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

Refer to NMFS No:
2003/01270

February 17, 2005

Bill McDonald, Director
Pacific Northwest Region
1150 N Curtis Rd, Ste 100
Boise, Idaho 83706-1234

Re: Endangered Species Act Interagency Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Ongoing Operation and Maintenance of the Deschutes River Basin Projects, Deschutes River, Crooked River, and Clear Creek, HUCs - 17070306 (Lower Deschutes), 17070301 (Upper Deschutes), and 17070305 (Lower Crooked), Crook, Deschutes, Jefferson, and Wasco Counties, Oregon

Dear Mr. McDonald:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to Section7(a)(2) of the Endangered Species Act (ESA) on the effects of contracting water and carrying out the proposed ongoing operation and maintenance of the Deschutes River Basin Projects in Crook, Deschutes, Jefferson, and Wasco Counties, Oregon. In this Opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*). As required by Section 7 of the ESA, NMFS included an incidental take statement with terms and conditions necessary to minimize the impact of taking that is reasonably likely to be caused by this action. Take from actions by the action agency that meet these terms and conditions will be exempt from the ESA take prohibition. Critical habitat for MCR steelhead was proposed on December 14, 2004 (69 FR 74572). Consultation was substantively completed at this point, so NMFS did not analyze effects to proposed critical habitat. If a final rule is published in the future designating critical habitat for MCR steelhead, the Bureau of Reclamation (BOR) should evaluate whether reinitiation of consultation is necessary.

This document also includes the results of our consultation on the action's likely effects on essential fish habitats (EFH) for Chinook (*O. tshawytscha*) and coho (*O. kisutch*) salmon pursuant to Section305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects to EFH. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations. If the response is inconsistent with the recommendations, the BOR must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations.

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

Please direct any questions regarding these consultations to Scott Hoefer of my staff in the Oregon State Habitat Office at 503.231.6938.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Ronald J. Eggers, BOR

Endangered Species Act - Section 7 Consultation
Biological Opinion

&

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

Ongoing Operation and Maintenance of the Deschutes River Basin Projects
Deschutes River, Crooked River, and Clear Creek,
Crook, Deschutes, Jefferson, and Wasco Counties, Oregon
17070306 (Lower Deschutes), 17070301 (Upper Deschutes), and 17070305 (Lower Crooked)

Agency: U.S. Bureau of Reclamation, Pacific Northwest Region

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Date Issued: February 17, 2005

Issued by: for Michael R Crouse
D. Robert Lohn
Regional Administrator

Refer to: **2003/01270**

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INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531-1544), as amended, establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (together "Services"), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. This biological opinion (Opinion) is the product of an interagency consultation pursuant to Section7(a)(2) of the ESA and implementing regulations 50 C.F.R. 402.

The analysis also fulfills the essential fish habitat (EFH) requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (Section 305(b)(2)).

The U.S. Bureau of Reclamation (BOR) proposes to continue operating and maintaining the Deschutes River Basin projects. The primary purpose of the operation and maintenance of the projects is to provide irrigation water to water right holders. Secondarily, the projects provide flood control, fish and wildlife benefits, and recreation opportunities. The BOR is proposing the action according to its authority under various Federal statutes enacted by Congress. The administrative record for this consultation is on file at the Oregon State Habitat Office.

Background and Consultation History

The BOR requested a list of ESA threatened and endangered species from NMFS in February 2000, and requested an updated list in February 2001. NMFS received a draft biological assessment (BA) for review and comment on July 9, 2001, and provided written comments on the draft BA on August 22, 2001. The Services met with the BOR to discuss comments on the draft BA on October 23, 2001. The BOR reevaluated and revised the proposed action, which resulted in a process to develop a new BA. That process consisted of BOR specialists working closely with the Services during the development of each section of the BA. On July 23, 2002, the Services met with the BOR to discuss the proposed action, and on September 10, 2002, to discuss the environmental baseline sections. A meeting on November 19, 2002, and a conference call on January 8, 2003, were held between the Services and the BOR to discuss the modeled hydrologic effects analysis, and the draft proposed action chapter, and the consultation status was discussed on a conference call on February 6, 2003.

NMFS received a complete BA and EFH assessment on the ongoing operation and maintenance of the Deschutes River Basin projects, a document describing the operations of the projects, streamflow modeling results from the BOR, and a written request for concurrence with a finding that the project is 'not likely to adversely affect' (NLAA) Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*) on October 1, 2003. Based on information provided in the BA and developed during informal consultation, NMFS did not concur with the BOR's finding that the proposed project was NLAA MCR steelhead because reduced flow levels in the lower Deschutes River during eight months of the year (October-May) resulting from the operation and maintenance of the projects cause a reduction of juvenile steelhead edge rearing habitat. Accordingly, NMFS sent a nonconcurrence letter on October 29, 2003. NMFS stated in the letter that we intended to complete this consultation and believed we had the necessary information to do so, so we assumed that consultation was initiated with the receipt of the BA and accompanying information on October 1, 2003. On December 1, 2003, NMFS received a letter from the BOR stating that they needed some additional time to acquire and evaluate additional information from the Pelton/Round Butte Federal Energy Regulatory Commission (FERC) relicensing process before initiating formal consultation. On January 20, 2004, NMFS recieved a letter with supplemental information from the BOR reaffirming their NLAA conclusion.

A draft Opinion was sent to the BOR on April 29, 2004. On September 2, 2004, NMFS and the BOR met to discuss the draft Opinion. NMFS addressed most of the BOR's concerns in the Opinion and sent an unsigned Opinion to them on December 16, 2004. On January 13, 2005, NMFS staff met with the BOR to discuss remaining concerns with the unsigned Opinion, particularly the Terms and Conditions. The meeting resulted in a number of e-mail exchanges between NMFS and the BOR to ensure this final Opinion was accurate and acceptable to both agencies.

The operation and maintenance of the projects would likely affect Tribal trust resources. Because the action is likely to affect Tribal trust resources, NMFS contacted the Confederated Tribes of the Warm Springs Reservation (CTWSR) pursuant to the Secretarial Order (June 5, 1997). On January 29, 2004, NMFS contacted Robert Bruno, the General Manager of the Natural Resources Department of CTWSR by telephone to get input regarding the BOR's operation and maintenance of the Deschutes River Basin Projects. He said that the BOR has worked well with them over the years and has included them in decision making processes, and that the CTWSR is comfortable with how BOR is operating the Deschutes River Basin Projects.

Proposed Action

Proposed actions are defined in the Services' consultation regulations (50 C.F.R. 402.02) as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." Additionally, U.S. Code (16 U.S.C. 1855(b)(2)) further defines a Federal action as "any action authorized, funded, or undertaken or proposed to be authorized, funded, or undertaken by a Federal agency." Because the BOR proposes to operate and maintain the Deschutes River Basin projects that may affect listed resources, it must consult under ESA Section 7(a)(2) and MSA Section 305(b)(2). The description that follows was taken from the BA provided by the BOR.

Federal Facilities Included in the Proposed Action

A list of storage and diversion facilities associated with the three projects is provided in Table 1. Not all of the facilities listed in Table 1 are included in the proposed action. The BOR holds title to only some of the diversion facilities within the Federal BOR projects; water rights related to most of the Federal facilities are primarily held by the respective irrigation districts. The Oregon State Watermaster oversees the delivery of water from these facilities according to existing water rights and consistent with state water law. Further, actual day-to-day operations are conducted by the primary irrigation districts associated with these Federal projects. This consultation involves operation and maintenance (O&M) activities associated with those facilities for which BOR has authority to operate, largely defined by BOR ownership. Storage, diversion, and delivery facilities comprising the proposed action include:

Deschutes Project
- Crane Prairie Dam and Reservoir
- Wickiup Dam and Reservoir
- Haystack Dam and Reservoir
- North Unit Headworks and Main Canal
- Distribution system for NUID project lands

Crooked River Project
- Bowman Dam and Prineville Reservoir
- Crooked River Diversion Dam and Feed Canal
- Crooked River Distribution Canal
- Barnes Butte and Ochoco Relift Pumping Plants
- Nine small pumping plants and associated canals

Wapinitia Project
- Wasco Dam and Clear Lake

Other facilities associated with the Federal BOR projects are owned, operated, and maintained by the irrigation districts or other parties. The BOR has no authority in directing operations associated with these private facilities. Limited actions associated with these facilities are interrelated and interdependent to the proposed action in this consultation and include:

Deschutes Project
- Diversion of Crane Prairie Reservoir storage water by Arnold, Central Oregon, and Lone Pine Irrigation Districts
- Diversion of natural flow water into the North Unit Main Canal by NUID

Crooked River Project
- Diversion of water from the Crooked River by NUID’s Crooked River Pumping Plant
- Storage, flood control operations, release, and diversion of Ochoco Reservoir storage water by OID

- Diversion of natural flow from the Crooked River by the Crooked River Diversion Dam
- Conveyance of Prineville Reservoir storage water into diversion facilities owned by OID
- Diversions of Prineville Reservoir storage water by privately-owned canals, including Rice Baldwin, Central Ditch, Lowline Ditch, and People's Ditch

Wapinitia Project

- Diversion of Clear Lake storage water by JFDIC's Clear Creek Diversion.

