is rare. Freshwater fisheries affecting UWR steelhead are managed according to a Fisheries Management and Evaluation Plan (FMEP) approved by NMFS under ESA section 4(d). This FMEP requires the release of all unmarked steelhead in lower Columbia, Willamette, and tributary fisheries. Since these fisheries are all catch and release, harvest impacts have been less than 2% in recent years.

3.2.2.4.5 Hatcheries

There are no winter steelhead hatchery programs in the Upper Willamette basin, but a non-native summer steelhead hatchery program creates threats to listed winter steelhead. Although there is some separation in run and spawn timing between hatchery-origin summer and wild winter steelhead, the potential exists for genetic introgression. Competition for rearing resources and spawning sites may also occur between hatchery-origin summer steelhead and wild winter steelhead (NMFS 2008a).

3.2.2.4.6 Predation

Stream-type juveniles, especially yearling smolts such as steelhead, are vulnerable to bird predation in the estuary (Fresh et al. 2005). In addition, steelhead are subject to pinniped predation when they return to the estuary as adults although the magnitude of pinniped predation for Upper Willamette fish is unknown (NMFS 2008a). Pikeminnow are significant predators of both yearling and subyearling juvenile migrants (Friesen and Ward 1999).

3.2.2.4.7 Ocean & Climate

Analyses of Upper Willamette River salmon and steelhead status generally assumed that future ocean and climate conditions will approximate the average conditions that prevailed during the recent base period used for status assessments (LCFRB 2004). However, until recently, ocean and climate conditions have been poor for most Columbia River salmonids than the long-term average and future trends are unclear. Further reductions in salmonid production due to long-term ocean and climate trends will need to be addressed through implementation of additional recovery actions.

3.2.2.5 Summary of Rangewide Status

The Upper Willamette winter steelhead DPS is currently at a moderate risk of extinction. All four of the populations in the DPS are currently at moderate risk. Limiting factors for this ESU have come from multiple sources, including tributary dams, habitat degradation, hatchery effects, past harvest management, and predation.

Winter steelhead have different life history requirements than spring Chinook, which could explain their reduced extinction risk. They migrate into the Willamette River from December through April, when stream temperatures are cold, and spawn almost immediately upon reaching spawning grounds. Their spawning habitat is also more widespread than that of spring Chinook: they spawn in the mainstems of the Molalla, North Santiam, South Santiam, and Calapooia

rivers, as well as in small tributaries to those rivers. This more diverse spawning habitat lessens the risk to the populations overall. Winter steelhead have also not been as adversely affected by the Willamette Project dams as spring Chinook because they are not as dependent upon the headwater habitat above the dams for holding and spawning. In addition, since steelhead spawning is more widespread, these fish are not as susceptible to the direct effects of the dams (unlike spring Chinook, which, if they are not transported above the dams, must spawn in the mainstem rivers directly below the dams, where altered flows and water temperature affect their spawning success).

3.2.3 Lower Columbia River Salmon & Steelhead Species

Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, and Columbia River (CR) chum salmon spawn and rear in Columbia River tributaries from Hood River and the White Salmon River downstream to the mouth of the Columbia River. LCR steelhead spawn and rear in Columbia River tributaries between the Wind and Cowlitz rivers (inclusive) in Washington and between the Hood and Willamette rivers (inclusive) in Oregon. The range of all four LCR species also includes, or historically included, the Clackamas River, which is a Willamette River tributary. Fish from these ESUs and DPS' also use, or used historically, the lower Willamette River mainstem as rearing and/or migratory habitat. These species are likely to be affected by the proposed action, but to a lesser extent than the two Upper Willamette species.

3.2.3.1 Lower Columbia River Chinook Salmon

The Lower Columbia River (LCR) Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from the mouth of the Columbia River upstream to and including the White Salmon River in Washington and the Hood River in Oregon, and including the Willamette River upstream to Willamette Falls (exclusive of spring-run Chinook salmon in the Clackamas River), as well as seventeen artificial propagation programs (NMFS 2005c). The LCR Chinook salmon ESU exhibits three major life history types: fall-run ("tules"), late fall-run ("brights"), and spring-run (Good et al. 2005).

The WLCTRT identified 32 historical independent populations within this ESU, divided into 6 major population groups as shown in Table 3-11 (Myers et al. 2006).

Table 3-11 Historical populations in the LCR Chinook salmon ESU (Myers et al. 2006).

MAJOR POPULATION GROUP	POPULATION*
Cascade Spring	Upper Cowlitz (C,G), Cispus (C), Tilton, Toutle, Kalama, Lewis (C), Sandy (C,G)
Gorge Spring	(Big) White Salmon (C), Hood
Coastal Fall	Grays, Elochoman (C), Mill Creek, Youngs Bay, Big Creek (C), Clatskanie, Scappoose
Cascade Fall	Lower Cowlitz (C), Upper Cowlitz, Toutle (C), Coweeman (G), Kalama, Lewis (G), Salmon Creek, Washougal, Clackamas (C), Sandy
Cascade Late Fall	Lewis (C,G), Sandy (C,G)
Gorge Fall	Lower Gorge, Upper Gorge (C,G), (Big) White Salmon (C,G), Hood

*The designations "C" and "G" identify Core and Genetic Legacy populations, respectively. Core populations historically represented the centers of abundance and productivity for a major population group. Genetic legacy populations have had minimal influence from nonendemic fish due to artificial propagation activities or exhibit important life history characteristics no longer found throughout the ESU (WLCTRT 2003).

3.2.3.1.1 Current Viability

Data for this ESU are limited, but available data indicate that many populations currently have low abundance. Where data allow calculation of abundance trends for individual populations, those trends are mostly negative, some severely so. Assuming that the reproductive success of hatchery-origin fish has been equal to that of natural-origin fish, analysis indicates a negative long-term growth rate for all populations except the Coweeman River fall run (Good et al. 2005).

While the spatial structure of some populations in this ESU is similar to historical conditions, spatial structure of many populations has been significantly impaired either by numerous small habitat blockages, tributary hydropower development (primarily in the White Salmon, Hood, Lewis, and Cowlitz rivers) or, for populations spawning above Bonneville Dam, by inundation of historic habitat. Diversity of most fall-run populations has been eroded by large hatchery influences and periodically low effective population sizes. In contrast, hatchery programs for spring Chinook salmon are preserving the genetic legacy of populations that were extirpated from blocked areas (WLCTRT 2004).

Extinction risk over a 100-year time frame (Table 3-12) was derived qualitatively for each population, based on risk categories and criteria identified by the WLCTRT (WLCTRT 2004). Assessments were updated in 2007 for populations that spawn in Oregon tributaries (McElhany et al. 2007). The TRT's rating system categorized extinction risk probabilities as very low, low, moderate, high, and very high based on abundance, productivity, spatial structure, and diversity characteristics. The risk assessment was based on a qualitative analysis of the best available data and anecdotal information for each population.

Table 3-12 Risk of extinction (in 100 years) for populations of LCR Chinook salmon (sources: Washington's Lower Columbia Fish Recovery Board plan [LCFRB 2004] and McElhany et al. [2007] for Oregon populations).

Type	Strata	Population	State	Extinction Risk Category
Spring	Cascade	Cowlitz	W	High
		Cispus	W	High
		Tilton	W	Very High
		Toutle	W	Very High
		Kalama	W	Very High
		NF Lewis	W	Very High
		Sandy	O	Moderate
	Gorge	(Big) White Salmon	W	Very High
		Hood	O	Very High
Fall	Coastal	Grays/Chinook	W	High
		Elochoman/Skamokawa	W	High
		Mill/Abernathy/Germany	W	High
		Youngs Bay	O	Very High
		Big Creek	O	Very High
		Clatskanie	O	High
		Scappoose	O	Very High
	Cascade	Lower Cowlitz	W	High
		Upper Cowlitz	W	Very High
		Toutle	W	High
		Coweeman	W	Moderate
		Kalama	W	High
		Lewis	W	Moderate
		Salmon	W	Very High
		Washougal	W	High
		Clackamas	O	Very High
		Sandy	O	Very High
	Gorge	Lower Gorge	W/O	High/Very High
		Upper Gorge	W/O	High/Very High
		(Big) White Salmon	W	High
		Hood River	O	Very High
Late Fall	Cascade	NF Lewis	W	Moderate
		Sandy	O	Low

3.2.3.1.2 Limiting Factors

Limiting factors for this ESU are summarized below. For additional information, see the Washington Lower Columbia Recovery and Subbasin Plan (LCFRB 2004). (Oregon is currently developing a recovery plan for LCR Chinook salmon that spawn in Oregon tributaries.)

3.2.3.1.3 Tributary Habitat

Widespread urban development and other land use activities have severely degraded stream habitats, water quality, and watershed processes affecting anadromous salmonids in most lower Columbia River subbasins, particularly in low to moderate elevation habitats where fall Chinook salmon spawn and rear (NMFS 2008a).

3.2.3.1.4 Estuary Habitat

Alterations in flow and diking have resulted in the loss of shallow water, low velocity habitats used extensively by subyearling juveniles, such as fall and late-fall LCR Chinook salmon. The ocean survival of yearling juveniles (juvenile Chinook from spring-run populations) can be affected by estuary factors such as changes in food availability and the presence of contaminants. Characteristics of the plume are also thought to be significant to yearling migrants during transition to the ocean phase of their lifecycle, because yearling migrants appear to use the plume as habitat, in contrast to sub-yearlings, which stay closer to shore (Fresh et al. 2005). Estuary limiting factors and recovery actions are addressed in detail in the estuary module of the comprehensive regional planning process (NMFS 2007b).

3.2.3.1.5 Multipurpose Dams

Federal Columbia River Hydropower System impacts on populations originating downstream of Bonneville Dam are limited to effects on migration and habitat conditions in the Columbia River below Bonneville and in the estuary. The five LCR Chinook salmon populations that spawn above Bonneville Dam have been affected by upstream and downstream passage at the dam and by inundation of tributary spawning habitat.

Tributary dams in the White Salmon, Hood, Lewis, Cowlitz, Sandy, and Clackamas basins have affected populations in those tributaries (NMFS 2008a), although many of those effects are being addressed as a result of recent FERC re-licensing and associated ESA consultations. Removal of Condit Dam is expected to support restoration of the spring and fall run Chinook populations in the White Salmon River (NMFS 2006e). Removal of Powerdale Dam is expected to support the restoration of the spring and fall fun Chinook populations in the Hood River (NMFS 2005f). Upstream and downstream passage facilities will be developed at the Lewis River Hydroelectric Project, a first step toward restoring the spring run (NMFS 2007b). Upstream and downstream passage facilities will be developed at the Cowlitz River Hydroelectric Project (NMFS 2004a), allowing restoration of the Cispus Spring run, Tilton spring run, and Upper Cowlitz spring and fall run populations. Removal of Marmot and Little Sandy dams in the Sandy Basin will improve access for spring Chinook salmon into the upper Sandy watershed (NMFS 2003a).

3.2.3.1.6 Harvest

LCR Chinook salmon are harvested in the Columbia River and its tributaries and in ocean fisheries off Oregon, Washington, and Canada. Permitted harvest rate limits for fall-run Chinook salmon have dropped from 65% just after listing to 42% in 2007. Harvest rates on spring-run fish have been reduced from 50 to 25% (NMFS 2008a).

3.2.3.1.7 Hatcheries Practices

Hatchery management practices have reduced the diversity and productivity of natural populations in this ESU, especially the tule fall Chinook populations. For LCR spring Chinook salmon, virtually all production is of hatchery origin (NMFS 2008a).

3.2.3.1.8 Predation

Yearling smolts from spring-run populations are vulnerable to bird predation in the estuary (Fresh et al. 2005). In addition, spring Chinook are subject to pinniped predation when they return to the estuary as adults (NMFS 2007c). Pikeminnow are significant predators of both yearling and subyearling juvenile migrants (Friesen and Ward 1999).

3.2.3.1.9 Ocean & Climate

Analyses of lower Columbia River salmon and steelhead status generally assumed that future ocean and climate conditions will approximate the average conditions that prevailed during the recent base period used for status assessments. However, until recently, conditions have been poor for most Columbia River salmonids and the long-term average and future trends are unclear (NMFS 2007a). Further reductions in salmon production due to long-term ocean and climate trends will need to be addressed through implementation of additional recovery actions.

3.2.3.2 Lower Columbia River Coho Salmon

The Lower Columbia River (LCR) coho salmon ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries from the mouth of the Columbia up to and including the White Salmon and Hood rivers, and includes the Willamette River to Willamette Falls, Oregon, as well as twenty-five artificial propagation programs (NMFS 2005c). Juvenile LCR coho salmon migrate to the ocean as yearlings from mid-April through the end of May with peak migrations during May. Adult LCR coho salmon typically migrate through the lower Columbia River from September through November.

The WLCTRT identified 24 historical populations in this ESU, grouped into three major population groups as shown in Table 3-13.

Table 3-13 Historical populations in the LCR coho salmon ESU (Myers et al. 2006).

STRATUM	POPULATION
Coast	Grays, Elochoman, Mill Creek, Youngs Bay, Big Creek, Clatskanie, Scappoose Creek
Cascade	Lower Cowlitz, Coweeman, SF Toutle, NF Toutle, Upper Cowlitz, Cispus, Tilton, Kalama, NF Lewis, EF Lewis, Salmon Creek, Washougal, Clackamas, Sandy
Gorge	Lower Gorge, Washington Upper Gorge and (Big)White Salmon River, Oregon Upper Gorge and Hood River

3.2.3.2.1 Current Viability

Data on LCR coho salmon are limited. In most cases, populations have low current abundance and high proportions of hatchery-origin spawners. Spatial structure of most populations has been impaired either by loss of habitat, small blockages or major tributary hydropower development (primarily in the White Salmon, Hood, Lewis, and Cowlitz rivers). The diversity of populations has been eroded by large hatchery influences and periodically low effective population sizes. (The genetic legacy of the Lewis and Cowlitz River coho populations is preserved in ongoing hatchery programs.)

Extinction risk over a 100-year time frame (Table 3-14) was derived qualitatively for each population, based on risk categories and criteria identified by the WLCTRT (WLCTRT 2004). Assessments were updated in 2007 for populations that spawn in Oregon tributaries (McElhany et al. 2007). The TRT's rating system categorized extinction risk probabilities as very low, low, moderate, high, and very high based on abundance, productivity, spatial structure, and diversity characteristics. The risk assessment was based on a qualitative analysis of the best available data and anecdotal information for each population.

Table 3-14 Risk of extinction in 100 years categories for populations of LCR coho (sources: Washington's Lower Columbia Fish Recovery Board plan [LCFRB 2004] and McElhany et al. [2007] for Oregon populations).

STRATUM	POPULATION	STATE	EXTINCTION RISK CATEGORY
Coast	Grays	W	High
	Elochoman	W	High
	Mill Creek	W	High
	Youngs Bay	O	Very High
	Big Creek	O	Very High
	Clatskanie	O	High
	Scappoose	O	High
Cascade	Lower Cowlitz	W	High
	Coweeman	W	High
	SF Toutle	W	High
	NF Toutle	W	High
	Upper Cowlitz	W	Very High
	Cispus	W	Very High
	Tilton	W	Very High
	Kalama	W	High
	NF Lewis	W	High
	EF Lewis	W	High

STRATUM	POPULATION	STATE	EXTINCTION RISK CATEGORY
	Salmon	W	Very High
	Washougal	W	High
	Clackamas	O	Low
	Sandy	O	High
Gorge	Lower Gorge	O/W	Very High/High
	WA Upper Gorge and White Salmon River	W	Very High
	OR Upper Gorge and Hood River	O	Very High

3.2.3.2.2 Limiting Factors

Limiting factors for this ESU are summarized below. For additional information, see the Washington Lower Columbia Recovery and Subbasin Plan (LCFRB 2004). (Oregon is currently developing a recovery plan for LCR coho salmon that spawn in Oregon tributaries.)