Table 1. Major facilities associated with Federal projects in the Deschutes River Basin

Facility	Owner-ship	Stream	Year Constructed or Rehabilitated	Entity Responsible for O&M	Comments
Deschutes River Project					
Crane Prairie Dam & Reservoir	United States	Deschutes River	1940	COID-Transferred*	55,300 acre-feet active storage
Wickiup Dam & Reservoir	United States	Deschutes River	1949	NUID-Transferred	200,000 acre-feet active storage
Haystack Dam & Equalizing Reservoir	United States	Off-stream	1957	NUID-Transferred	5,600 acre-feet active storage
Arnold Diversion Dam & Canal	Arnold ID	Deschutes River	1951	Arnold ID	Diverts Deschutes River water comprised of storage from Crane Prairie Reservoir and privately-held natural flow water rights.
Central Oregon Diversion Dam & Canal	COID	Deschutes River	1900	COID	Diverts Deschutes River water comprised of storage from Crane Prairie Reservoir and privately-held natural flow water rights.
North Canal Dam	Private	Deschutes River	1912-1914		Private-Owner not established
North Unit Headworks & Main Canal	United States	Deschutes River	1949	NUID-Transferred	Diverts Deschutes River water comprised of storage from Wickiup Reservoir and privately-held natural flow water rights.

Facility	Owner-ship	Stream	Year Constructed or Rehabilitated	Entity Responsible for O&M	Comments
North Canal Diversion Dam & Pilot Butte Canal	COID	Deschutes River	1900	COID	Diverts Deschutes River water comprised of storage from Crane Prairie Reservoir & privately-held natural flow water rights.
Crooked River Pumping Plant	NUID	Crooked River	1968	NUID	Diverts Crooked River water using water right held by NUID & delivers to Deschutes Project lands & to non-Project Crooked River lands.
Crooked River Project					
Arthur R. Bowman Dam & Prineville Reservoir	United States	Crooked River	1961	OID-Reserved+	148,640 acre-feet active storage (150,216 acre-feet storage capacity)
Ochoco Dam & Reservoir	OID	Ochoco Creek	1918-1920, 1950, 1995	OID	39,000 acre-feet active storage, 5,266 acre-feet storage accessed by pump
Crooked River Diversion Dam & Feed Canal	United States	Crooked River	1961, 2000	OID-Transferred	Diverts Crooked River water comprised of Prineville Reservoir storage water and privately-held natural flow water rights.
Barnes Butte & Ochoco Relift Pumping Plants	United States	Off-stream	1961	OID-Transferred	Pumps water from Croked River Feed Canal to Crooked River Distribution Canal & Ochoco Main Canal.
Crooked River Distribution Canal	United States	Off-stream	1961	OID-Transferred	Distributes Crooked River water to OID project lands.
Central Ditch, People's Ditch, Rice Baldwin Ditch, Lowline Ditch	All Private	Crooked River		All Private	Diverts Crooked River water comprised of Prineville Reservoir storage water & privately-held natural flow water rights.
Ochoco Main Canal	OID	Ochoco Creek	1917	OID	Diverts water from Ochoco Dam.

Facility	Owner-ship	Stream	Year Constructed or Rehabilitated	Entity Responsible for O&M	Comments
9 small pumping plants & distribution canals	United States	Off-stream	Various	OID-Transferred	Pumps water from Crooked River Distribution Canal or Ochoco Main Canal into distribution canals.
Rye Grass Canal	OID	Ochoco Creek	1897	OID	Diverts from Ochoco Creek & captures return flows in the system.
Wapinitia Project					
Wasco Dam & Clear Lake	United States	Clear Creek (White River trib.)	1959	JFDIC-Transferred	11,900 acre-feet active storage.
Clear Creek Diversion Dam	JFDIC	Frog Creek & Clear Creek	Unknown	JFDIC	
* "Transferred Works" are facilities in which daily responsibility for O&M activities are transferred to and financed by the irrigation district. + "Reserved Works" are facilities in which the O&M is the responsibility of the United States. Daily O&M responsibility may be contracted to another entity, but the United States maintains the financial responsibility.					

The BOR facilities may be transferred or reserved works. Transferred works mean that daily operation and maintenance activities have been transferred to and are financed by the contracting entity (usually an irrigation district), but the ownership remains with the U.S. Government. Reserved works, typically dams and reservoirs which serve more than one function, are operated and maintained by BOR, either directly or by contract with one or more irrigation districts. The BOR maintains financial responsibility and collects O&M costs from contracting entities who receive water from that project. All of the Federal facilities included in the proposed action are transferred works, with the exception of Bowman Dam in the Crooked River Project which is a reserved work operated by OID under contract.

The BOR conducts regular inspections of dams that it has jurisdiction over to ensure that structural integrity, safety, and maintenance requirements are met by the designated operating entities. The BOR provides runoff forecasts to dam operators and at times requires specific operations to protect the facility.

The BOR's water management is dictated by its authorities, annual water supply, water rights, contracts, and irrigation demand. An explanation of how BOR operates the water storage and delivery system is lengthy. The BOR's BA provides a summary of these operations and refers to accompanying documents that provide more detailed information.

Operating strategies for BOR projects are based on legal and statutory requirements, including Congressional authorizing legislation, state water law, and contractual obligations. All BOR projects in the Deschutes River Basin are authorized for the purpose of irrigation, primarily to develop more reliable water supplies. Legislation subsequent to the 1902, and 1939, BOR Acts also authorizes some storage facilities to be used for flood control, limited recreation, and fish and wildlife purposes. In addition, all dams must be operated in a manner that protects them from potential failure. These five purposes—irrigation water supply, flood control, recreation, fish and wildlife, and preservation of the dam—drive the strategies for operating the reservoirs. General operating strategies for achieving these purposes are summarized below.

General Operations

Reservoirs that are operated for irrigation and flood control have three major operating seasons: winter, spring, and summer.

Winter Operations (approximately November - early March)

There are no releases for irrigation; low winter releases are made. A specific amount of space may be required to control potential winter rain-on-snow or other flooding events. Water is released, if necessary, to achieve or maintain the required space. Space may also be required during this period in anticipation of spring runoff from melting snow. Typically, irrigation demand has drawn the reservoirs well below winter/spring flood control levels and they refill during the winter until reaching flood control levels.

Spring Flood Control and/or Refill (approximately March - June)

Reservoirs without flood control obligations store available inflow. Reservoirs with flood control operations are maintained to help control runoff, with releases dependent on the forecast runoff volume and timing. These reservoirs are filled for irrigation water supply as the runoff diminishes and generally reach their highest surface level in May. In the Deschutes River Basin, Prineville Reservoir is the only Federally-owned reservoir officially operated for formal flood control in this manner.

Summer Drawdown Season (approximately June - October)

This season begins when natural flow is insufficient to meet irrigation demand; *i.e.*, inflow is less than the demand. Release of storage (drafting of the reservoir) is required to meet the demands. In dry years, drawdown may begin before June.

Flood Control

Many BOR storage facilities are operated for flood protection by drafting the reservoir during non-flooding periods to provide space to store high flows that result from rainfall and snowmelt. Flood control operations may be formal or informal. Formal flood control means that operating criteria were developed under Section 7 of the Flood Control Act of 1944. In practice, the Corps and BOR jointly develop the criteria in a manner that balances flood control potential with irrigation water supply potential. Bowman Dam and Ochoco Dam are the only dams in the Deschutes River Basin operated under formal flood control rules and signed agreements. Informal flood control follows operating rules developed by BOR and does not involve coordination with the Corps.

Incidental Operations

Operations do consider recreation and fish and wildlife needs, although they are secondary or incidental to operation for irrigation and flood control.

Special Operational Requests

There are instances when BOR can accommodate a special request for a change in routine operations while still meeting primary requirements. Sometimes these operational changes are made in response to emergency circumstances. For example, reservoir releases may be reduced temporarily to improve the likelihood of finding a drowned victim, water releases may be changed in response to unexpected equipment malfunction or breakdown, or river flows may be reduced temporarily for construction of bridges, placement of stream gages, and installation of shoreline revetments. In these instances, BOR would look for an opportunity to release needed storage from another reservoir.

Within applicable constraints, BOR has altered operational approaches to improve conditions for fish and wildlife or the environment. These changes are implemented consistent with BOR's authorities, state water law, and only if contractual obligations and public safety are not impacted. Specific operation of BOR facilities comprising the proposed action are summarized in the remainder of this chapter.

Deschutes Project Operations

The Deschutes Project lands stretch north and northeast from the city of Bend to Madras, Oregon. Approximately 85,000 acres are irrigated to produce grain, hay, mint, potatoes, seeds, and irrigated pasture. Additional lands are irrigated in the area using privately developed water supplies. Principal Federally-owned features included in the proposed action are Crane Prairie Dam and Reservoir, Wickiup Dam and Reservoir, Haystack Dam and Reservoir, and North Unit Headworks and Main Canal. Total active capacity of the Federal reservoirs is 255,300 acre-feet. In addition, Haystack Reservoir functions as a re-regulating reservoir and temporarily restores water transported in the irrigation system.

Four irrigation districts have contracts for this storage water, including: NUID, COID, Lone Pine Irrigation District (also known as Crook County Improvement District No. 1), and Arnold Irrigation District. Arnold, Lone Pine, and Central Oregon Irrigation Districts use storage in Crane Prairie Reservoir to supplement water supplies obtained from other privately developed sources. COID irrigates about 45,000 acres, Lone Pine ID irrigates about 2,400 acres, and Arnold ID irrigates about 4,400 acres. All diversion and distribution facilities for these three irrigation districts are privately owned and operated. The water right to divert the stored water is privately held. The proposed action includes storing water in and releasing water from Crane Prairie Reservoir for diversion at several privately-owned diversions. Diversion of stored water at these diversions is an interrelated and interdependent action.

NUID uses storage in Wickiup and Haystack Reservoirs to provide a full supply of water to irrigate its lands. Project water is used to irrigate about 50,000 acres. NUID irrigates an additional 8,800 acres using non-project water obtained from water pumped from the Crooked River. The pumping of Crooked River water is interrelated and interdependent to the proposed action.

To summarize, the following project operations are included in the proposed action: (1) Storage in and release of water from Crane Prairie Dam and Reservoir for diversion (an interrelated and interdependent action is diversion of storage water by private facilities); (2) storage in and release of water from Wickiup Dam and Reservoir for diversion; (3) diversion of Wickiup Reservoir storage water by North Unit Headworks and Main Canal (an interrelated and interdependent action is the diversion of natural flow water); and (4) storage in and release of water from Haystack Dam and Reservoir for diversion.

Storage and Delivery of Water. Crane Prairie and Wickiup Reservoirs store water for use in the Deschutes Project and are operated together as a combined system. The operation of these two reservoirs is generally governed by the January 4, 1938, inter-district contract and the water rights associated with storage of the Deschutes River water.

The inter-district contract stipulates the priority for storing water between the two reservoirs. Following the irrigation season, water can be stored in Crane Prairie Reservoir at any time or at any rate provided that storage is below 30,000 acre-feet. After storage has reached 30,000 acre-feet, inflow is bypassed to Wickiup Reservoir until storage in Wickiup Reservoir reaches 180,000 acre-feet, at which time storage is resumed at Crane Prairie Reservoir until a total of 45,000 acre-feet of storage is filled. Wickiup Reservoir is then filled to a total of 200,000 acre-feet (full pool) before further filling of Crane Prairie Reservoir.

Crane Prairie Reservoir has a maximum storage capacity of 50,000 acre-feet, of which 30,000 acre-feet is identified as “reliable storage supply” in the inter-district contract, and 20,000 acre-feet is identified as “surplus water available.” Table 2 shows the storage is allocated as follows.

Table 2. Crane Prairie Reservoir storage allocation

District	Allocation of Reliable Storage Supply (acre-feet)	Allocation of Surplus Storage (acre-feet)	Total Allocation (acre-feet)
Lone Pine ID	10,500		10,500
Arnold ID	10,500	3,000	13,500
COID	9,000	17,000	26,000
Total	30,000	20,000	50,000

Allocation of the surplus storage water is complex. Of the first 15,000 acre-feet, 1/5 accrues to Arnold ID, up to a maximum of 3,000 acre-feet, and 4/5 accrues to COID, up to a maximum of 12,000 acre-feet. The remainder of the surplus storage (5,000 acre-feet) accrues to COID.

At the time of the inter-district contract, it was anticipated that the capacity of Crane Prairie Reservoir would be 50,000 acre-feet. The actual capacity of the reservoir is 55,300 acre-feet. In the wettest years water is stored above 50,000 acre-feet, but only after Wickiup Reservoir has reached or is assured to reach full capacity of 200,000 acre feet.

Reservoir refill operations are managed to maximize storage each year and maintain to the extent possible uniform flows below each reservoir. With modern satellite telemetered reservoir outflows and snowpack measurements, operations are becoming more responsive to changes in water conditions through the winter. Typically, the irrigation season ends and storage commences in October.

Reservoir outflows are determined after considering the amount of reservoir storage and the present inflow. Daily changes on the river are organized by the Watermaster, an OWRD employee, to meet storage requirements and irrigation demands. Irrigation personnel are contacted to implement the changes in releases at the projects.

Crane Prairie and Wickiup Dams are operated under informal flood control rules, which are rarely invoked. The reservoirs undergo an annual review of hydrologic conditions as they approach full capacity. If the review indicates elevated inflow is likely, a flood plan is developed by BOR in cooperation with the irrigation districts and the Oregon State Watermaster.

Crane Prairie Dam and Reservoir Operation. The BOR has title to Crane Prairie Dam and Reservoir, however, as a transferred work, daily O&M is the responsibility of COID personnel. The BOR owns no water rights for storing or diverting Crane Prairie stored water.

Irrigation releases typically begin by mid-to-late April. Non-irrigation releases may occur earlier if the reservoir is full and must pass inflow. The reservoir does not typically begin to draft appreciably until late May or early June. Irrigation releases typically peak in June and July between 200 cubic feet per second (cfs) and 500 cfs, but can be higher or lower depending on the water supply. In dry years, lower flows are maintained to stretch the water supply over the entire season. An effort is made to set a summer flow that can be maintained without constant adjustments. Releases are typically reduced to minimum downstream flows in late October or early November. Although Crane Prairie Reservoir has no minimum flow requirements, the watermaster and the irrigation districts have a non-binding agreement to release a minimum of 30 cfs to protect instream resources. Winter flows below Crane Prairie Dam are often higher than this in all but the driest years.

Table 3 summarizes operations at Crane Prairie Dam and Reservoir. Table 4 shows the average monthly flow exceedance for water years 1990 to 2001 below Crane Prairie Dam. From the table, the 90% exceedance for October was 64 cfs, meaning that 90% of the time average monthly October flows equal or exceed 64 cfs.

Wickiup Dam and Reservoir Operation. NUID operates Wickiup Dam and Reservoir according to the terms of the inter-district contract described earlier. Day-to-day operations are directed by the Watermaster to meet storage requirements and irrigation demands. The BOR does not hold the water right for storing or diverting Wickiup stored water.

The irrigation season extends from April 1 to October 31, with the reservoir typically beginning to refill by mid-October. The filling schedule must adhere to the terms of the inter-district contract, which allows Wickiup Reservoir to fill at any time and at any rate provided that storage is below 180,000 acre-feet, while meeting minimum downstream releases (discussed later in this chapter). After storage has reached 180,000 acre-feet, outflow from Crane Prairie Reservoir is curtailed until that reservoir reaches 45,000 acre feet. Wickiup Reservoir is then filled to 200,000 acre-feet (full pool) before further filling of Crane Prairie Reservoir beyond 45,000 acre-feet.