3.2.3.2.3 Tributary Habitat

Widespread development and land use activities have severely degraded stream habitats, water quality, and watershed processes affecting coho salmon in most lower Columbia River subbasins, particularly in low to moderate elevation habitats (NMFS 2008a).

3.2.3.2.4 Estuary Habitat

The ocean survival of yearling juveniles (such as LCR coho) can be affected by estuary factors such as changes in food availability and the presence of contaminants. Characteristics of the plume are also thought to be significant to coho migrants during transition to the ocean phase of their lifecycle, because yearling migrants appear to use the plume as habitat, in contrast to sub-yearlings, which stay closer to shore (Fresh et al. 2005). Estuary limiting factors and recovery actions are addressed in detail in the estuary module of the comprehensive regional planning process (NMFS 2007c).

3.2.3.2.5 Multipurpose Dams

Impacts of the Federal Columbia River Hydropower System on LCR coho populations spawning downstream of Bonneville Dam are limited to effects on migration and habitat conditions in the Columbia River below Bonneville and in the estuary. The two populations that spawn upstream of Bonneville Dam are affected by upstream and downstream passage at Bonneville Dam and by inundation of historic habitat (WLCTRT 2004 and McElhany et al. 2007).

Tributary dams in the White Salmon, Hood, Lewis, Cowlitz, Sandy, and Clackamas basins have affected populations in those tributaries (NMFS 2008a), although many of those effects are being addressed as a result of recent FERC re-licensing and associated ESA consultations. Removal of Condit Dam by 2009 is expected to support restoration of the White Salmon River portion of the WA Upper Gorge coho population (NMFS 2006e). Removal of Powerdale Dam is expected to

support restoration of the Hood River portion of the OR Upper Gorge coho population (NMFS 2005f). Upstream and downstream passage facilities will be developed at the Lewis River Hydroelectric Project, a first step toward restoring the NF Lewis River coho population (NMFS 2008a). Upstream and downstream passage facilities will be developed at the Cowlitz River Hydroelectric Project (NMFS 2004a), supporting restoration of the Cowlitz, Cispus, and Tilton coho populations. Removal of Marmot and Little Sandy dams in the Sandy Basin will improve passage for the coho population into the upper Sandy watershed (NMFS 2003a).

3.2.3.2.6 Harvest

Lower Columbia River coho are harvested in the ocean and in Columbia River and tributary freshwater fisheries of Oregon and Washington. Harvest rates on coho salmon prior to the 1990s fluctuated from approximately 60 to 90%, but have been reduced since listing to 15 to 25% (NMFS 2008a).

3.2.3.2.7 Hatchery Practices

Hatchery management practices have reduced the diversity and productivity of natural populations throughout the Columbia River Basin. LCR coho salmon populations have been heavily influenced by hatchery production over the years (NMFS 2008a).

3.2.3.2.8 Predation

As stream-type juveniles, coho are vulnerable to bird predation in the estuary (Fresh et al. 2005). Pikeminnow are also significant predators of stream-type migrants (Friesen and Ward 1999).

3.2.3.2.9 Ocean & Climate

Analyses of lower Columbia River salmon and steelhead status generally assumed that future ocean and climate conditions will approximate the average conditions that prevailed during the recent base period used for status assessments. However, until recently, conditions have been poor for most Columbia River salmonids than the long-term average and future trends are unclear. Further reductions in salmon production due to long-term ocean and climate trends will need to be addressed through implementation of additional recovery actions.

3.2.3.3 Lower Columbia River Steelhead

The LCR steelhead DPS includes all naturally produced steelhead in tributaries to the Columbia River between the Cowlitz and Wind Rivers (inclusive) in Washington and the Willamette and Hood Rivers (inclusive) in Oregon, excluding steelhead in the upper Willamette River above Willamette Falls (NMFS 2006b). Ten artificial propagation programs are also included in the ESU. Two distinct races of steelhead, summer and winter, historically were and currently are found in the lower Columbia River (Myers et al. 2006).

The WLCTRT identified 23 historical populations within the DPS, which were divided into 4 major population groups as shown in Table 3-15 (Myers et al. 2006).

Table 3-15 Historical populations in the LCR steelhead ESU (Myers et al. 2006).

MAJOR POPULATION GROUP	POPULATION*
Cascade Summer	Kalama (C), NF Lewis, EF Lewis (G), Washougal (C,G)
Gorge Summer	Wind (C), Hood
Cascade Winter	Lower Cowlitz, Coweeman, NF Toutle (C), SF Toutle, Coweeman, Upper Cowlitz (C,G), Lower Cowlitz, Cispus (C), Tilton, Kalama, NF Lewis (C), EF Lewis, Salmon Creek, Washougal, Clackamas (C), Sandy (C)
Gorge Winter	Lower Gorge, Upper Gorge, Hood (C,G)

*The designations "C" and "G" identify Core and Genetic Legacy populations, respectively. Core populations historically represented the centers of abundance and productivity for a major population group. Genetic legacy populations have had minimal influence from nonendemic fish due to artificial propagation activities or exhibit important life history characteristics no longer found throughout the ESU (WLCTRT 2003).

3.2.3.3.1 Current Viability

Many populations in this DPS are small and have negative long- and short-term trends in abundance. In addition, for most populations the probability is high that the true growth rate is less than one (Good et al. 2005). Spatial structure of most populations has been impaired either by loss of habitat, small blockages or major tributary hydropower development (primarily in the Hood, Lewis, and Cowlitz rivers). The diversity of populations has been eroded by large hatchery influences; a number of the populations have a substantial fraction of hatchery-origin spawners and are thought to be largely sustained by hatchery production.

Extinction risk over a 100-year time frame (Table 3-16) was derived qualitatively for each population, based on risk categories and criteria identified by the WLCTRT (WLCTRT 2004). Assessments were updated in 2007 for populations that spawn in Oregon tributaries (McElhany et al. 2007). The TRT's rating system categorized extinction risk probabilities as very low, low, moderate, high, and very high based on abundance, productivity, spatial structure and diversity characteristics. The risk assessment was based on a qualitative analysis of the best available data and anecdotal information for each population.

Table 3-16 Risk of extinction categories for populations of LCR steelhead (sources: Washington's Lower Columbia Fish Recovery Board plan [LCFRB 2004] and McElhany et al. [2007] for Oregon populations).

Type	Strata	Population	State	Extinction Risk Category
Summer	Cascade	Kalama	W	High
		NF Lewis	W	Very High
		EF Lewis	W	High
		Washougal	W	High
	Gorge	Wind	W	Moderate
		Hood	O	Very High

Type	Strata	Population	State	Extinction Risk Category
Winter	Cascade	Lower Cowlitz	W	High
		Coweeman	W	High
		NF Toutle	W	High
		SF Toutle	W	Moderate
		Upper Cowlitz	W	High
		Cispus	W	High
		Tilton	W	Very High
		Kalama	W	Moderate
		NF Lewis	W	High
		EF Lewis	W	High
		Salmon	W	High
		Washougal	W	High
		Clackamas	O	Low
		Sandy	O	High
	Gorge	Lower Gorge	W/O	High/High
		Upper Gorge	W/O	High/Moderate
		Hood	O	Moderate

3.2.3.3.2 Limiting Factors

Limiting factors for this DPS are summarized below. For additional information, see the Washington Lower Columbia Recovery and Subbasin Plan (LCFRB 2004). (Oregon is currently developing a recovery plan for LCR steelhead that spawn in Oregon tributaries.)

3.2.3.3.3 Tributary Habitat

Widespread development and land use activities have severely degraded stream habitats, water quality, and watershed processes affecting anadromous salmonids in most lower Columbia River subbasins, particularly in low to moderate elevation habitats (NMFS 2008a).

3.2.3.3.4 Estuary Habitat

The ocean survival of yearling juveniles (such as LCR steelhead) can be affected by estuary factors such as changes in food availability and the presence of contaminants. Characteristics of the plume are also thought to be significant to coho migrants during transition to the ocean phase of their lifecycle, because yearling migrants appear to use the plume as habitat, in contrast to sub-yearlings, which stay closer to shore (Fresh et al. 2005). Estuary limiting factors and recovery actions are addressed in detail in the estuary module of the comprehensive regional planning process (NMFS 2007c).

3.2.3.3.5 Multipurpose Dams

Impacts of the FCRPS on LCR steelhead populations spawning downstream of Bonneville Dam are limited to effects on migration and habitat conditions in the Columbia River below Bonneville and in the estuary. The four populations that spawn upstream of Bonneville Dam are affected by upstream and downstream passage at Bonneville Dam and by inundation of historic habitat (McElhany et al. 2007 and WLCTRT 2004). Winter steelhead populations have also been blocked from higher elevation spawning habitats by construction of FERC-licensed hydropower facilities (NMFS 2008a), although many of those effects are being addressed as a result of recent FERC relicensing and associated ESA consultations. Removal of Marmot Dam will improve passage for the winter-run steelhead population into the upper Sandy River watershed (NMFS 2003a). Upstream and downstream passage facilities will be developed at the Lewis River Hydroelectric Project, a first step toward restoring the North Fork Lewis winter-run steelhead population (NMFS 2007b). Upstream and downstream passage facilities will also be developed at the Cowlitz River Hydroelectric Project, supporting the restoration of the Upper Cowlitz, Tilton, and Cispus winter-run steelhead populations (NMFS 2004a).

3.2.3.3.6 Harvest

LCR steelhead are harvested in Columbia River and tributary freshwater fisheries in Oregon and Washington. Fishery impacts on wild LCR steelhead have been limited to less than 10% since the implementation of mark-selective fisheries in the 1980s (NMFS 2008a).

3.2.3.3.7 Hatchery Practices

Hatchery management practices have reduced the diversity and productivity of natural populations throughout the Columbia River Basin (NMFS 2008a).

3.2.3.3.8 Predation

Stream-type juveniles, especially steelhead smolts, are vulnerable to bird predation in the estuary (Fresh et al. 2005). Steelhead are also subject to pinniped predation when they return to the estuary as adults (NMFS 2007c). Pikeminnow are significant predators of both yearling and subyearling juvenile migrants (Friesen and Ward 1999).

3.2.3.3.9 Ocean & Climate

Analyses of lower Columbia River salmon and steelhead status generally assumed that future ocean and climate conditions will approximate the average conditions that prevailed during the recent base period used for status assessments. However, until recently, conditions have been poor for most Columbia River salmonids than the long-term average and future trends are unclear. Further reductions in steelhead production due to long-term ocean and climate trends will need to be addressed through implementation of additional recovery actions (NMFS 2008a)

3.2.3.4 Columbia River Chum Salmon

The Columbia River chum ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon (NMFS 1999b). Three artificial propagation programs are also part of the ESU. Adult CR chum salmon typically enter the Columbia River in October and spawn from early November through December (Myers et al. 2006). Juvenile CR chum salmon migrate to the estuary as fry between February and May.

The WLCTRT identified 16 historical populations in 3 major population groups as shown in Table 3-17 (Myers et al. 2006).

Table 3-17 Historical populations in the CR chum ESU (Myers et al. 2006).

Stratum	Population*
Coastal	Grays (C,G), Elochoman (C), Mill Creek, Youngs Bay (C), Big Creek (C), Clatskanie, Scappoose
Cascade	Cowlitz (C, G?), Kalama, Lewis (C), Salmon Creek, Washougal, Clackamas (C), Sandy
Gorge	Lower Gorge (C,G), Upper Gorge

*The designations "C" and "G" identify Core and Genetic Legacy populations, respectively. Core populations historically represented the centers of abundance and productivity for a major population group. Genetic legacy populations have had minimal influence from nonendemic fish due to artificial propagation activities or exhibit important life history characteristics no longer found throughout the ESU (WLCTRT 2003).

3.2.3.4.1 Current Viability

Estimates of abundance and trends are available only for the Grays River and Lower Gorge populations. The 10-year trend was negative for the Grays River population and just over 1.0 for the Lower Gorge. These populations then increased for a few years before declining (Keller 2006).

Extinction risk over a 100-year time frame (Table 3-18) was derived qualitatively for each population, based on risk categories and criteria identified by the WLCTRT (WLCTRT 2004). Assessments were updated in 2007 for populations that spawn in Oregon tributaries (McElhany et al. 2007). The TRT's rating system categorized extinction risk probabilities as very low, low, moderate, high, and very high based on abundance, productivity, spatial structure, and diversity characteristics. The risk assessment was based on a qualitative analysis of the best available data and anecdotal information for each population.

Table 3-18 Risk of extinction in 100 years; categories for populations of Columbia River chum (sources: Washington's Lower Columbia Fish Recovery Board plan [LCFRB 2004] and McElhany et al. [2007] for Oregon populations).

Stratum	Population	State	Extinction Risk Category
Coastal	Grays	W	High
	Elochoman	W	High
	Mill Creek	W	Very High
	Youngs Bay	O	Very High
	Big Creek	O	Very High
	Clatskanie	O	Very High
	Scappoose	O	Very High
Cascade	Cowlitz	W	Very High
	Kalama	W	Very High

Stratum	Population	State	Extinction Risk Category
	Lewis	W	Very High
	Salmon	W	Very High
	Washougal	W	High
	Clackamas	O	Very High
	Sandy	O	Very High
Gorge	Lower Gorge	O/W	Very High/Moderate
	Upper Gorge	O/W	Very High/Very High

3.2.3.4.2 Limiting Factors

Limiting factors for this ESU are summarized below. For additional information, see the Washington Lower Columbia Recovery and Subbasin Plan (LCFRB 2004). (Oregon is currently developing a recovery plan for LCR chum salmon that spawn in Oregon tributaries.)

3.2.3.4.3 Tributary Habitat

Widespread development and land use activities have severely degraded stream habitats, water quality, and watershed processes affecting anadromous salmonids in most lower Columbia River subbasins, particularly in the low to moderate elevation habitats most often used by chum (NMFS 2008a).

3.2.3.4.4 Estuary Habitat

The estuary is an important habitat for migrating juveniles from Columbia River chum populations. Alterations in attributes of flow and diking have resulted in the loss of emergent marsh, tidal swamp and forested wetlands. These habitats are used extensively by chum juveniles, which migrate from their natal areas soon after emergence (Fresh et al. 2005). Estuary limiting factors and recovery actions are addressed in detail in a comprehensive regional planning process (NMFS 2007c).

3.2.3.4.5 Multipurpose Dams

FCRPS impacts on populations originating below the Portland/Vancouver metro area are limited to effects on migration and habitat conditions in the lower Columbia River below Bonneville and the estuary. Populations spawning above and just below Bonneville Dam are affected by passage, inundation of historic habitat, and flow management.

3.2.3.4.6 Harvest

Harvest impacts on chum are limited to indirect fishery mortality; there are currently no commercial or recreational fisheries on chum salmon. A small number of chum salmon (less than 50 fish in each of the last five years) are taken incidentally in lower river commercial gill net fisheries (NMFS 2008a).

3.2.3.4.7 Hatchery Practices

Historical hatchery practices do not appear to have influenced chum populations. WDFW's conservation hatcheries are currently an element of chum salmon protection and restoration efforts (NMFS 2008a).

3.2.3.4.8 Predation

Avian predators are assumed to have minimal effect on chum salmon. The significance of fish predation on juvenile chum and pinniped predation on adults is unknown (NMFS 2008a).

3.2.3.4.9 Ocean & Climate

Analyses of lower Columbia River salmon and steelhead status generally assumed that future ocean and climate conditions will approximate the average conditions that prevailed during the recent base period used for status assessments. However, until recently, conditions have been poor for most Columbia River salmonids than the long-term average and future trends are unclear. Further reductions in salmon production due to long-term ocean and climate trends will need to be addressed through implementation of additional recovery actions (NMFS 2008a).

3.2.4 Interior Columbia River ESU/DPSs

Middle Columbia River steelhead, Snake River (SR) spring/summer Chinook salmon, SR fall Chinook salmon, SR sockeye salmon, SR steelhead, Upper Columbia River (UCR) spring Chinook salmon, and UCR steelhead spawn in tributaries to the Columbia River above the mouth of the Willamette River (NMFS 2005c, NMFS 2006b). Adults and juveniles of these ESUs migrate through the lower Columbia River, and some juvenile rearing occurs there as well, as well as in the lower Willamette River below Willamette Falls.