Table 3. Summary of Crane Prairie Dam and Reservoir operations

Item	Comment
Releases	
30 cfs	Informal (non-binding) minimum release by agreement of watermaster and irrigation districts.
200-500 cfs	Typical peak irrigation release.
Rate of rise (maximum)	No standard ramping rate as it depends on the flows, trying not to make sudden changes.
Rate of drop (maximum)	No standard ramping rate as it depends on the flows, trying not to make sudden changes.
Reservoir Content	
Minimum pool	None required; typically stays above 10,000 acre-feet. Recorded minimum of 9,470 acre-feet in 1980*.
24,000 acre-feet	Average end-of-September carryover (1961-2001 period of record).
30,000 acre-feet	Maximum storage level until Wickiup Reservoir reaches 180,000 acre-feet
45,000 acre-feet	Maximum storage level until Wickiup Reservoir reaches 200,000 acre-feet
55,300 acre-feet	Full pool; achieved in about 1 out of every 3 years
Allocation of Reservoir Content	
COID	26,000 acre-feet
Arnold ID	13,500 acre-feet
Lone Pine ID	10,500 acre-feet
*1961-2002 period of record. For the period 1925-1960, the reservoir reached empty or near empty in 14 of the years, with the latest occurring in 1950.	

Table 4. Average monthly flow (cfs) exceedance below Crane Prairie Dam, Deschutes River Basin over the 1990-2001 water years

Gage Location	% Exceedance	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Deschutes River													
Below Crane Prairie Reservoir	90% 50% 10%	64 195 432	45 163 338	51 132 302	74 126 427	45 124 333	29 151 310	65 148 264	160 271 525	131 268 578	134 269 536	117 271 503	109 276 487
Information from http://pn.usbr.gov/hydromet/index.html													

Irrigation releases typically begin by mid-April and the reservoir commences drafting. In wet years this can be delayed until early May, and in extremely wet years the reservoir may not draft until early June. Irrigation releases typically peak in July between about 1,400 cfs and 1,600 cfs, but can be higher. Irrigation demand begins to diminish in September and releases are typically down to minimum flows by the middle of October.

During the non-irrigation season, a minimum flow of 20 cfs is normally maintained at the gaging station about 1,000 feet downstream from Wickiup Dam. This minimum flow was established following a hearing held in September 1954 on the amended application to increase the storage in Wickiup Reservoir. The Oregon State Engineer identified a minimum release of 20 cfs for downstream conservation. Under normal storage conditions, this amount can be readily obtained from the downstream toe drain along the toe of the dam. Flows higher than 20 cfs can usually be supplied in a series of wet years without risk to refill (and thus to storage rights), as was the case from 1997 to 2001.

Wickiup Dam and Reservoir operations are summarized in Table 5. Table 6 shows the average monthly flow exceedance for water years 1990 through 2001, below Wickiup Dam. From the table, the 90% exceedance for October was 215 cfs, meaning that 90% of the time average monthly October flows equal or exceed 215 cfs.

Table 5. Summary of Wickiup Dam and Reservoir operations

Item	**Comment**
Releases	
20 cfs	Minimum release order of Oregon State Engineer in 1954.
+200 cfs	Typical minimum release in wetter years (roughly 40% of years).
1400-1600 cfs	Typical peak irrigation release.
Rate of rise (maximum)	Existing limits are 1 foot per hour, but watermaster voluntarily operates to ½ foot per day. USFS proposed rates are 0.1 foot per 4-hours; adhered to when possible. Reservoir elevation, flood operations, and downstream conditions will dictate the release criteria.
Rate of drop (maximum)	Daily limits same as above. USFS proposed hourly limit is 0.2 foot per 12 hours; adhered to when possible.
Reservoir Content	
Minimum pool	None required; typically stays above 25,000 acre-feet. Recent recorded minimum was 15,600 acre-feet (1994)*.
61,000 acre-feet	Average end-of-September carryover.
180,000 acre-feet	Maximum storage limit until Crane Prairie Reservoir fills to 45,000 acre-feet.
200,000 acre-feet	Full pool; achieved or nearly achieved in approximately 70% of years.
*The reservoir reached 8,100 acre-feet and 8,800 acre-feet in 1955 and 1970, respectively, and reached 1,980 acre-feet in 1952.	

Table 6. Average monthly flow (cfs) exceedance below Wickiup Dam, Deschutes River Basin for 1990-2001 water years

Gage Location	% Exceedance	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Deschutes River													
Below Wickiup Reservoir	90%	215	20	19	17	19	22	101	711	899	1209	1237	905
	50%	493	25	36	23	33	94	585	1003	1294	1458	1419	1172
	10%	919	710	573	914	1053	739	784	1364	1557	1772	1630	1422
Information from http://pn.usbr.gov/hydromet/index.html													

Haystack Dam and Reservoir Operation. Haystack Dam and Reservoir is an off-stream storage facility. Because of the distance from Wickiup Reservoir to the NUID project lands (about 100 miles), the regulatory storage provided by Haystack Reservoir is required. Inflow to Haystack Reservoir is primarily provided by two diversions: (1) From the Deschutes River near Bend, Oregon, by means of North Unit Main Canal, and (2) the Crooked River Pumping Plant at a point where the North Unit Main Canal crosses the Crooked River. In addition, natural inflow can occur from Haystack Creek, although this is typically minor compared to the canal feeds. Infrequent rain-on-snow flood events are the only source of appreciable inflow from Haystack Creek.

If the reservoir levels go into surcharge conditions (more than 100% full), Haystack Feeder Canal acts as a spillway for emergency releases. During the non-irrigation season, the Haystack Feeder Canal control gates are kept in the full open position as a precaution to ensure the capability to bypass flood flows up to 800 cfs.

During the irrigation season, which usually runs from early to mid-April through mid-October, the reservoir typically operates between elevations of about 2828 feet to 2841 feet (2,900 acre-feet to 5,500 acre-feet) to supply irrigation releases. Operations follow a cyclic pattern where the reservoir is drafted and then refilled periodically to maintain its operating range. In October following the irrigation season, the reservoir is typically refilled to an elevation range of 2835 feet to 2838 feet (4,150 acre-feet to 4,750acre-feet). During the nonirrigation season, all outflows from the reservoir are curtailed and the reservoir is maintained at a fairly constant elevation until the following April.

Because it is an off-stream reservoir and discharges to the NUID canal, there are no minimum flows or ramping rates associated with the operation of Haystack Reservoir. The typical minimum reservoir level of approximately 2,900 acre-feet is sufficient to maintain fishery and recreational resources associated with the reservoir. There is no established minimum pool.

Diversion of Water. The primary diversion point for Deschutes Project water occurs at the North Canal Dam on the main Deschutes River near Bend at RM 164.8. Due to numerous changes in canal companies and ownerships over the years, it is unclear who owns North Canal Dam. However, it is clear that BOR does not own the feature, and therefore, bears no responsibility for the O&M of the dam.

Four irrigation districts divert water into their respective canals at the North Canal Dam – NUID using the North Unit Main Canal, Lone Pine ID and COID using the North Canal (also called the Pilot Butte Canal), and Swalley ID using the Swalley Canal. Only NUID, Lone Pine ID, and COID divert Federal project water.

Diversion of Crane Prairie storage water by COID, Arnold ID, and Lone Pine ID occurs through privately owned and operated diversion facilities. The BOR does not own or operate these diversion facilities or possess the diversion water rights. The Oregon State Watermaster regulates diversion of this water. Delivery and diversion of Crane Prairie storage water into these private facilities is interrelated and interdependent to the proposed action.

The North Canal Dam is the last major diversion point for irrigation water from the Deschutes River, and marks the low flow point on the river just downstream of the dam. The diversion of natural and storage flows, mostly by private diversions, along with diversions of Deschutes Project water essentially dewaters the Deschutes River by the time it passes the North Canal Dam. Irrigators early on recognized the need to provide a minimum release past the North Canal Dam, and since the early 1960s a non-binding "gentlemen's agreement" among several of the major irrigation districts has provided at least 30 cfs. The parties to this agreement include NUID, COID, Tumalo ID, and Swalley ID. In addition to the 30 cfs, the Watermaster must pass about 5 cfs to meet several small irrigation demands further downstream.