3.2.4.1 Middle Columbia River Steelhead

The Middle Columbia River (MCR) steelhead DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding *O. mykiss* from the Snake River Basin, as well seven artificial propagation programs (NMFS 2006b).

The Interior Columbia Technical Recovery Team (IC TRT) identified 17 extant populations of MCR steelhead in four major population groups (MPGs) (NMFS 2008a).

During the most recent 10-year period for which trends could be estimated, the trend in abundance was greater than 1.0 for three populations, stable for three populations, and less than 1.0 for the remainder (if this number is greater than 1.0, the population abundance is increasing; if it is less than 1.0, the abundance is decreasing). The risk presented to the MCR steelhead populations as a result of their spatial distribution is very low to moderate for all the populations except the Upper Yakima, where most historical spawning areas are not occupied. The risk presented by the status of genetic diversity is low to moderate for all but one MCR steelhead population. The Upper Yakima population has a high diversity risk due to introgression with resident *O. mykiss* and loss of juvenile life history variation as a result of habitat changes (NMFS 2008a).

Key limiting factors for the MCR steelhead DPS include multipurpose dams, tributary habitat and in-basin hydropower, water storage projects, predation, hatchery effects, harvest, and estuary conditions. Ocean conditions have also affected the status of this DPS (NMFS 2008a).

3.2.4.2 Snake River Fall Chinook

The Snake River (SR) Fall Chinook ESU includes all naturally spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, as well as four artificial propagation programs (NMFS 2005c).

The IC TRT identified three historical populations of this ESU, although only the lower Snake River mainstem population is extant. This population extends from Hells Canyon to the confluence of the Snake and Columbia Rivers, including the lower reaches of tributaries to the Snake River (ICTRT 2003; McClure et al. 2005).

Total returns of fall Chinook over Lower Granite Dam increased steadily from the mid-1990s to the present. Over the last 23 full brood year returns through 2004, when only natural production is considered, SR fall Chinook populations have not replaced themselves (i.e., average R/S has been less than 1.0). However, R/S productivity was above 1.0 between 1995 and 1999, and preliminary estimates for the 2000-2003 brood years also indicate R/S>1.0 (NMFS 2008a).

The risk to the ESU as a result of its spatial distribution is moderately high because approximately 85% of historic habitat is inaccessible. Risk due to diversity for the ESU is moderately high because of the loss of diversity associated with extinct populations and the significant hatchery influence on the extant population (NMFS 2008a).

Key limiting factors for the SR fall Chinook salmon ESU include mainstem hydroelectric dams in the Columbia and Snake rivers, predation, harvest, hatcheries, the estuary, and tributary habitat. Ocean conditions have also affected the status of this ESU (NMFS 2008a).

3.2.4.3 Snake River Spring/Summer Chinook

The SR Spring/Summer Chinook Salmon ESU includes all naturally spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins, as well as fifteen artificial propagation programs (NMFS 2005c).

The IC TRT identified 28 extant historical populations of SR spring/summer Chinook salmon and aggregated those populations into 5 major population groups (MPGs). Abundance has been stable or increasing for most SR spring/summer Chinook. 2007 SR spring Chinook jack counts, which are a qualitative indicator of future adult returns, were the second highest on record. However, SR spring/summer Chinook populations have not replaced themselves when only natural production is considered (i.e., average recruits per spawner has been less than 1.0). The risk posed to all SR spring/summer Chinook populations as a result of their spatial structure is low or moderate, except for the Upper Grande Ronde and Lemhi populations, which are at high

risk for spatial structure. The risk posed by diversity factors to nearly all SR spring/summer Chinook populations is low or moderate, with the exception of some populations in the Upper Salmon MPG (NMFS 2008a).

Key limiting factors for the SR spring/summer Chinook salmon ESU include Federal and non-Federal multipurpose dams, predation, harvest, estuary conditions, and tributary habitat. Ocean conditions have also affected that status of this ESU. Although hatchery management is not identified as a limiting factor for the ESU as a whole, the ICTRT has indicated potential hatchery impacts for a few individual populations (NMFS 2008a).

3.2.4.4 Snake River Sockeye

The SR sockeye ESU includes all anadromous and residual sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive broodstock program (NMFS 2005c).

Although sockeye salmon were numerous in many areas of the Snake River basin, only a single remnant population, residing in the lakes of the Sawtooth Valley, Idaho, remains. From 1988 through 1999, the number of sockeye observed returning to Redfish Lake varied from 0 to 8 fish, with only three years when more than 1 fish returned. Since then, most of the returning fish have been of hatchery origin, although some residual sockeye have produced some adult returns. The highest number of adult returning in recent years was 257 in 2000. An average of about 12 fish per year have returned over the past 5 years. In addition, a substantial number of juvenile and adult fish of hatchery origin from this ESU are present in captive rearing facilities as part of an artificial propagation program. The program has been successful in its goals of preserving important lineages of Redfish Lake sockeye salmon for genetic variability and in preventing extinction in the near-term. The Stanley Basin Sockeye Technical Oversight Committee has determined that the next step toward meeting the goal of re-establishing and amplifying the wild population is to increase the number of smolts released.

The major factors limiting the conservation value of critical habitat for SR sockeye are the effects on the migration corridor posed by the mainstem lower Snake and Columbia River hydropower system, reduced tributary stream flows and high temperatures, and barriers to tributary migration. The spawning and rearing lakes lie within designated wilderness where habitat is considered good to excellent. Ocean conditions have also affected that status of this ESU (NMFS 2008a).

3.2.4.5 Snake River Steelhead

The SR steelhead DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and artificial impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, as well six artificial propagation programs (NMFS 2006b).

The IC TRT identified 24 populations in five major population groups. SR steelhead are also distinguished as A-run or B-run based on differences in migration timing and age and size at

return. A-run steelhead are believed to occur throughout the steelhead streams in the Snake River Basin, and B-run are thought to be produced only in the Clearwater and Salmon rivers. Abundance has been stable or increasing for most A-run SR steelhead but declining for B-run SR steelhead during the last 20 brood cycles. Median population growth rate (lambda) was not available for average A-and B-run populations, but was positive for the two Grande Ronde populations with sufficient data to make an estimate. On average, during the last 20 full brood cycles, when only natural production is considered, A-run SR steelhead populations have replaced themselves (i.e., average R/S has been >1.0), while B-run steelhead have not. The risk posed to nearly all SR steelhead populations as a result of their spatial structure is very low or low. Only one population, Panther Creek, is categorized as having high risk as a result of its spatial structure, because only 30% of its historic range is occupied. The risk to all SR steelhead populations as a result of genetic diversity factors is low or moderate (NMFS 2008a).

Key limiting factors for the SR steelhead DPS include multipurpose dams, predation, harvest, hatchery effects, and tributary habitat. Ocean conditions have also affected the status of this DPS (NMFS 2008a).

3.2.4.6 Upper Columbia Spring Chinook

Upper Columbia River (UCR) spring Chinook spawn and rear in the mainstem Columbia River and its tributaries between Rock Island and Chief Joseph dams (NMFS 2008a).

This ESU contains one MPG composed of three existing populations and one extinct population. The upriver migration of this ESU is blocked by Chief Joseph Dam, completed in 1961. Prior to that, migration was blocked by Grand Coulee Dam, completed 20 years earlier (NMFS 2008a).

Based on Biological Review Team (BRT) trend estimates, abundance has declined for all three populations during the last 20 brood cycles. Population growth rate (lambda) is increasing for the Wenatchee and Methow populations and decreasing for the Entiat population. In 2007, UCR spring Chinook jack counts, an indicator of future adult returns, were at their highest level since 1977. The risk posed to all UCR spring Chinook populations as a result of spatial structure is either low or moderate, and risk posed by diversity factors is high, as a result of reduced genetic diversity from homogenization of populations (NMFS 2008a).

Key limiting factors for the UCR spring Chinook ESU include the FCRPS and Mid-Columbia multipurpose dams, predation, harvest, hatchery effects, and estuary and tributary habitats. Further consideration must take into account poor ocean conditions and the impact of hatchery practices (NMFS 2008a).

3.2.4.7 Upper Columbia River Steelhead

The Upper Columbia River (UCR) steelhead DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and artificial impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, as well six artificial propagation programs (NMFS 2006b).

The DPS consists of four populations in one major population group. Total abundance has been increasing for all UCR steelhead during the last 20 brood year returns, based on lambda and BRT trend estimates. When only natural production is considered, however, UCR steelhead populations have not been replacing themselves over the last 20 full brood year returns (i.e., average R/S has been less than 1.0). The risk posed to UCR steelhead populations by spatial structure is low for the Wenatchee and Methow, moderate for the Entiat, and high for the Okanogan. Risk to all UCR steelhead populations as a result of diversity factors is high, due to hatchery practices (NMFS 2008a).

Key limiting factors for the UCR steelhead DPS include multipurpose dams, predation, harvest (until the late 1980s), hatchery effects (until the late 1990s), and tributary and estuary habitat. Ocean conditions have also affected the status of this DPS (NMFS 2008a).

3.3 CRITICAL HABITAT FOR COLUMBIA & WILLAMETTE BASIN SALMONIDS

NMFS has designated critical habitat for 12 of the 13 salmon and steelhead species that may be affected by the Proposed Action.[4] Designated areas in the Willamette basin are most directly affected by the Proposed Action and as such, are given more detailed review. Critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line.[5] Within these areas, the primary constituent elements (PCEs) essential for the conservation of these species are those sites and habitat components that support one or more life stages, including:

- Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.
- Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
- Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival
- Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
- Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation (NMFS 2005d) (offshore marine

[4] Critical habitat has not been designated for Lower Columbia River coho salmon.
[5] In areas where ordinary high-water line has not been defined, the lateral extent is the bankfull elevation (i.e., the level at which water begins to leave the channel and move into the floodplain, generally reached at a discharge with a 1- to 2-year recurrence interval).

PCEs were not identified for SR spring/summer Chinook salmon, SR fall Chinook salmon, and SR sockeye salmon; NMFS 1993 and 1999c).

NMFS describes the conservation role that the designated critical habitat provides each species below. The Critical Habitat Analytical Review Teams (CHARTs) rated 525 occupied fifth field hydrologic units (referred to as HUC5s or watersheds) in the Columbia River basin. The CHARTs gave each of these occupied watersheds a high, moderate, or low rating. High-value watersheds/areas are those with a high likelihood of promoting conservation, while low value watersheds/areas are expected to contribute relatively little. Conservation value was determined by considering the factors listed in Table 3-20.

Table 3-20 Factors considered by Columbia Basin CHARTs to determine the conservation value of occupied watersheds.

FACTORS	CONSIDERATIONS
PCE quantity	Total stream area or number of reaches in the watershed where PCEs are found; compares to both distribution in other watersheds and to probable historical quantity within the watershed
PCE quality – current condition	Existing condition of the quality of PCEs in the watershed
PCE quality – potential condition	Likelihood of achieving PCE potential in the watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility
PCE quality – support of rarity/importance	Support of rare genetic or life history characteristics or rare/important types in the watershed
PCE quality – support of abundant populations	Support of variable-sized populations relative to other watersheds and the probably historical levels in the watershed
PCE quality – support of spawning/rearing	Support of spawning or rearing of varying numbers of populations (i.e., different run-timing or life history types within a single ESU and or different ESUs)

Of the 525 occupied watersheds, 382 were assigned a high rating, 93 a moderate rating, and 50 a low rating. The CHART ratings do not address SR spring/summer Chinook salmon, SR fall Chinook salmon, or SR sockeye salmon as critical habitat was designated for these ESUs in 1993. Ratings for the LCR coho salmon ESU are under development.

Many factors, both human-caused and natural, have contributed to the decline of salmon over the past century. Salmon habitat has been altered through activities such as urban development, logging, grazing, power generation, water storage projects, and agriculture. These habitat alterations have resulted in the loss of important spawning and rearing habitat and the loss or degradation of migration corridors (Table 3-21). NMFS describes the specific PCEs that were applied for each reach of designated critical habitat in the action area within the Environmental

Baseline chapter 4.0. In the Environmental Baseline chapter, existing habitat conditions are considered in terms of its ability to support the designated PCEs.

Table 3-21 Major factors limiting the conservation value of designated critical habitat for those species with designated critical habitat. (PCSRF 2006).

Species	Major Limiting Factors
UWR Chinook salmon	Reduced access to spawning/rearing habitat Degraded water quality High water temperature Lost/degraded floodplain connectivity and lowland stream habitat Reduced streamflow
UWR steelhead	Reduced access to spawning/rearing habitat Degraded water quality High water temperature Lost/degraded floodplain connectivity and lowland stream habitat Reduced streamflow
LCR Chinook salmon	Altered channel morphology and stability Reduced access to spawning/rearing habitat Loss of habitat diversity Excessive sediment High water temperature
LCR steelhead	Altered channel morphology and stability Lost/degraded floodplain connectivity and lowland stream habitat Reduced access to spawning/rearing habitat Excessive sediment High water temperature Reduced streamflow
CR chum salmon	Altered channel morphology and stability Excessive sediment Reduced streamflow Loss of habitat diversity
MCR steelhead	Altered channel morphology and floodplain Excessive sediment Impaired passage Degraded water quality Hydropower system mortality Reduced streamflow
SR spring/summer Chinook salmon	Altered channel morphology and floodplain Excessive sediment Degraded water quality Hydropower system mortality Reduced streamflow
SR fall Chinook salmon	Reduced spawning/rearing habitat Degraded water quality Hydropower system mortality
SR steelhead	Altered channel morphology and floodplain Excessive sediment Degraded water quality Hydropower system mortality Reduced streamflow

Species	Major Limiting Factors
SR sockeye salmon	Altered channel morphology and floodplain Impaired passage Reduced streamflow Hydropower system mortality
UCR spring Chinook salmon	Altered channel morphology and floodplain Riparian degradation and loss of in-river large woody debris Impaired passage Reduced streamflow Hydropower system mortality
UCR steelhead	Altered channel morphology and floodplain Riparian degradation and loss of in-river large woody debris Excessive sediment Degraded water quality Reduced streamflow Hydropower system mortality

3.3.1 Critical Habitat for Upper Willamette River (UWR) Chinook Salmon

3.3.1.1 McKenzie Subbasin

Figure 3-8 shows the designation of critical habitat for UWR Chinook salmon in the McKenzie subbasin and its respective watersheds.

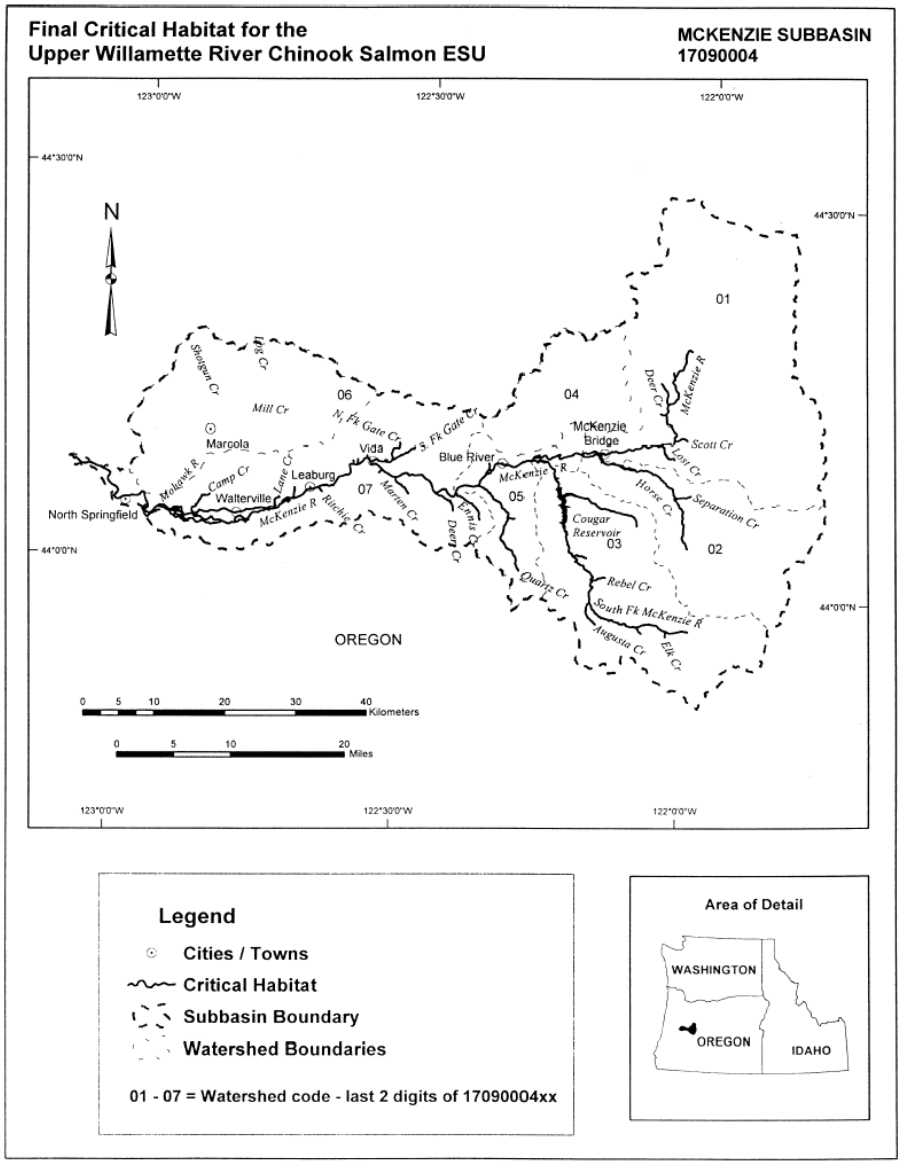

Figure 3-8 Critical habitat in the McKenzie subbasin

For UWR Chinook salmon, the CHART rated seven occupied watersheds found in the McKenzie subbasin. Each watershed is numbered in Figure 3-8, and represents individual watersheds. Of these seven watersheds, five were assigned a high rating and two a medium rating (NMFS 2005g). The watersheds that received a high rating include: Upper McKenzie River (1709000401), Horse Creek (1709000402), South Fork McKenzie River (1709000403), McKenzie River/Quartz Creek (1709000405), and Lower McKenzie River (1709000407). The

watersheds that received a medium rating were Blue River (1709000404) and Mohawk River (1709000406) (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the entire Blue River (1709000404) and Mohawk River (1709000406) watersheds because economic benefits of exclusion outweighed the benefits of designation. Among the mainstem McKenzie and many tributaries included in NMFS' final designation of critical habitat were the South Fork McKenzie River both above and below Cougar Dam (NMFS 2005d).

3.3.1.2 Middle Fork Willamette Subbasin

Figure 3-9 shows the designation of critical habitat for UWR Chinook salmon in the Middle Fork Willamette subbasin and its respective watersheds.

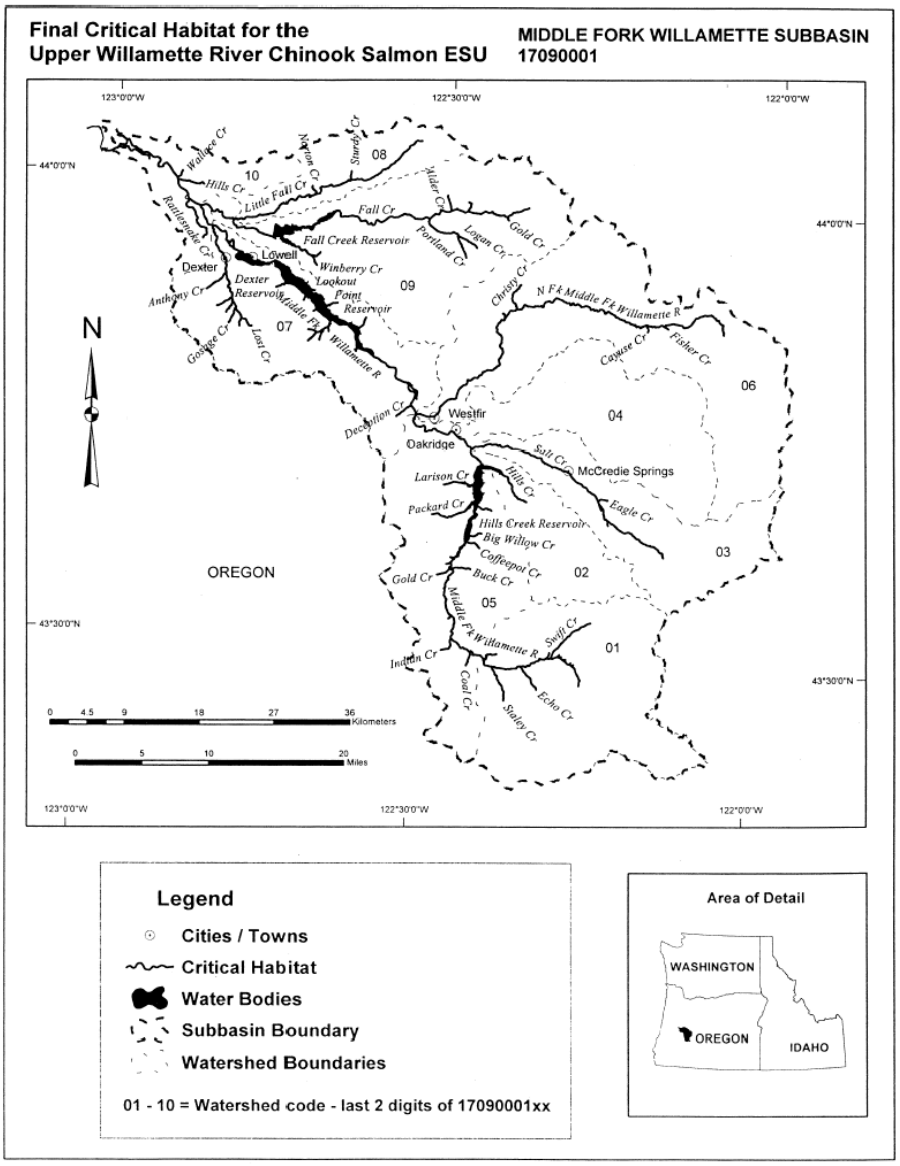

Figure 3-9 Critical habitat in the Middle Fork Willamette subbasin.

The CHART rated ten watersheds found in the Middle Fork Willamette subbasin; each has a number in Figure 3-9. Of the ten watersheds reviewed, four were rated as having high and six were rated as having medium conservation value. Watersheds that received a high rating include: Upper Middle Fork Willamette River watershed (1709000101), Salt Creek/Willamette River watershed (1709000103), North Fork of Middle Fork Willamette River watershed (1709000106), and Fall Creek watershed (1709000109). Those that received a medium rating include: Hills Creek watershed (1709000102), Salmon Creek watershed (1709000104), Hills Creek Reservoir watershed (1709000105), Middle Fork Willamette/Lookout Point watershed (1709000107), Little Fall Creek watershed (1709000108), and Lower Middle Fork of Willamette River watershed (1709000110) (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the entire Salmon Creek watershed (1709000104) economic benefits of exclusion outweighed the benefits of designation. NMFS included the mainstem Middle Fork Willamette, including extensive mainstem reaches and tributaries above Dexter, Lookout Point, and Hills Creek dams. NMFS also included the North Fork Middle Fork Willamette and Salt Creek above Lookout Point dam, as well as Fall Creek and many tributaries above and below Fall Creek dam (NMFS 2005d).

3.3.1.3 Coast Fork Willamette Subbasin

The CHART rated four watersheds in the Coast Fork Willamette subbasin. Row River (1709000201), Mosby Creek (1709000202), Upper Coast Fork Willamette River (1709000203), and Lower Coast Fork Willamette River (1709000205) watersheds all received low ratings (NMFS 2005g).

The entire Coast Fork Willamette subbasin was excluded in NMFS' final determination of critical habitat.

3.3.1.4 Upper Willamette Subbasin

Figure 3-10 shows the designation of critical habitat for UWR Chinook salmon in the Upper Willamette River subbasin and its respective watersheds.

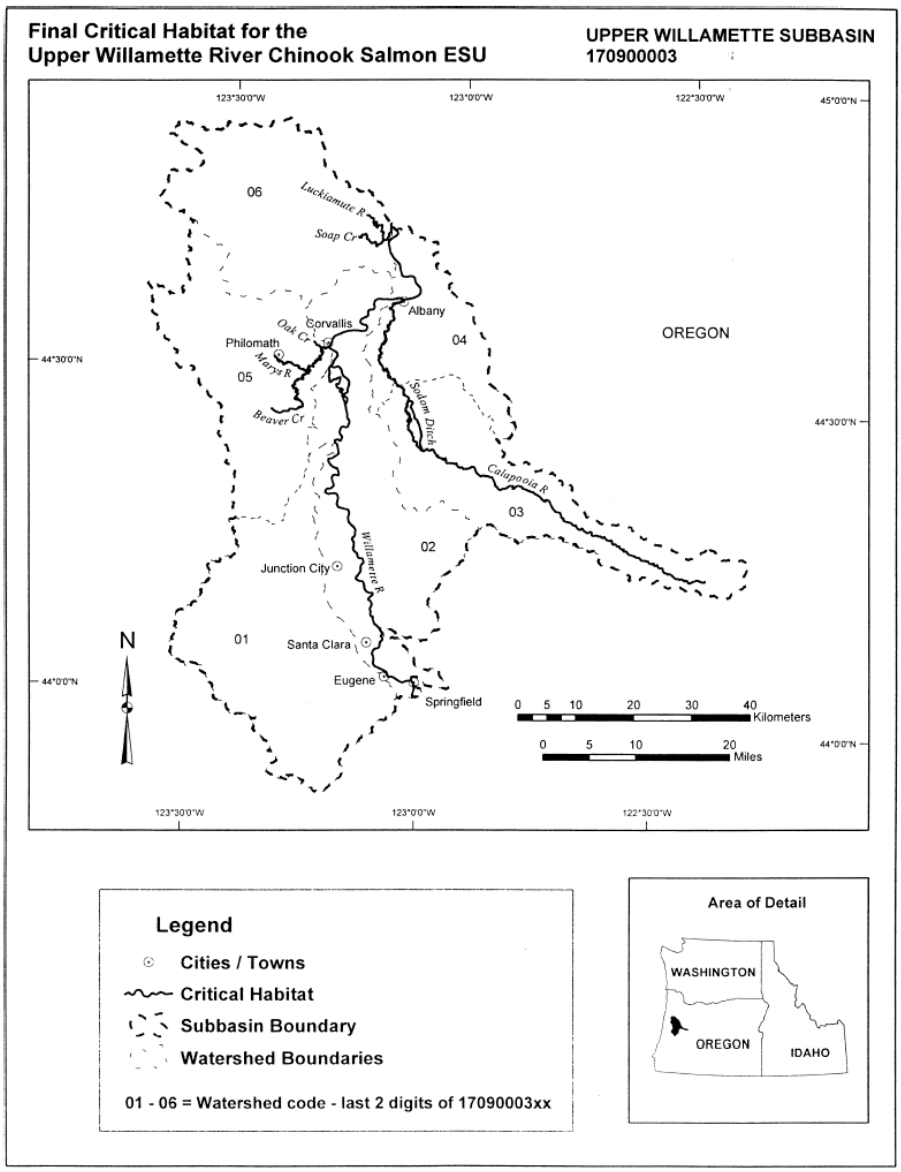

Figure 3-10 Critical habitat in the Upper Willamette subbasin.

The CHART rated six watersheds found in the Upper Willamette subbasin, numbered in Figure 3-10. Of the six watersheds reviewed, three were rated as having low and three were rated as having medium conservation value. Watersheds that received a medium rating include: Calapooia River watershed (1709000303), Marys River watershed (1709000305), and Luckiamute River watershed (1709000306). Those that received a low rating include: Long Tom River watershed (1709000301), Muddy Creek watershed (1709000302), and Oak Creek watershed (1709000304) (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the entire Long Tom River watershed (1709000301) and the tributaries of the Muddy Creek (1709000302) and Oak Creek (170900304) watersheds because economic benefits of exclusion outweighed the benefits of designation. NMFS included the mainstem Willamette River, the Calapooia River, and portions of the Mary's River and Luckiamute River watersheds (NMFS 2005d).

3.3.1.5 North Santiam Subbasin

Figure 3-11 shows the designation of critical habitat for UWR Chinook salmon in the North Santiam subbasin and its respective watersheds.

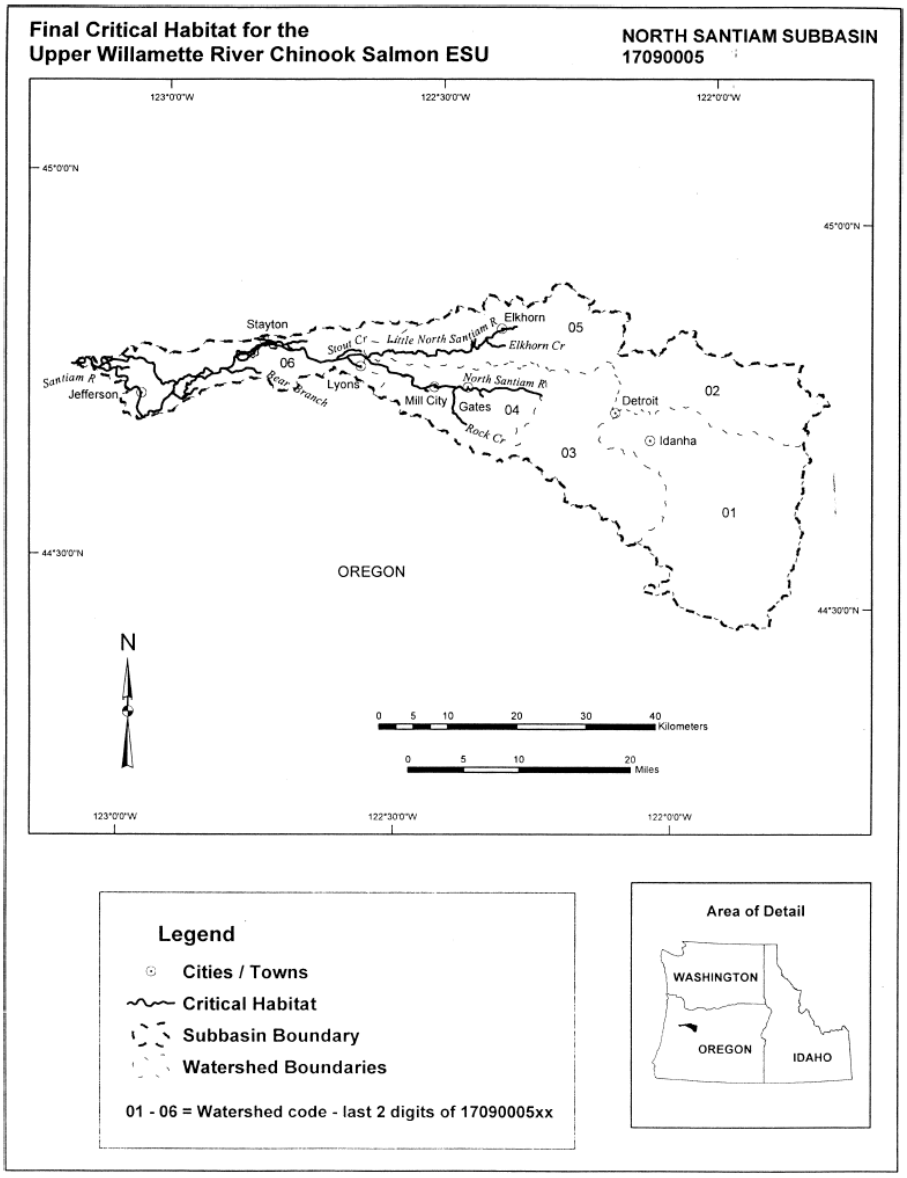

Figure 3-11 Critical habitat in the North Santiam subbasin.