The DRC and other interested parties have made a significant effort in the last few years to improve flows past North Canal Dam (along with other locations in the basin) by leasing or purchasing water rights from traditional irrigation users. The combination of leases, "gentlemen's agreements," and irrigation flow totaled approximately 45 cfs passing North Canal Dam during the 2002 irrigation season. This "minimum" will vary from year-to-year depending on the water supply and demands and leasing arrangements negotiated.

North Unit Headworks and Main Canal. The North Unit Main Canal, with headworks at North Canal Dam, is the principal water delivery feature for the Deschutes Project. This is the only Federally-owned diversion facility associated with the Deschutes Project. The canal has a maximum diversion capacity of 1,100 cfs, although diversions during the irrigation season are generally from 247 cfs in October to 640 cfs in July. Annual average diversions are 193,559 acre-feet/year (based on period of record from 1961-2000) which includes storage water from Wickiup Reservoir and natural flow water rights (BOR 2003).

NUID has been able to reduce their peak demand and increase the reliability of their storage water through conservation and efficiency improvements. In the past, maximum diversion into the North Unit Main Canal was often at the 1,100 cfs capacity, where maximum demand now will typically call for about 800 cfs (although higher flows may sometimes be needed for short periods to keep the system in balance).

The diversion contains a fish screen complex constructed in 1945 which does not meet current fish screening standards. The BOR has completed preliminary designs to upgrade the fish screen to comply with current standards.

The irrigation diversion season is generally April 1 to November 1. NUID diverts both natural flows and storage water into the North Unit Main Canal. Anytime natural flows on the Deschutes River are above about 1,500 cfs, as calculated by the Watermaster, some or all of NUID's demands can be met from natural flows. However, NUID's natural flow rights are junior to all major irrigators on the river, and once Deschutes River natural flows drop to 1,500 cfs or less, it relies entirely on storage water from Wickiup Reservoir. Because of this heavy reliance on stored water and the uncertainty of reservoir refill in future years, NUID operates in a very conservative manner to maximize the carryover water in Wickiup Reservoir.

The average monthly flow exceedance for water years 1915 through 1991 below North Canal Dam are shown in Table 7. These flows reflect hydrologic effects of diversions associated with the proposed, interrelated and interdependent, and private actions. The diversion of natural flow rights by COID, Lone Pine ID, Arnold ID, Tumalo ID, and Swalley ID are not part of the proposed or interrelated and interdependent actions.

Table 7. Average monthly flow (cfs) exceedance below North Canal Dam, Deschutes River Basin for 1915-1991 water years

Gage Location	% Exceedance	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Deschutes River													
Below Bend	90% 50% 10%	70 241 802	372 661 1140	450 798 1217	482 835 1274	478 863 1320	441 845 1408	88 286 1161	34 106 680	29 106 627	29 73 352	25 83 430	26 113 512
Information from http://pn.usbr.gov/hydromet/index.html													

Crooked River Project Operations

The Crooked River Project is near Prineville, Oregon. About 23,000 acres are irrigated using project water, with OID irrigating about 21,000 of those acres. A number of smaller irrigation associations or individual users irrigate less than 2,000 acres with Prineville Reservoir storage water. Irrigated acres produce grain, hay, garlic, turf, grass seed, mint, and irrigated pasture on farm units ranging in size from large livestock ranches to small suburban residential tracts.

Principal Federally-owned features included in the proposed action are Arthur R. Bowman Dam, Prineville Reservoir, and the Crooked River Diversion Dam, Feed Canal, and Distribution Canal. Additionally, BOR has title to several off-stream pumping plants and distribution canals within the OID irrigation system. The BOR also holds a water right to store water behind Bowman Dam and divert the stored water into Federally- and privately-owned facilities.

Ochoco Dam and Reservoir, which stores and releases Ochoco Creek water, is a privately-owned facility operated by OID. The BOR does not hold the water right for storing or diverting Ochoco Creek water. However, operation of OID-owned facilities is coordinated with operation of Bowman Dam and Prineville Reservoir and other Federal facilities in the Crooked River Project; therefore, operations of OID-owned facilities are included as interrelated and interdependent activities in this consultation.

The following is a brief summary of project operations included in the proposed action. Refer to pages 66-81 in the Operations Report for a detailed description. The proposed action includes: Storage and release of water from Prineville Reservoir and Bowman Dam, diversion of Prineville Reservoir storage water by contractors into the Crooked River Feed Canal and other private facilities which is an interrelated and interdependent action, and conveyance of Prineville Reservoir storage water in Federally-owned facilities.

Storage and Delivery of Water. The total active capacity of Prineville Reservoir is 148,640 acre-feet. Prineville Reservoir serves as a primary water supply for some lands within OID, as well as a supplemental water supply to the district and other individuals. Additionally, OID relies on storage water in Ochoco Reservoir to provide primary and supplementary supplies of water to district members. Operations of Bowman Dam are part of the proposed action. Operations at Ochoco Dam are interrelated and interdependent to the proposed action.

The BOR forecasts runoff for the Crooked River at Prineville Reservoir and Ochoco Creek at Ochoco Reservoir for effective utilization of storage space for flood control and water conservation. Prineville and Ochoco Reservoirs are filled concurrently, based on runoff forecasts.

Bowman Dam and Prineville Reservoir Operation. Crooked River flows are comprised of winter snowfall and spring runoff in its upstream watershed and from spring flows as the river approaches its confluence with the Deschutes River. Upper Crooked River flows are highly variable, both seasonally and annually. This reach of the river is fed mostly by surface runoff, and soils are shallower and less porous than in the Deschutes River Subbasin. Nearly all of the annual volume of reservoir inflow typically occurs during the December through June period (95%). Inflows from July through September account for less than 1% of the total, with inflows often less than 10 cfs.

Prineville Reservoir has a much better refill probability than Ochoco Reservoir. Maximum fill occurs at Prineville Reservoir in approximately 3 out of 4 years, where Ochoco Reservoir only fills about 50% of the years. Therefore, priority is placed on using irrigation water from Prineville Reservoir to the maximum extent feasible, with Ochoco Reservoir releases made only to serve those lands with insufficient or no access to Prineville Reservoir water.

The BOR has contracted with OID to perform O&M at Bowman Dam and Prineville Reservoir. Reservoir releases are made by OID between April 1 and October 31 as required to meet irrigation demand. OID coordinates water delivery requests within the district and calls orders into the damtender who makes releases from Prineville Reservoir.

Bowman Dam is operated under formal flood control rules and signed agreements. Flood control criteria at Bowman Dam involves flood control rule curves established by the Corps that prescribe the amount of reservoir space needed to control the predicted volume of runoff. A series of rule curves or tables determine the space requirement for a given water supply forecast on a particular date. Rule curves were developed using historic runoff, system storage potential, and downstream flow restrictions (*i.e.*, downstream channel capacity).

Flood control operation for Bowman Dam begins with no less than 60,000 acre-feet of evacuated space (equivalent to a maximum storage of 88,640 acre-feet of water) in Prineville Reservoir on November 15 through February 15. During this time, water may not be stored if only 60,000 acre-feet of space is vacant. After February 15, the reservoir can be filled as determined by a special forecast runoff equation and related established rule curve through April 30. Final fill may occur between April 1 and April 30 depending on forecasted runoff volume. Once flood control space has been filled, flow begins to occur over the uncontrolled spillway crest. Releases from the outlet works are managed to minimize property damage.

Authorizing legislation for the Crooked River Project mandates a minimum 10 cfs release through Prineville Reservoir. Currently, BOR maintains minimum releases ranging between 10-75 cfs below Bowman Dam. Storable inflows are bypassed if existing contractual obligations are not impacted. The lower flows in that range are released in drier years and extended drought conditions when refill of the reservoir is jeopardized. The uncontracted storage in Prineville Reservoir is used to achieve these releases. The legal mandated minimum release remains 10 cfs.

Recreation on Prineville Reservoir is a consideration of current operations, although not specifically an authorized purpose. Therefore, reservoir level is not driven by recreation, but it is considered. If sufficient storage exists, spaceholder contracts can be met, and sufficient flows are being passed, an attempt is made to keep enough water in Prineville Reservoir to maintain boat access at ramps at Prineville State Park through peak visitation periods (typically May - August).