The CHART rated three occupied watersheds found in the North Santiam subbasin, and numbered in Figure 3-11. The Middle North Santiam River watershed (1709000504) and Little North Santiam River watershed (1709000505) were rated as having a high conservation value and the Lower North Santiam watershed (1709000506) was rated as having a medium conservation value (NMFS 2005g).

The CHART also rated three unoccupied watersheds. The Upper North Santiam River watershed (1709000501) and North Fork Breitenbush River watershed (1709000502) were rated as possibly having high conservation value and the Detroit Reservoir/Blowout Divide Creek

watershed (1709000503) was rated as possibly having medium conservation value (NMFS 2005g). The CHART concluded that the currently unoccupied watersheds may be essential to the conservation of the ESU.

In its final designation of critical habitat, NMFS excluded the three unoccupied watersheds because the economic benefits of exclusion outweighed the benefits of designation. Critical habitat includes the mainstem North Santiam below Big Cliff and Detroit dams, as well as portions of the Little North Fork Santiam River watershed (NMFS 2005d).

3.3.1.6 South Santiam Subbasin

Figure 3-12 shows the designation of critical habitat for UWR Chinook salmon in the South Santiam subbasin and its respective watersheds.

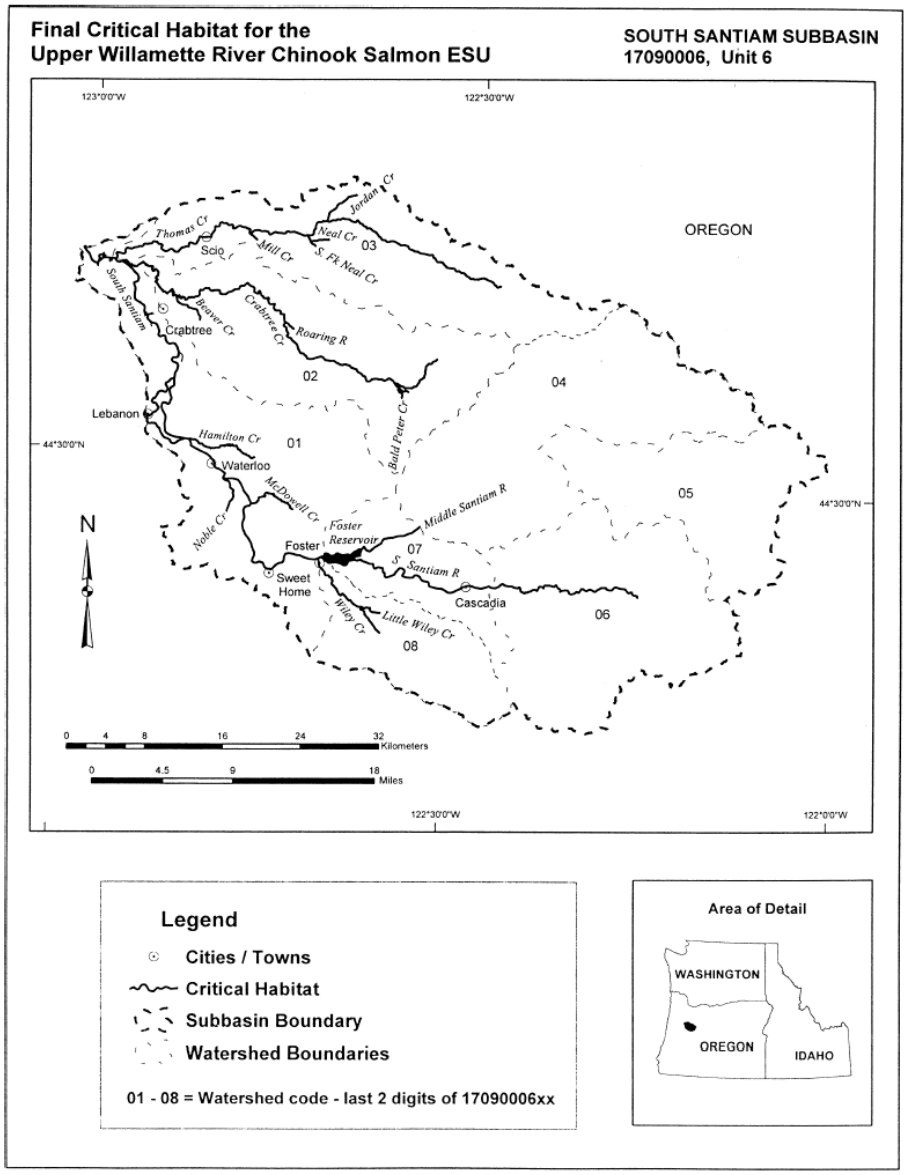

Figure 3-12 Critical habitat in the South Santiam subbasin.

The CHART rated six watersheds in the South Santiam subbasin, numbered in Figure 3-12. Of the six watersheds reviewed, three were rated as having high and three were rated as having medium conservation value. Those that received a high rating include: Hamilton Creek/South Santiam River watershed (1709000601), South Santiam River watershed (1709000606), and South Santiam River/Foster Reservoir watershed (1709000607). Those that received a medium rating include: Crabtree Creek watershed (1709000602), Thomas Creek watershed (1709000603), and Wiley Creek watershed (1709000608) (NMFS 2005g).

In its final designation of critical habitat, NMFS included the mainstem South Santiam both below and above Foster and Green Peter dams and portions of the Middle Santiam River (NMFS 2005d).

3.3.1.7 Middle Willamette Subbasin

Figure 3-13 shows the designation of critical habitat for UWR Chinook salmon in the Middle Willamette subbasin and its respective watersheds.

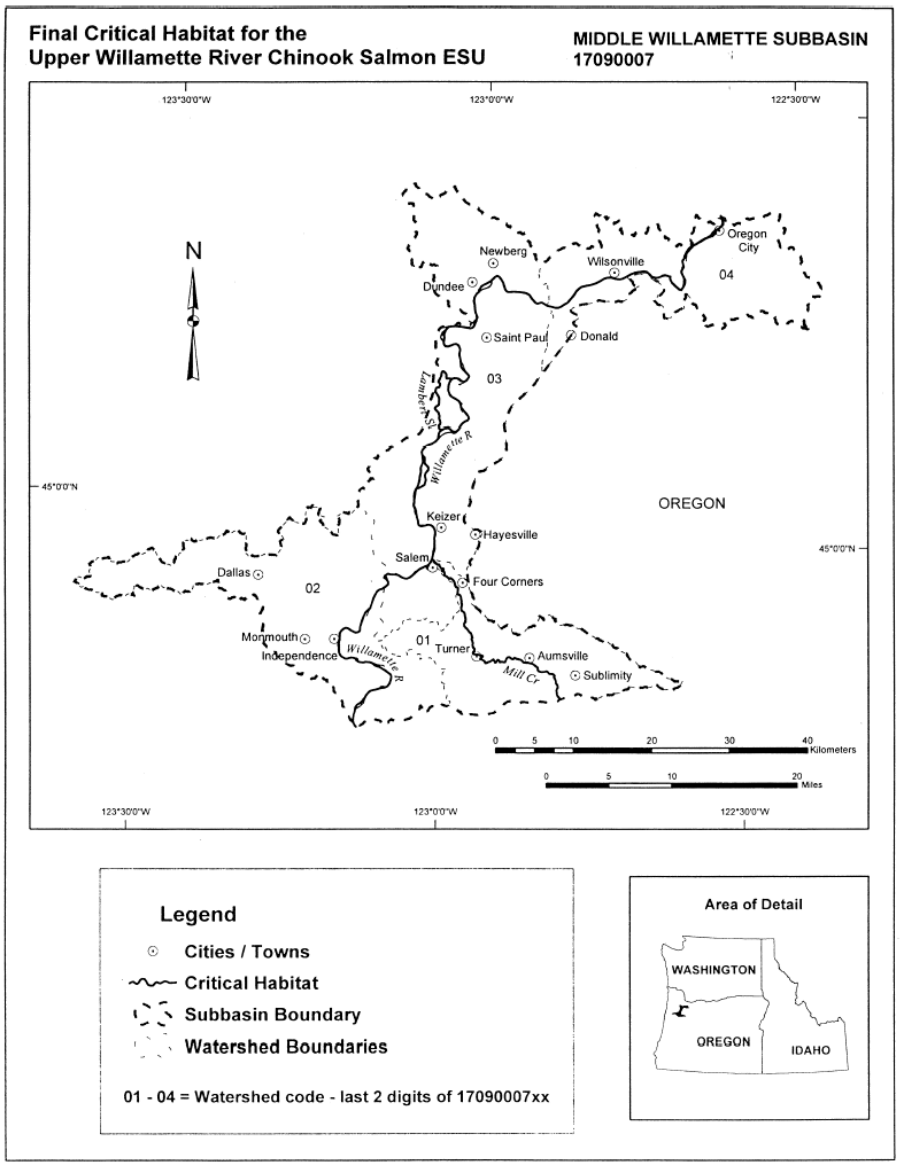

Figure 3-13 Critical habitat in the Middle Willamette subbasin.

The CHART rated four watersheds, numbered in Figure 3-13, in the Middle Willamette subbasin and concluded that all of the watersheds in this subbasin were of low conservation value. The watersheds include: Mill Creek/Willamette River Watershed (1709000701), Rickreall Creek watershed (1709000702), Willamette River/Chehalem Creek watershed (1709000703), and Abernethy Creek watershed (1709000704) (NMFS 2004g).

In its final designation of critical habitat, NMFS excluded the tributaries of all four watersheds. However, NMFS designated the mainstem Willamette River and portions of Mill Creek as critical habitat (NMFS 2005d).

3.3.1.8 Molalla/Pudding Subbasin

Figure 3-14 shows the designation of critical habitat for UWR Chinook salmon in the Molalla/Pudding subbasin and its respective watersheds.

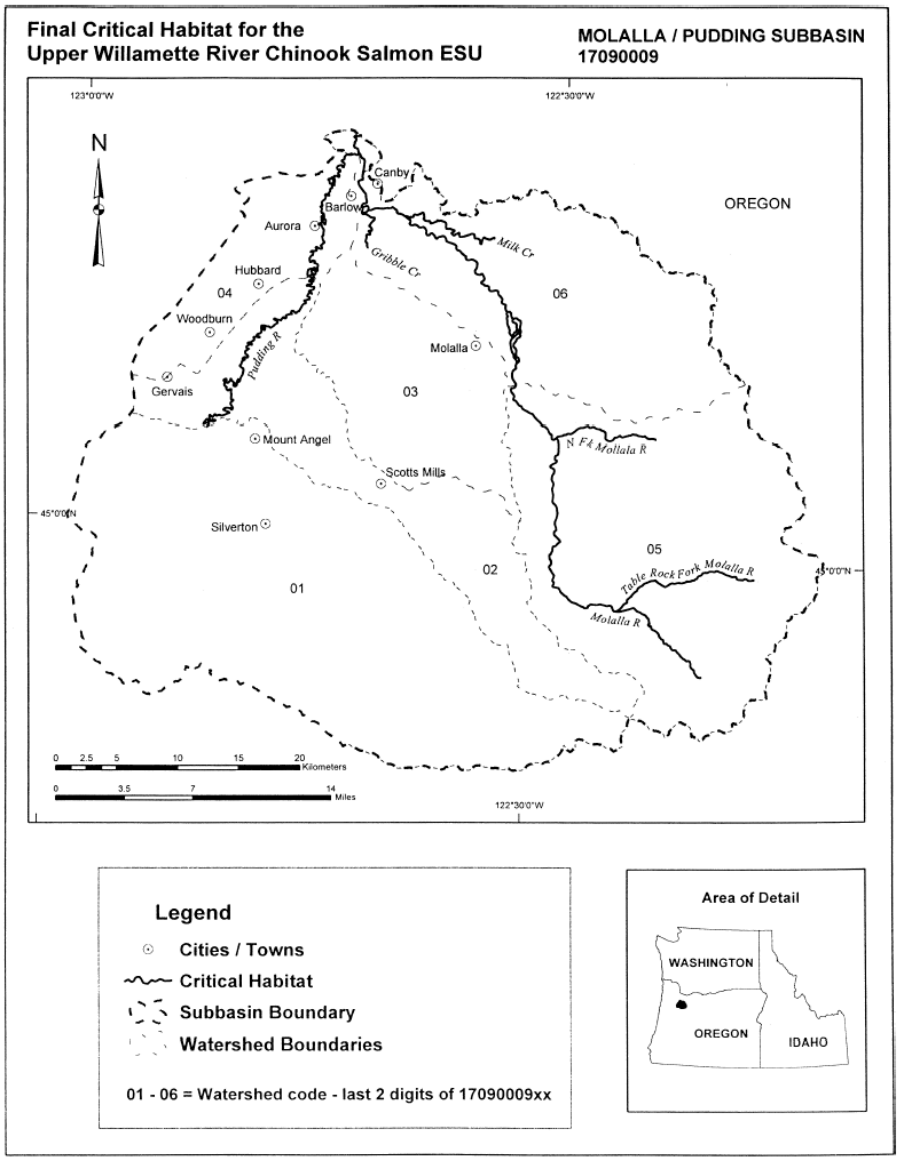

Figure 3-14 Critical habitat in the Molalla/Pudding subbasin.

The CHART rated six watersheds in the Molalla/Pudding subbasin, numbered in Figure 3-14. The Upper Molalla River watershed (1709000905) and Lower Molalla River watershed (1709000906) received a medium rating. The Abiqua Creek/Pudding River (1709000901), Butte Creek/Pudding River (1709000902), Rock Creek/Pudding River (1709000903), and Senecal Creek/Mill Creek watersheds (1709000904) received a low rating (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the entire Abiqua Creek/Pudding River (1709000901) and Rock Creek/Pudding River (1709000903) watersheds and the tributaries of the Butte Creek/Pudding River (1709000902) and Senecal Creek/Mill Creek (1709000904) watersheds because the economic benefits of exclusion outweighed the benefits of designation. NMFS included the mainstem Pudding River as well as the mainstem Molalla River and several of its tributaries (NMFS 2005d).

3.3.1.9 Clackamas Subbasin

Figure 3-15 shows the designation of critical habitat for UWR Chinook salmon in the Clackamas subbasin and its respective watersheds.