Table 8 summarizes operations at Bowman Dam and Prineville Reservoir. Table 9 shows the average monthly flow exceedance for water years 1990 through 2001 below Bowman Dam (Prineville Reservoir). From the table, the 90% exceedance for October was 44 cfs, meaning that 90% of the time average monthly October flows equal or exceed 44 cfs.

Table 8. Summary of Bowman Dam and Prineville Reservoir operations

Item	Comment
Releases	
10 cfs	Minimum authorized release.
30-35 cfs	Typical informal minimum release during extreme drought, but may be as low as 10 cfs.
75 cfs	Informal minimum release target provided by bypassing inflows from BOR's uncontracted storage space.
200-240 cfs	Typical peak irrigation releases.
2,000 cfs	Informal target, not to exceed for flood control; increased bank erosion above this level.
Rate of change (maximum)	None
Reservoir Content	
Minimum pool	None required; recent recorded minimum pool was 22,450 acre-feet in 1993.
Maximum winter flood control pool (Nov. 15 - Feb. 15)	88,640 acre-feet
83,000 acre-feet	Average end-of-October carryover storage.
148,640 acre-feet	Full pool; achieved roughly 3 out of 4 years.

Table 9. Average monthly flow (cfs) exceedance below Bowman Dam, Crooked River for 1990-2001 water years

Gage Location	% Exceedance	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Crooked River													
Near Prineville Below Bowman Dam	90% 50% 10%	44 115 297	33 74 160	31 68 782	30 65 1308	31 91 1636	26 218 1548	79 373 2742	159 249 1022	179 228 1090	187 222 315	196 227 372	122 206 262
Information from http://pn.usbr.gov/hydromet/index.html													

Diversion of Water. Prineville Reservoir storage water is diverted primarily by the Crooked River Diversion Dam into the Feed Canal, upstream from the city of Prineville at RM 56 on the Crooked River. This is the only Federally-owned diversion facility on the Crooked River. In 2000, BOR constructed a new diversion weir, fish screen, and fish bypass and outfall structure to improve resident fish protection at the diversion. Design of the new features was reviewed and approved by the USFWS and ODFW.

The canal capacity is 180 cfs. Average 1994 through 2001 flows diverted into the Crooked River Feed Canal are 50,985 acre-feet per water year, comprised of Prineville storage water and natural flow rights held by OID. Approximately 40 cfs bypasses this diversion to meet non-OID irrigation diversions with water rights to natural flows and/or contracted storage water, and to maintain flows in the Crooked River. OID and BOR have cooperatively made the non-binding decision to maintain at least 10 cfs through the low flow point on the Crooked River, roughly the stretch between the golf course near the city of Prineville to the confluence with Ochoco and McKay Creeks, to prevent the river from drying up.

From the diversion dam, the Crooked River Feed Canal runs north 8.3 miles and is siphoned under Ochoco Creek to the Barnes Butte Pumping Plant, serving irrigable lands along its course. The Barnes Butte Pumping Plant lifts a maximum of 147 cfs from the end of the Feed Canal to the head of the 15.8-mile-long Crooked River Distribution Canal which runs through the center of district lands. Operation of the Barnes Butte Pumping Plant requires extra water to be diverted in the Feed Canal to allow continuous pump operation and avoid short cycling or potential pump damage. This extra water is spilled back into Ochoco Creek.

The Ochoco Relift Pumping Plant is on the Crooked River Distribution Canal at about mile 5 and lifts a portion of the flow to replenish the Ochoco Main Canal that serves lands east and west of McKay Creek. The distribution canal continues in a northwest direction, crossing McKay Creek at Reynolds Dam by siphon, where spills are made into the creek. The Crooked River Distribution Canal terminates at Lytle Creek, where the flows join any remaining spills coming from the Ochoco Main Canal and are routed down Lytle Creek to the Crooked River. In addition to the Barnes Butte and Ochoco Relift Pumping Plants, BOR has developed several smaller offstream pumping plants that distribute Project storage water and convey natural flow water (under a water right held by OID) to Crooked River project lands within OID's boundaries. These pumping plants take water from the Crooked River Feed Canal, Distribution Canal, or Ochoco Main Canal as described in the Operations Report on pages 60-62.

OID has strived to modify its diversion operations and facilities to improve fish passage and habitat by enhancing instream fish passage, minimizing diversion of fish into canals, and improving instumentation at existing streamflow gaging sites through partnerships with a wide variety of entities. Some examples include: Design and construction of several infiltration galleries, replacement of outdated weirs with advanced inverted weirs to allow fish passage, construction of several siphons which separate the irrigation ditch from the stream to avoid dewatering or chemical contamination of the creek, upgrades on numerous gaging (streamflow monitoring) stations to include temperature monitoring; and construction of year-round fish ladders. OID has also strived to eliminate virtually all of its diversion dams that have historically blocked fish passage.

Wapinitia Project Operations

The Wapinitia Project consists of approximately 2,100 acres of irrigated lands in the White River Subbasin. The Wapinitia Project, Juniper Division, is near the confluence of the White and Deschutes Rivers and beside Maupin in northcentral Oregon. Project lands are on Juniper Flat, a plateau 3 to 6 miles wide and approximately 17 miles long. The project lands produce pasture, hay, and wheat; storage provides supplemental water supply for about 2,000 acres.

Federally-owned project features included in the proposed action are Wasco Dam and Clear Lake. Wasco Dam is the only storage facility in the Wapinitia Project, with a total active capacity of 11,900 acre-feet. The dam was constructed in 1959 at the outlet of Clear Lake, a natural lake. JFDIC uses storage in Clear Lake to supplement other privately developed water supplies.

The following is a brief summary of project operations included in the proposed action. Refer to pages 91-94 in the Operations Report for a detailed description. The proposed action includes the storage behind and release of water from Wasco Dam for diversion at the Clear Creek Diversion. Storage water is diverted into the privately owned and operated Clear Creek Diversion facilities under water rights held by JFDIC. Diversion of this storage water is interrelated and interdependent to the proposed action.

Storage and Delivery of Water.

Wasco Dam and Clear Lake Operations. Project water is stored in Clear Lake behind Wasco Dam, about 35 miles west of Maupin, Oregon. The drainage area comprises over 8 square miles and is fed from seasonal precipitation, principally in the form of winter snowfall. Wasco Dam storage is used to supplement the irrigation flows on the project when the natural flows begin to decrease in July during wet years and as early as April in dry years. The total amount of water diverted from natural streamflow and storage for the Wapinitia Project is about 5,000 acre-feet annually. The diversion of the storage water is an interrelated and interdependent action; the diversion of the natural flow is by private facilities and not part of the proposed or interrelated and interdependent actions.

Summer inflows are received from many springs in the immediate reservoir area. To refill the reservoir for the irrigation season, the emergency gate is closed every year from October through April, with the regulating gate remaining open to bypass possible flood flows. If the elevation of the lake were to reach 3511 feet during the closure period, flood flows would discharge via the overflow weirs and through the open regulating gate. Operation of Wasco Dam and Clear Lake are summarized in Table 10.

Table 10. Summary of Wasco Dam and Clear Lake operations

Item	Comment
Releases	
Minimum release	None required. Some seepage occurs.
20-45 cfs	Typical peak irrigation release from dam.
50 cfs	Typical maximum diversion into Clear Creek diversion works.
52.9 cfs	JFDIC water right at Clear Creek diversion works.
Rate of change (maximum)	No limits.
Reservoir Content	
Minimum pool	None. The original natural lake volume remains when all storage water is used. Storage is nearly emptied in most drought years.
2,540 acre-feet	Average end-of-October carryover.
11,900 acre-feet	Full pool (active capacity). Refills completely less than 20% of the years.

Diversion of Water. JFDIC has a water right to divert a maximum of 52.9 cfs at the Clear Creek diversion works. In normal years, natural flows from Clear Creek and Frog Creek will typically meet irrigation demands until some time in May or June before releases are needed from Wasco Dam. In wet years, reservoir releases may not be needed until late June or early July; in very dry years releases may be needed in April. Clear Creek is essentially dewatered at the Clear Creek diversion works during the irrigation season (except for early season water in excess of irrigation demand), but some leakage occurs and springs begin to replenish the live flow within about a mile downstream (BOR 2003).

Water is conveyed from the Clear Creek diversion works through the JFDIC Main Ditch to McCubbin's Gulch, a natural watercourse. Water is then carried down McCubbin's Gulch to the extreme western edge of the district where it becomes part of the district's delivery system at Pine Grove. Flows at Pine Grove typically need to be 20 to 25 cfs to meet irrigation demand, with 30 cfs being the maximum capacity.

Facilities Maintenance

Maintaining facilities in good operating condition is important. Failure of features, such as outlet works stuck in the open or closed position or major cavitation/erosion damage, can quickly lead to significant damage to the structure and possible uncontrolled water releases which can be devastating to life, property, and the environment. The purpose of maintenance programs is to maintain facilities in good operating condition and to identify potential problems and repair features before failure occurs. Nonetheless, unexpected failure does occur. These failures can happen at any time and often require emergency repair operations to avoid major damage to the structure.

Federally-owned water conveyance and control facilities and facilities included in BOR's Safety of Dams program, require periodic inspection, maintenance, and repair; all major features undergo a major review of operation and maintenance at 3-year intervals. Periodic inspection may require operation of features at specific reservoir water surface elevations to assure continued reliable operation. Times of inspections are generally accomplished near the end of the irrigation season. When underwater dive inspections are required, minimum flows during inspections are coordinated with ODFW. Specific times, duration of flow interruptions, and minimum flow needs are coordinated with the ODFW, OWRD, and USFS. Repairs consist of repairing eroded concrete, recoating or replacing corroded metalwork, repairing cavitation damage to control gates, removing rock and debris from intake and outlet structures, and repairing metal and concrete outlet conduits. Dewatering of various features is often required for inspections, repairs, and other maintenance activities. Reduced or increased riverflow, lowering or raising the reservoir water surface, installation of bulkheads, and construction of cofferdams for temporary diversion of flows may be required.

Transferred works are routinely inspected jointly by BOR and the operating entity under the Review of Operation and Maintenance Program. If required maintenance is identified in an inspection, the operating entity prepares the specifications and is required to submit those specifications to BOR for review and approval.

Maintenance activities at one facility in a system may require system operation changes that affect reservoir levels and flows at other facilities. Emergency actions conducted by BOR which result in significant changes in flows or pool levels at reservoirs are coordinated with resource management agencies and other parties with major interests in the operation. When damage is identified or appears likely to occur, the risks are evaluated and a decision is made to make repairs immediately (emergency or unscheduled repairs) or, if practical, to delay repairs until the regular maintenance schedule.

The Operations Description report describes routine maintenance activities specific to BOR's Deschutes River Basin project facilities (pages 49-51, 83, and 95). Work planned is subject to change depending on funding appropriations, additional study, or other unforeseen events. Non-routine maintenance activities potentially affecting ESA-listed species would entail a separate Section 7 consultation.

Congressional Authorizations

Deschutes Project. The Deschutes Project was authorized by a finding of feasibility by the Secretary of the Interior on September 24, 1937; it was approved by the President on November 1, 1937 pursuant to the Act of June 25, 1910 (36 Stat. 836) and the Act of December 5, 1924 (43 Stat. 702). Construction of Haystack Dam was authorized by the Congress in Public

Law 83-573 dated August 10, 1954. Irrigation is the authorized purpose of the Deschutes Project.

Crooked River Project. The Crooked River Project was authorized under the Act of August 6, 1956, specifically to provide irrigation water for lands in the Crooked River Project and other beneficial purposes, including flood control. The Act authorized the construction of minimum basic public recreation (health and safety) facilities and structures to promote the preservation and propagation of fish and wildlife. The authorized fish and wildlife purposes were specifically described as the construction of a fish screen and ladder at the Crooked River Diversion structure and a minimum release of 10 cfs from Bowman Dam to maintain the downstream fishery when releases are not being made for irrigation or flood control. Although no space in Prineville Reservoir is specifically allocated for health and safety facilities or for the minimum 10 cfs release, these purposes are considered during annual planning of reservoir operations.

The authorizing act was amended in 1959 to extend the Crooked River Project by increasing the land area receiving water, and again in 1964 to permit construction of additional irrigation facilities. Both amendments were intended to utilize uncontracted space in Prineville Reservoir for irrigation.

The Act does not authorize the use of the storage space for any purpose other than irrigation and flood control. Natural flow from the upper Crooked River is passed through Prineville Reservoir without being stored and is released from Bowman Dam to meet the minimum 10 cfs release requirement.

Wapinitia Project. Congress authorized the Wapinitia Project, Juniper Division, in Public Law 84-559 dated June 4, 1956. The authorized purpose of the project was for the irrigation of about 2,100 acres. Construction of minimum basic recreation facilities to allow public access and maintain health and safety were also authorized.

Contracts

Under provisions of the Reclamation Act, specific authorizations for features of the Deschutes Project, and subsequent contractual obligations, project costs were to be repaid by the beneficiaries; *i.e.*, those entities who received project water or whose original irrigation facilities may have been improved or enlarged by the United States. In accordance with BOR law, the United States entered into various forms of repayment contracts with entities for reservoir storage, rehabilitation, and/or enlargement of existing facilities (that were privately owned at the time), or for the construction of a new storage and delivery system (*e.g.*, Wickiup Dam and the delivery system for the NUID) in exchange for repayment of the construction costs allocated to irrigation and the allotted operations and maintenance costs.

The use of the water stored in Federal reservoirs is administered in conjunction with water rights and provisions of state water law. The BOR operates reservoirs according to the contracts so that operations do not negatively affect storage without the permission or direction of the contractors. Repayment and other contracts having implications for the operation of Deschutes River Basin project facilities are described in the Operations Report and referenced as appropriate in the section that follows.

Deschutes Project. The BOR has current contracts with COID for operation of Crane Prairie Reservoir and with NUID for operation of Wickiup and Haystack Reservoirs. The Operations Description report at pages 30-32 provides details about these contracts.

The January 4, 1939, repayment contract with COID requires BOR to provide 50,000 acre-feet of storage in Crane Prairie Reservoir. The contract has specific language regarding the coordination of storage and releases between Wickiup and Crane Prairie Reservoirs. The contract contains language that allocates storage in the reservoirs according to the January 4, 1938, contract entered into between Arnold ID, COID, Lone Pine ID, and NUID.

Under provisions of the repayment contract between BOR and NUID, BOR agreed to construct facilities to provide 200,000 acre-feet of storage space to NUID to irrigate 50,000 acres in exchange for repayment by NUID of a portion of construction, operation, and maintenance costs. The contract also notes that project water supply is subject to the terms of the January 4, 1938, inter-district contract (between NUID, COID, Lone Pine, and Arnold ID) referred to earlier and a January 4, 1939, contract between the United States and COID. Table 11 summarizes the allocation of storage space in the two Deschutes Project reservoirs as defined by the relevant contracts. Storage in both reservoirs is fully contracted. Haystack Reservoir serves as a reregulating reservoir for releases made out of Wickiup Reservoir; therefore, it is not included in Table 11.

Table 11. Water storage allocation for Deschutes River Basin Federal reservoirs

Reservoir	Spaceholder/Contractor	Storage Allocations (acre-feet)
Deschutes Project		
Crane Prairie Reservoir	COID	26,000
	Arnold ID	13,500
	Lone Pine	10,500
	TOTAL	50,000
Wickiup Reservoir	NUID	200,000
Crooked River Project		
Prineville Reservoir	OID	57,899
	14 Smaller Contracts	10,374
	Uncontracted	80,360
	TOTAL	148,633
Wapinitia Project		
Clear Lake	JFDIC	11,900

Crooked River Project. The BOR has repayment contracts with OID and 14 other water users for operation of Bowman Dam and storage water from Prineville Reservoir. The Operations Description report at pages 64-65 provides details about these contracts. Under the contract provisions, BOR agreed to construct facilities and provide almost 68,000 acre-feet of irrigation storage space in Prineville Reservoir to spaceholders in exchange for repayment of a portion of construction, operation, and maintenance costs. Almost 53% of the storage space in Prineville Reservoir is currently uncontracted. The BOR has had a moratorium in place since the 1970s for new repayment contracts.