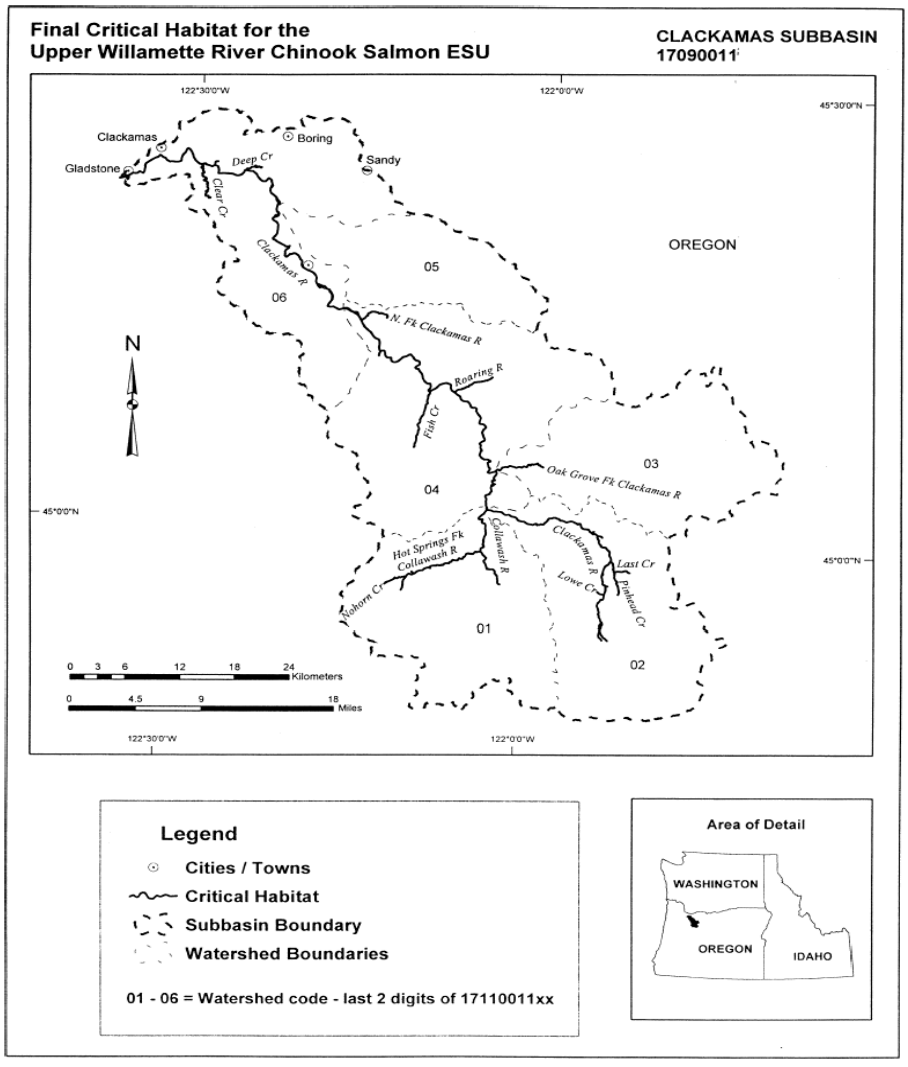

Figure 3-15 Critical habitat in the Clackamas subbasin.

The CHART rated six watersheds in the Clackamas subbasin, numbered in Figure 3-15. Of the six watersheds reviewed, five were rated as having high conservation value and one was rated as having low conservation value. Those that received a high rating include: Collawash River (1709001101), Upper Clackamas River (1709001102), Oak Grove Fork Clackamas River (1709001103), Middle Clackamas River (1709001104), and Lower Clackamas River watersheds (1709001106). The Eagle Creek watershed (1709001105) received a low rating (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the entire Eagle Creek watershed (1709001105) because the economic benefits of exclusion outweighed the benefits of designation. NMFS included the Clackamas River, Roaring River, and Collawash River in its critical habitat designations (NMFS 2005d).

3.3.1.10 Lower Willamette/Columbia River Corridor

Figure 3-16 shows the designation of critical habitat for UWR Chinook salmon in the lower Willamette/Columbia River corridor.

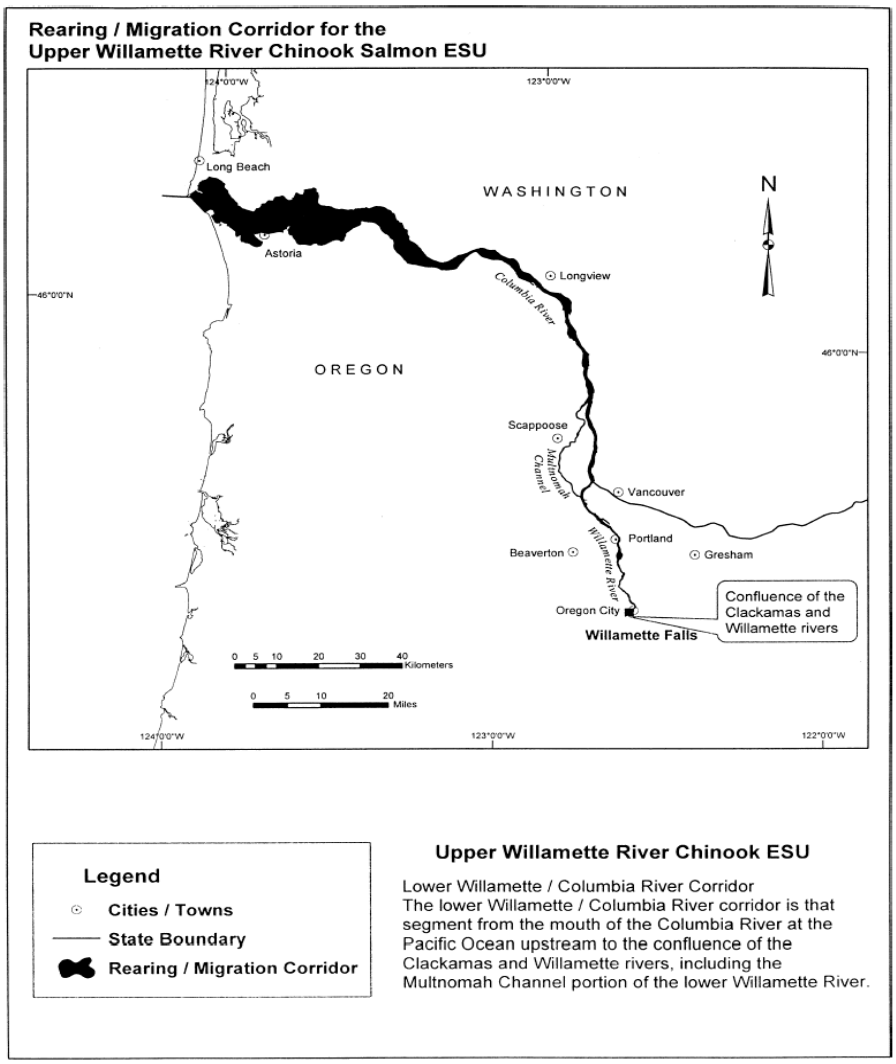

Figure 3-16 Critical habitat in the Lower Willamette/Columbia River corridor.

The CHART concluded that the Lower Willamette/Columbia River corridor was of high conservation value to the UWR Chinook ESU (NMFS 2005g).

In its final designation, NMFS included the entire corridor as critical habitat (NMFS 2005d).

3.3.2 Critical Habitat for Upper Willamette River (UWR) Steelhead

3.3.2.1 Upper Willamette Subbasin

Figure 3-17 shows the designation of critical habitat for UWR steelhead in the Upper Willamette subbasin and its respective watersheds.

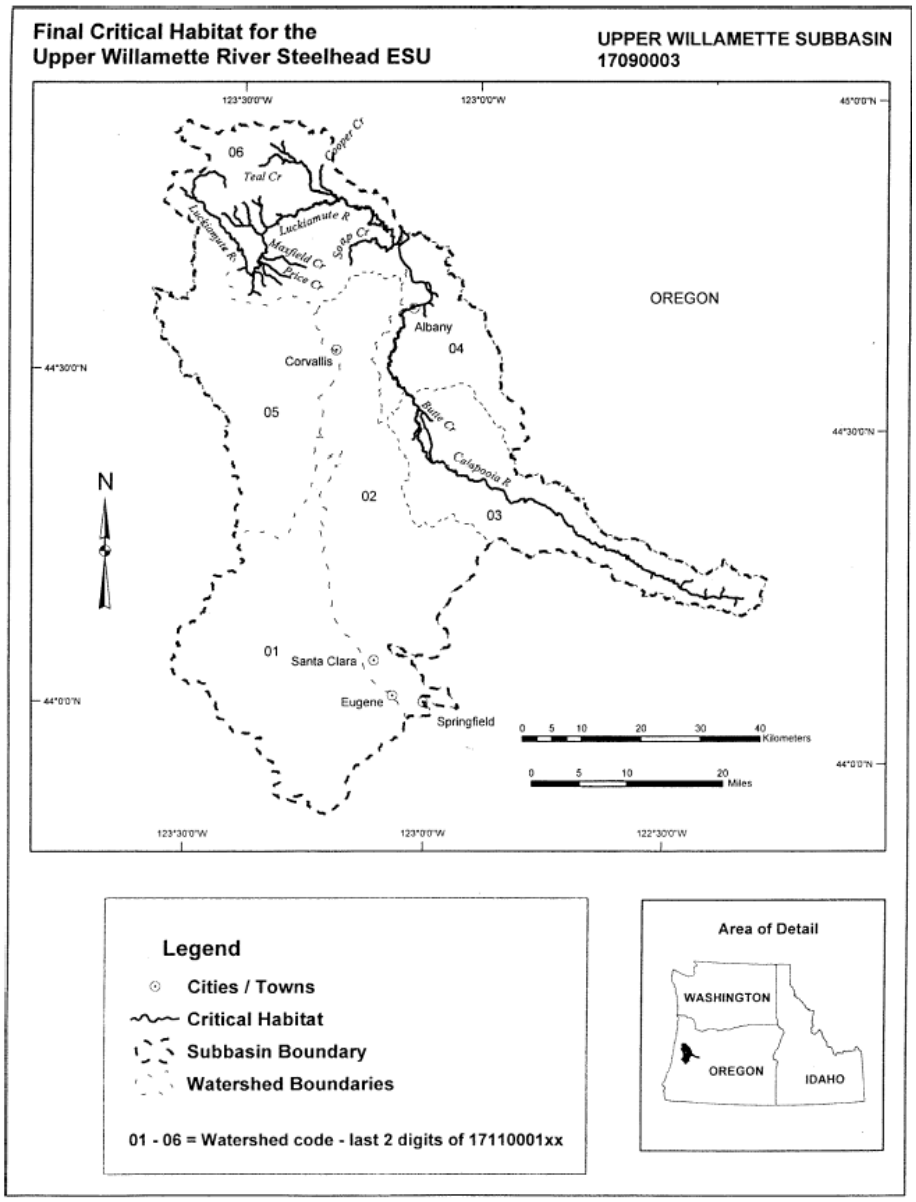

Figure 3-17 Critical habitat in the Upper Willamette subbasin.

The CHART rated three watersheds in the Upper Willamette subbasin, numbered in Figure 3-17, and concluded that one of the watersheds in this subbasin was of high and two were of medium conservation value to the ESU. The Calapooia River watershed (1709000303) received a high rating while the Oak Creek watershed (1709000304) and Luckiamute River watershed (1709000306) received medium ratings. The CHART also concluded that all reaches of the Willamette River within this subbasin constitute a high value rearing and migration corridor for the Calapooia River population of UWR steelhead (NMFS 2005g).

In its final designation of critical habitat, NMFS included the mainstem Calapooia River, the mainstem Luckiamute River, and portions of tributaries to those rivers (NMFS 2005d).

3.3.2.2 North Santiam Subbasin

Figure 3-18 shows the designation of critical habitat for UWR steelhead in the North Santiam subbasin and its respective watersheds.

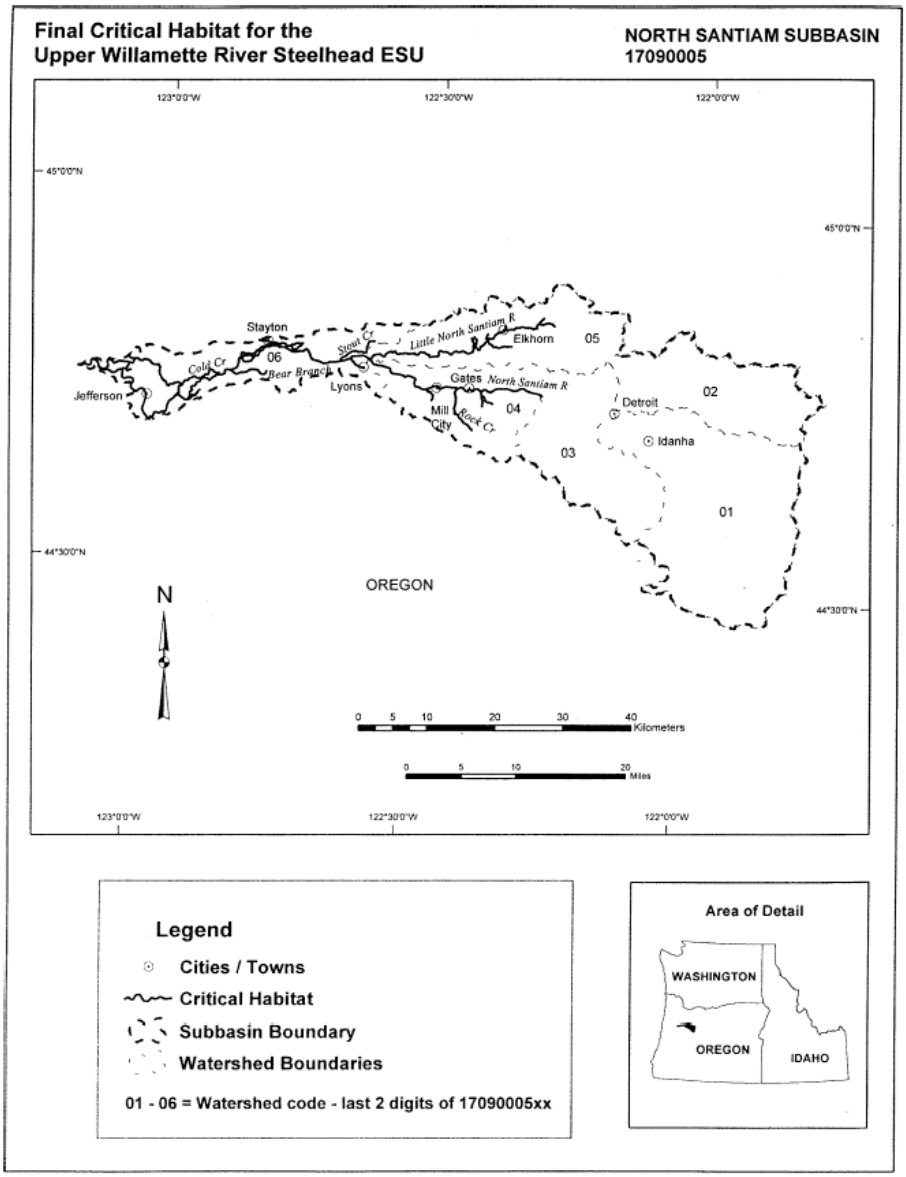

Figure 3-18 Critical habitat in the North Santiam subbasin.

The CHART rated three watersheds in the North Santiam subbasin, numbered in Figure 3-18, and concluded that all three were of high conservation value to the ESU. The Middle North Santiam River (1709000504), Little North Santiam River (1709000505), and Lower North Santiam River (1709000506) received a high rating (NMFS 2005g).

Critical habitat includes the mainstem North Santiam below Big Cliff and Detroit dams, and portions of the Little North Fork Santiam River watershed (NMFS 2005d).

3.3.2.3 South Santiam Subbasin

Figure 3-19 shows the designation of critical habitat for UWR steelhead in the South Santiam subbasin and its respective watersheds.

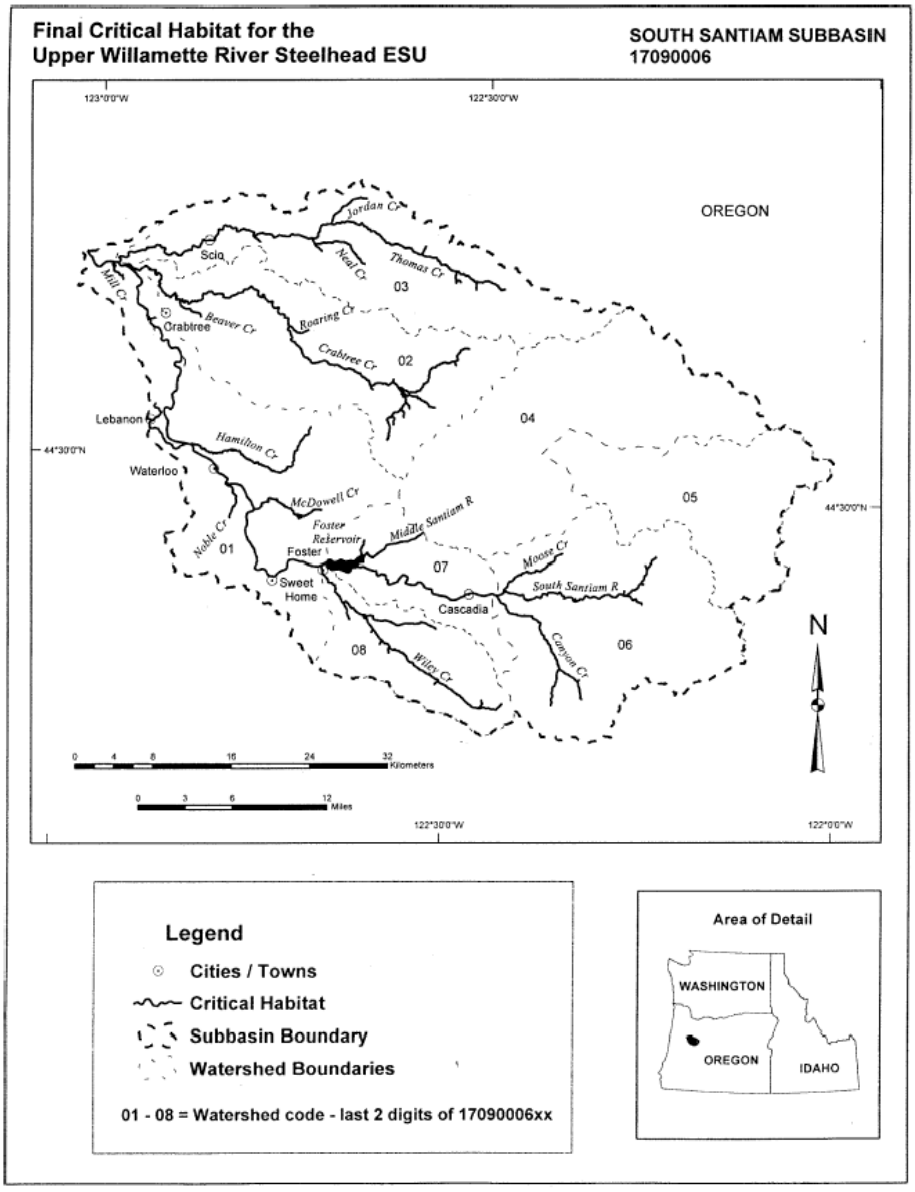

Figure 3-19 Critical habitat in the South Santiam subbasin.

The CHART rated six watersheds in the South Santiam subbasin, numbered in Figure 3-19, and concluded that all of them were of high conservation value to the ESU. The watersheds that received a high rating include: Hamilton Creek/South Santiam River watershed (1709000601), Crabtree Creek watershed (1709000602), Thomas Creek watershed (1709000603), South Santiam River watershed (1709000606), South Santiam River/Foster Reservoir watershed (1709000607), and Wiley Creek watershed (1709000608) (NMFS 2005g).

In its final designation of critical habitat, NMFS included the mainstem South Santiam both below and above Foster and Green Peter dams, including portions of the Middle Santiam River (NMFS 2005d).

3.3.2.4 Middle Fork Willamette Subbasin

Figure 3-20 shows the designation of critical habitat for UWR steelhead in the Middle Fork Willamette subbasin and its respective watersheds.

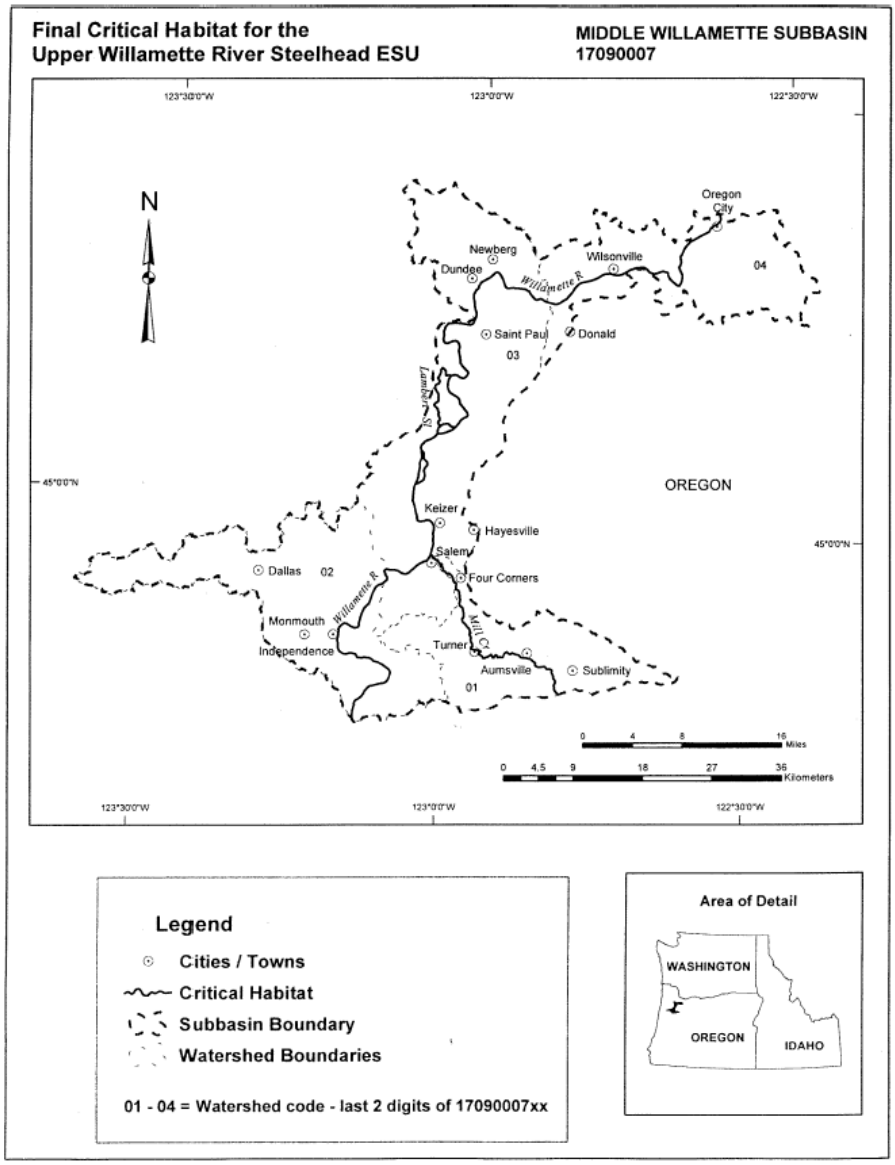

Figure 3-20 Critical habitat in the Middle Fork Willamette subbasin.

The CHART rated four watersheds in the Middle Willamette subbasin, numbered in Figure 3-20, and concluded that all four watersheds were of low conservation value to the ESU. However, that assessment pertained solely to the tributary streams in these watersheds, and not to the mainstem Willamette River or Mill Creek. The CHART concluded that all reaches of the Willamette River within this subbasin constitute a high value rearing and migration corridor. The four watersheds that received a low rating include: Mill Creek/Willamette River watershed (1709000701), Rickreall Creek watershed (1709000702), Willamette River/Chehalem Creek watershed (1709000703), and Abernethy Creek watershed (1709000704) (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the tributaries of all four watersheds because the economic benefits of exclusion outweighed the benefits of designation. However, NMFS designated the mainstem Willamette River and portions of Mill Creek as critical habitat (NMFS 2005d).

3.3.2.5 Yamhill Subbasin

Figure 3-21 shows the designation of critical habitat for UWR steelhead in the Yamhill subbasin and its respective watersheds.

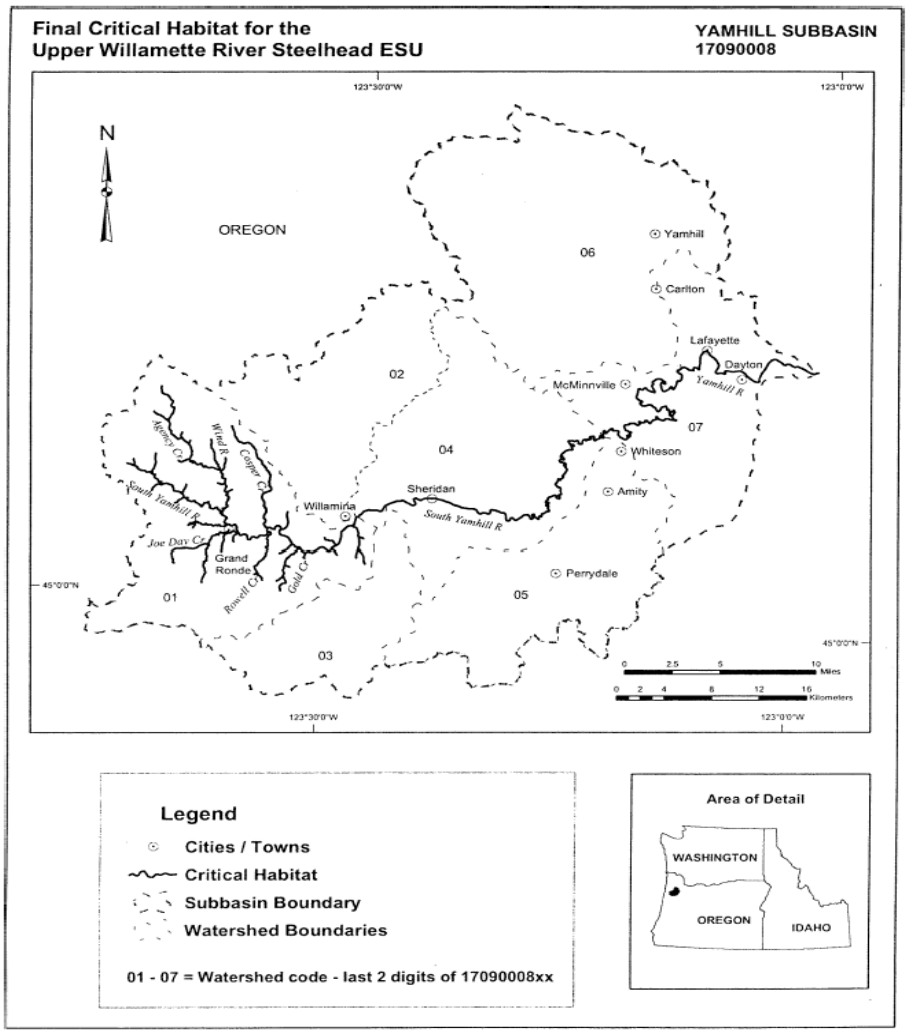

Figure 3-21 Critical habitat in the Yamhill subbasin.

The CHART rated seven watersheds in the Yamhill subbasin, numbered in Figure 3-21. Of the seven watersheds, one received a medium rating and six received a low rating. The Upper South Yamhill River watershed (1709000801) received a medium rating. The watersheds that received a low rating include: Willamina Creek watershed (1709000802), Mill Creek/South Yamhill River watershed (1709000803), Lower South Yamhill River watershed (1709000804), Salt Creek/South Yamhill River watershed (1709000805), North Yamhill River watershed (1709000806), and Yamhill River watershed (1709000807) (NMFS 2005g).

In its final designation of critical habitat, NMFS excluded the entire Willamina Creek, (1709000802), Mill Creek/South Yamhill River (1709000803), Salt Creek/South Yamhill River (1709000805), and North Yamhill River (1709000806) watersheds because the economic benefits of exclusion outweighed the benefits of designation. NMFS also excluded the tributaries from the Lower South Yamhill River (1709000804) and Yamhill River (1709000807) watersheds and Indian lands from the Upper South Yamhill River watershed (1709000801) because the economic benefits of exclusion outweighed the benefits of designation. NMFS designated the Yamhill River and South Yamhill River as critical habitat (NMFS 2005d).

3.3.2.6 Molalla/Pudding Subbasin

Figure 3-22 shows the designation of critical habitat for UWR steelhead in the Molalla/Pudding subbasin and its respective watersheds.

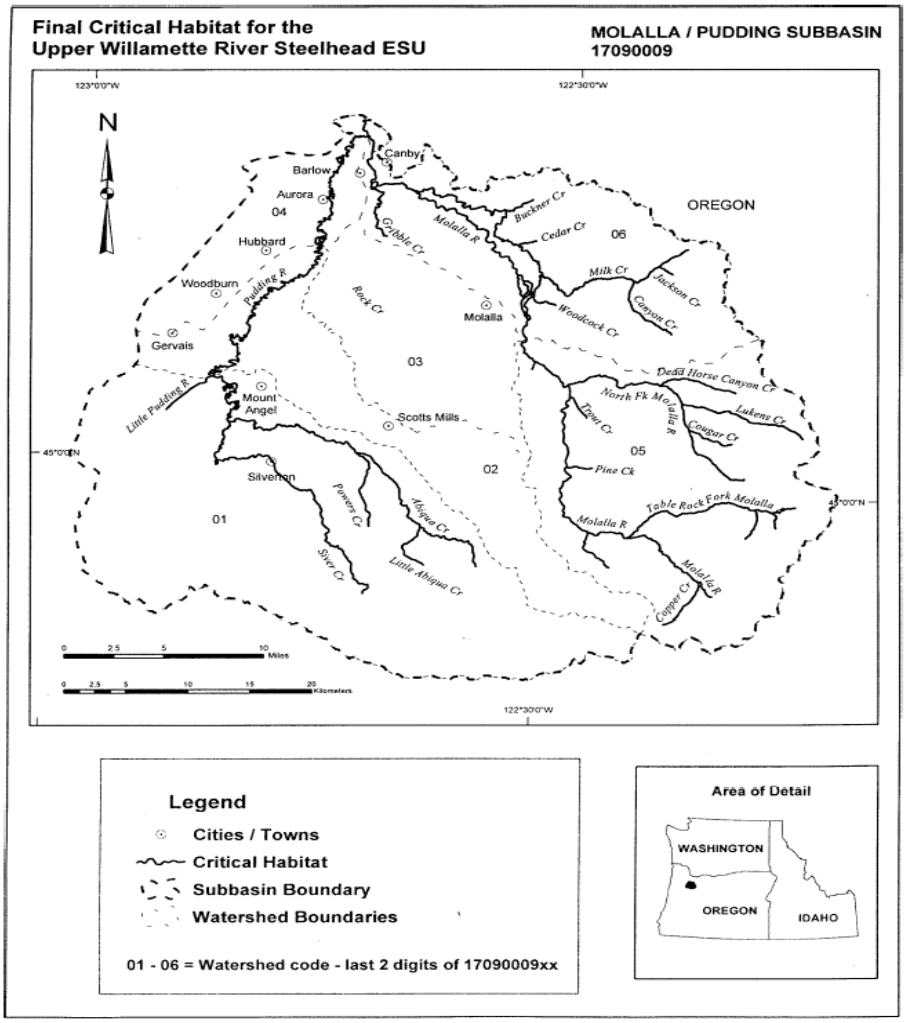

Figure 3-22 Critical habitat in the Molalla/Pudding subbasin.

The CHART rated six watersheds in the Molalla/Pudding subbasin, numbered in Figure 3-22. The Upper Molalla River watershed (1709000905) received a high rating. The Butte Creek/Pudding River (1709000902), Rock Creek/Pudding River (1709000903), and Lower Molalla River watersheds (1709000906) received a medium rating. The Abiqua Creek/Pudding River watershed (1709000901) and the Senecal Creek/Mill Creek watershed (1709000904) received a low rating (NMFS 2005g).

In its final critical habitat designation, NMFS excluded the entire Rock Creek/Pudding River (1709000903) watershed and the tributaries of the Butte Creek/Pudding River (1709000902) and Senecal Creek/Mill Creek (1709000904) watersheds because the economic benefits of exclusion outweighed the benefits of designation. NMFS included the Molalla River and the Pudding River as critical habitat (NMFS 2005d).

3.3.2.7 Tualatin Subbasin

Figure 3-23 shows the designation of critical habitat for UWR steelhead in the Tualatin subbasin and its respective watersheds.

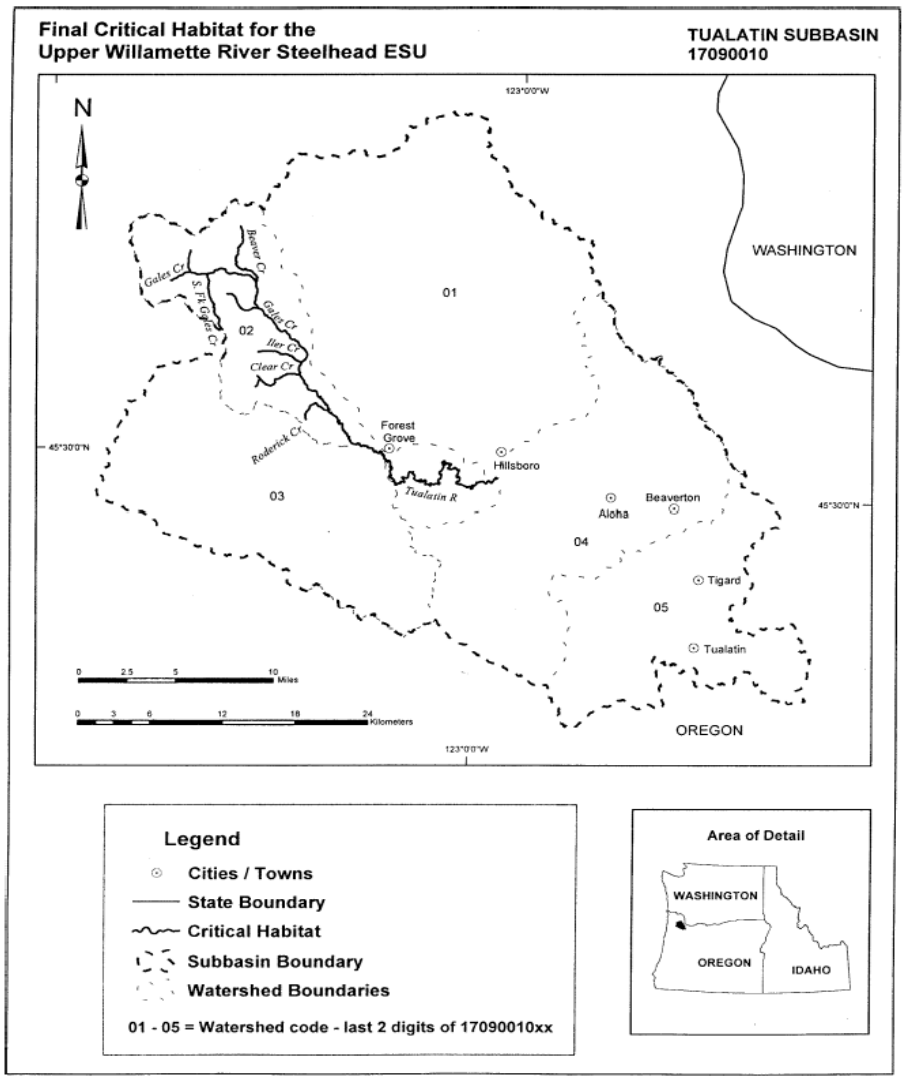

Figure 3-23 Critical habitat in the Tualatin subbasin.

The CHART rated five watersheds in the Tualatin subbasin, numbered in Figure 3-23, and concluded that the Gales Creek watershed may have the highest potential conservation benefit in the subbasin. The Gales Creek watershed (1709001002) received a medium rating while habitat areas in the remaining four watersheds received a low rating. Those watersheds that received a low rating include: Dairy Creek watershed (1709001001), Scoggins Creek watershed (1709001003), Rock Creek/Tualatin River watershed (1709001004), and Lower Tualatin River watershed (1709001005) (NMFS 2005g).

In its final critical habitat designation, NMFS excluded four entire watersheds because the economic benefits of exclusion outweighed the benefits or designation. Those excluded were as follows: Dairy Creek watershed (1709001001), Scoggins Creek watershed (1709001003), Rock Creek/Tualatin River watershed (1709001004), and Lower Tualatin River watershed (1709001005). NMFS included the mainstem Tualatin River in the Gales Creek watershed as well as Gales Creek and many of its tributaries (NMFS 2005d).

3.3.2.8 Lower Willamette/Columbia River Corridor

Figure 3-24 shows the designation of critical habitat for UWR steelhead in the lower Willamette/Columbia River corridor.

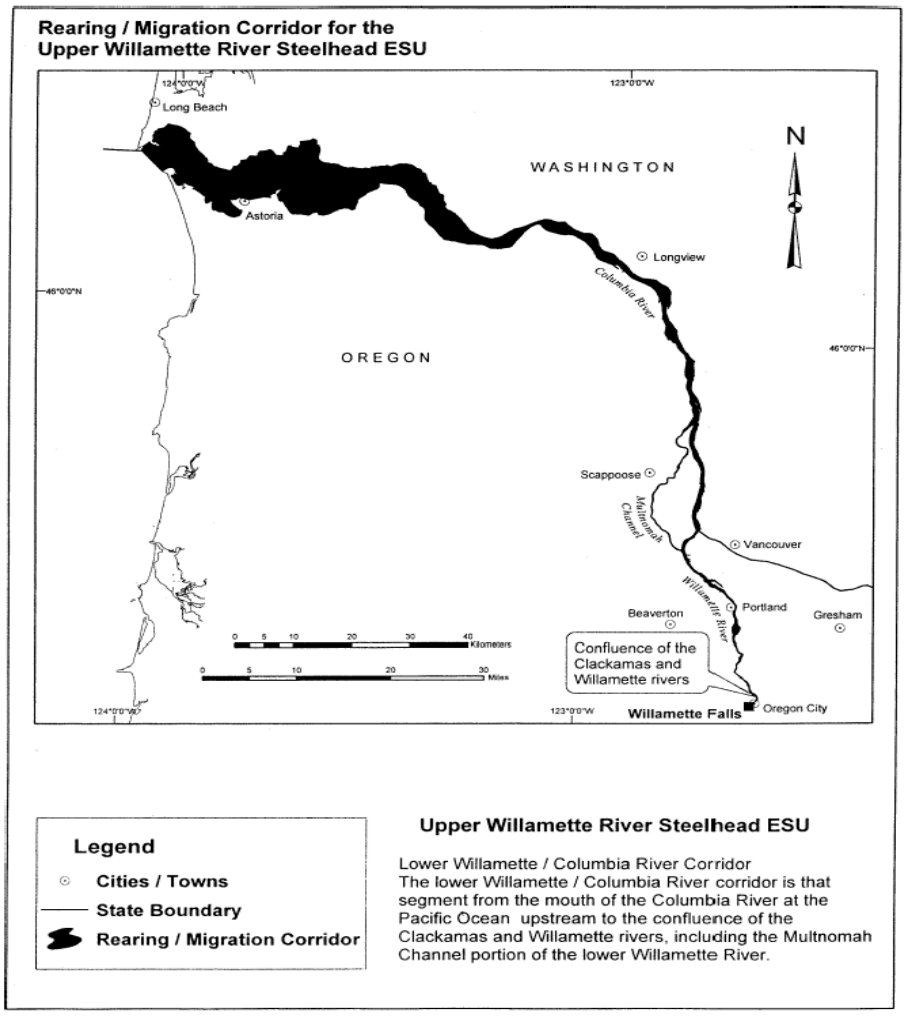

Figure 3-24 Critical habitat in the Lower Willamette/Columbia River corridor.

The CHART concluded that the Lower Willamette/Columbia River corridor was of high conservation value to the UWR steelhead DPS (NMFS 2005g).

In its final designation, NMFS included the entire corridor as critical habitat (NMFS 2005d).

3.3.3 Critical Habitat for Other ESU/DPSs

Summary information below describes the rangewide status of critical habitat for the other listed Columbia River basin ESUs/DPSs.

3.3.3.1 Critical Habitat for LCR Chinook

Designated critical habitat for LCR Chinook salmon includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Hood River as well as specific stream reaches in the following subbasins: Middle Columbia/Hood, Lower Columbia/Sandy, Lewis, Lower Columbia/Clatskanie, Upper Cowlitz, Cowlitz, Lower Columbia, Grays/Elochoman, Clackamas, and Lower Willamette (NMFS 2005d). There are 48 watersheds within the range of this ESU. Four watersheds received a low rating, 13 received a medium rating, and 31 received a high rating of conservation value to the ESU. The lower Columbia River rearing/migration corridor is considered to have a high conservation value and is the only habitat area designated in one of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 1,655 miles of habitat eligible for designation, 1,311 miles of stream are designated critical habitat.

3.3.3.2 Critical Habitat for LCR Steelhead

Designated critical habitat for LCR steelhead includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Hood River as well as specific stream reaches in the following subbasins: Middle Columbia/Hood, Lower Columbia/Sandy, Lewis, Lower Columbia/Clatskanie, Upper Cowlitz, Cowlitz, Clackamas, and Lower Willamette (NMFS 2005d). There are 32 watersheds within the range of this DPS. Two watersheds received a low rating, 11 received a medium rating, and 29 received a high rating of conservation value to the DPS. The lower Columbia River rearing/migration corridor is considered to have a high conservation value and is the only habitat area designated in one of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 2,673 miles of habitat eligible for designation, 2,324 miles of stream are designated critical habitat.

3.3.3.3 Critical Habitat for Columbia River Chum

Designated critical habitat for CR chum salmon includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the White Salmon River as well as specific stream reaches in the following subbasins: Middle Columbia/Hood, Lower Columbia/Sandy, Lewis, Lower Columbia/Clatskanie, Cowlitz, Lower Columbia, and Grays/Elochoman (NMFS 2005d). There are 20 watersheds within the range of this ESU. Three watersheds received a medium rating and 17 received a high rating of conservation value to the ESU. The lower Columbia River rearing/migration corridor is considered to have a high conservation value and is the only habitat area designated in one of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 725 miles of habitat areas eligible for designation, 708 stream miles are designated critical habitat.

3.3.3.4 Critical Habitat for Mid-Columbia River Steelhead

Designated critical habitat for MCR steelhead includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Yakima River as well as specific stream reaches in the following subbasins: Upper Yakima, Naches, Lower Yakima, Middle Columbia/Lake Wallula, Walla Walla, Umatilla, Middle Columbia/Hood, Klickitat, Upper John Day, North Fork John Day, Middle Fork John Day, Lower John Day, Lower Deschutes, Trout, and Upper Columbia/Priest Rapids (NMFS 2005d). There are 114 watersheds within the range of this DPS. Nine watersheds received a low rating, 24 received a medium rating, and 81 received a high rating of conservation value to the DPS. The lower Columbia River rearing/migration corridor downstream of the spawning range is considered to have a high conservation value and is the only habitat area designated in three of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 6,529 miles of habitat areas eligible for designation, 5,815 miles of stream are designated critical habitat.

3.3.3.5 Critical Habitat for Upper Columbia River Steelhead

Designated critical habitat for UCR steelhead includes all Columbia River estuarine areas and river reaches proceeding upstream to Chief Joseph Dam as well as specific stream reaches in the following subbasins: Chief Joseph, Okanogan, Similkameen, Methow, Upper Columbia/Entiat, Wenatchee, Lower Crab, and Upper Columbia/Priest Rapids (NMFS 2005d). There are 42 watersheds within the range of this DPS. Three watersheds received a low rating, 8 received a medium rating, and 31 received a high rating of conservation value to the DPS. The Columbia River rearing/migration corridor downstream of the spawning range is considered to have a high conservation value and is the only habitat area designated in 11 of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and

essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 1,332 miles of habitat areas eligible for designation, 1,262 miles of stream are designated critical habitat.

3.3.3.6 Critical Habitat for Upper Columbia River Spring Chinook

Designated critical habitat for UCR spring Chinook includes all Columbia River estuarine areas and river reaches proceeding upstream to Chief Joseph Dam as well as specific stream reaches in the following subbasins: Chief Joseph, Methow, Upper Columbia/Entiat, and Wenatchee (NMFS 2005d). There are 31 watersheds within the range of this ESU. Five watersheds received a medium rating and 26 received a high rating of conservation value to the ESU. The Columbia River rearing/migration corridor downstream of the spawning range is considered to have a high conservation value and is the only habitat area designated in 15 of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 1,002 miles of habitat areas eligible for designation, 974 miles of stream are designated critical habitat.

3.3.3.7 Critical Habitat for Snake River Fall Chinook

Designated critical habitat for SR fall Chinook salmon includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake rivers; all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; and the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam. Critical habitat also includes river reaches presently or historically accessible (except those above impassable natural falls and Dworshak and Hells Canyon dams) in the following subbasins: Clearwater, Hells Canyon, Imnaha, Lower Grande Ronde, Lower North Fork Clearwater, Lower Salmon, Lower Snake, Lower Snake-Asotin, Lower Snake-Tucannon, and Palouse. The lower Columbia River corridor is among the areas of high conservation value to the ESU because it connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Designated areas consist of the water, waterway bottom, and the adjacent riparian zone (defined as an area 300 feet from the normal high water line on each side of the river channel) (NMFS 1993). Designation did not involve rating the conservation value of specific watersheds as was done in subsequent designations (NMFS 2005d).

3.3.3.8 Critical Habitat for Snake River Spring/Summer Chinook

Designated critical habitat for SR fall Chinook salmon includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake rivers, and all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam. Critical habitat also includes river reaches presently or historically accessible

(except those above impassable natural falls, including Napias Creek Falls, and Dworshak and Hells Canyon dams) in the following subbasins: Hells Canyon, Imnaha, Lemhi, Little Salmon, Lower Grande Ronde, Lower Middle Fork Salmon, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, Middle Salmon-Chamberlain, Middle Salmon-Panther, Pahsimeroi, South Fork Salmon, Upper Middle Fork Salmon, Upper Grande Ronde, Upper Salmon, and Wallowa. The lower Columbia River corridor is among the areas of high conservation value to the ESU because it connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Designated areas consist of the water, waterway bottom, and the adjacent riparian zone (defined as an area 300 feet from the normal high water line on each side of the river channel) (NMFS 1999c). Designation did not involve rating the conservation value of specific watersheds as was done in subsequent designations (NMFS 2005d).

3.3.3.9 Critical Habitat for Snake River Sockeye

Designated critical habitat for SR sockeye salmon includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake rivers; all Snake River reaches from the confluence of the Columbia River upstream to the confluence of the Salmon River; all Salmon River reaches from the confluence of the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellow Belly, Pettit, and Alturas lakes (including their inlet and outlet creeks); Alturas Lake Creek; and that portion of Valley Creek between Stanley Lake Creek and the Salmon River (NMFS 1993). The lower Columbia River corridor is among the areas of high conservation value to the ESU because it connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Designated areas consist of the water, waterway bottom, and the adjacent riparian zone (defined as an area 300 feet from the normal high water line on each side of the river channel) (NMFS 1993). Designation did not involve rating the conservation value of specific watersheds as was done in subsequent designations (NMFS 2005d).

3.3.3.10 Critical Habitat for Snake River Steelhead

Designated critical habitat for SR steelhead includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake rivers as well as specific stream reaches in the following subbasins: Hells Canyon, Imnaha River, Lower Snake/Asotin, Upper Grande Ronde River, Wallowa River, Lower Grande Ronde, Lower Snake/Tucannon, Lower Snake River, Upper Salmon, Pahsimeroi, Middle Salmon-Panther, Lemhi, Upper Middle Fork Salmon, Lower Middle Fork Salmon, Middle Salmon-Chamberlain, South Fork Salmon, Lower Salmon, Little Salmon, Upper Selway, Lower Selway, Lochsa, Middle Fork Clearwater, South Fork Clearwater, and Clearwater (NMFS 2005d). There are 289 watersheds within the range of this DPS. Fourteen watersheds received a low rating, 44 received a medium rating, and 231 received a high rating of conservation value to the DPS. The lower Snake/Columbia River rearing/migration corridor downstream of the spawning range is considered to have a high conservation value and is the only habitat area designated in 15 of the

high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 8,225 miles of habitat areas eligible for designation, 8,049 miles of stream are designated critical habitat.

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