Wapinitia Project. The BOR and JFDIC entered into a repayment contract for provision of 11,900 acre-feet of storage from Clear Lake in exchange for repayment of a portion of construction, operation, and maintenance costs. JFDIC has repaid the construction costs associated with construction of project facilities. Storage in the project is fully contracted. The Operations Description report on page 91 provides details about these contracts.

Summary

The BOR proposes to operate the three Federal projects in the Deschutes River Basin to store, release, divert, and deliver project water (from storage) consistent with applicable law and historic operation of the recent past. Project operations have evolved over time to the current operations, but have remained fairly stable since the beginning of the 1990s. Irrigation storage from project reservoirs is released from the dams, diverted downstream at diversion dams and pump stations, and delivered through canals to project beneficiaries. Table 12 provides a summary of proposed and interrelated and interdependent actions associated with the major facilities connected with current Federal projects in the Deschutes River Basin.

The BOR is not responsible for effects on ESA-listed species of all water development and land management activities throughout the basin. For example, BOR is not responsible for the streamside rural development, road building, forest management, private water diversions, on-farm applications of pesticides and herbicides, or grazing influences that other state, Federal, and private agencies, organizations, and individuals have implemented in the Deschutes River Basin. These activities are discussed in this Opinion relative to the environmental baseline and cumulative effects, not as BOR activities.

Table 12. Summary of proposed and interrelated and interdependent actions

Facility	Proposed Action	Interrelated & Interdependent Actions
Deschutes Project		
Crane Prairie Dam & Reservoir	storage & release of water	diversion into private facilities
Wickiup Dam & Reservoir	storage & release of water	
North Unit Headworks & Main Canal	diversion of Wickiup Reservoir storage water	diversion of natural flow water
Haystack Dam & Reservoir	storage & release of water	
Arnold Diversion Dam & Canal, Central Oregon Headworks & Canal, North Canal (Pilot Butte)		diversion of Crane Prairie Reservoir storage water only
Crooked River Pumping Plant		diversion of Crooked River water
Crooked River Project		
Bowman Dam & Prineville Reservoir	storage & release of water	
Crooked River Diversion Dam & Feed Canal	diversion of Prineville Reservoir storage water	diversion of natural flow water
Crooked River Distribution Canal	delivery of Prineville Reservoir storage water	conveyance of natural flow water
Barnes Butte Pumping Plant & Ochoco Relift Plant	delivery of Prineville Reservoir storage water	conveyance of natural flow water
9 small pumping plants	delivery of Prineville Reservoir storage water	conveyance of natural flow water
Ochoco Dam & Reservoir		storage & release of Ochoco Creek water

Facility	Proposed Action	Interrelated & Interdependent Actions
Ochoco Main Canal, Rye Grass, & other distribution canals		conveyance of Prineville Reservoir storage water
Rice Baldwin, Central Ditch, People's Ditch, Lowline Ditch	diversion of Prineville Reservoir storage water	
Wapinitia Project		
Wasco Dam & Clear Lake	storage & release of water	
Clear Creek Diversion, JFDIC Main Ditch		diversion of Clear Lake storage water

Description of the Action Area

An action area is defined by the Services' regulations (50 C.F.R. Part 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The Columbia River downstream of the Deschutes River is not within the action area, because the aggregate effects of all 19 BOR tributary projects, including the Deschutes, Crooked River, and Wapinitia Projects, on streamflows in the mainstem Columbia River were considered in the FCRPS Opinion. The action area affected by the proposed action includes the Deschutes River, the Crooked River, Ochoco Creek, White River, and Clear Creek. On the Deschutes River, the action area starts at the mouth of the Deschutes River and extends upstream to the upper end of Crane Prairie Reservoir. On the Crooked River, the action area starts at the mouth and extends up the Crooked River to the upstream end of Prineville Reservoir. On Ochoco Creek, a tributary to the Crooked River, the action area starts at the mouth and extends upstream to the upper end of Ochoco Reservoir. On the White River, the action area starts at the mouth and extends upstream to its confluence with Clear Creek. On Clear Creek, a tributary to the White River, the action area starts at the mouth and extends upstream to the upper end of Clear Lake Reservoir. The fourth field hydrologic unit codes (HUCs) encompassing the action area are 17070306 (Lower Deschutes), 17070301 (Upper Deschutes), and 17070305 (Lower Crooked). The lower Deschutes River, within the Lower Deschutes HUC, serves as spawning habitat, rearing habitat, and a migratory corridor for MCR steelhead. Approximately the lower two miles of the White River is potential spawning and rearing habitat for MCR steelhead. The portion of the action area proposed for critical habitat on December 14, 2004 is limited to the Deschutes River, from the mouth upstream to the Pelton-Round Butte Project. The Lower Deschutes HUC and portion of the Upper Deschutes and Lower Crooked HUCs contain EFH for Chinook salmon (*O. tshawytscha*). The Lower Deschutes HUC has been designated EFH for coho salmon (*O. kisutch*), but coho did not occur here historically (BOR 2003).

ENDANGERED SPECIES ACT

The objective of this Opinion is to determine whether the ongoing operation and maintenance of the Deschutes River Basin Projects is likely to jeopardize the continued existence of MCR steelhead.

Evaluating the Effects of the Proposed Action

The standards for determining jeopardy and destruction or adverse modification of critical habitat are set forth in Section7(a)(2) of the ESA. In conducting analyses of habitat-altering actions under Section7 of the ESA, NMFS uses the following steps of the consultation regulations and when appropriate combines them with *The Habitat Approach* (NMFS 1999): (1) Consider the biological requirements and status of the listed species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; and (4) determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects. The purpose of this step is to further assess the species' status and risk in the action area, in order to inform NMFS' determination of what constitutes an "appreciable reduction" in survival and recovery. In completing this step of the analysis, NMFS determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species. If jeopardy is found, NMFS may identify reasonable and prudent alternatives for the action that avoid jeopardy.

Biological Requirements

The first step NMFS uses when applying ESA Section 7(a)(2) to the listed ESU considered in this Opinion includes defining the species' biological requirements within the action area. Biological requirements are population characteristics necessary for the listed ESUs to survive and recover to naturally-reproducing population sizes at which protection under the ESA would become unnecessary. The ESA-listed species' biological requirements may be described as characteristics of the habitat, population, or both (McElhany *et al.* 2000).

Key habitat components for MCR steelhead are: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (juvenile only), (8) riparian vegetation, (9) space, and (10) safe passage conditions. For this consultation, the key habitat components that function to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and growth and development to adulthood include substrate, water quantity, water velocity, cover/shelter, and space.

Status and Generalized Life History of Listed Species

In this step, NMFS also considers the current status of the listed species within the action area, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the ESA-listed species, NMFS starts with the determinations made in its decision to list the species and also considers any new data that is relevant to the species' status. Please refer to website: http://www.nwr.noaa.gov/1habcon/habweb/habguide/bioptemplate_app_a.pdf which includes a discussion of the general life history of MCR steelhead.

Based on the life histories of MCR steelhead, the action agency determined that the ongoing operation and maintenance of the Deschutes River Basin Projects is not likely to adversely affect incubating eggs, juveniles, smolts, and adults. Based on information provided in the BA and developed during informal consultation, NMFS does not concur with the BOR's finding that the proposed project was NLAA because reduced flow levels in the lower Deschutes River during eight months of the year (October-May) resulting from the operation and maintenance of the projects cause a reduction in edge water rearing habitat.

Critical habitat for MCR steelhead was proposed on December 14, 2004 (69 FR 74572). Consultation was substantively completed at this point, so NMFS did not analyze effects to proposed critical habitat. If a final rule is published in the future designating critical habitat for MCR steelhead, the Bureau of Reclamation (BOR) should evaluate whether reinitiation of consultation is necessary

Table 13. References for additional background on listing status, critical habitat designation, protective regulations, and life history for MCR steelhead

Species ESU	Status	Critical Habitat Designation	Protective Regulations	Life History
Steelhead (*Oncorhynchus mykiss)*				
Middle Columbia River	Threatened; March 25, 1999; 64 FR 14517	February 16, 2000; 65 FR 7764* December 14, 2004, proposed critical habitat; 69 FR 74572	July 10, 2000; 65 FR 42422	Busby *et al.* 1996; ODFW and WDFW 1998

* On April 30, 2002, the United States District Court for the District of Columbia adopted a consent decree resolving the claims in the National Association of Homebuilders, *et al.* v. Evans, Civil Action No. 00-2799 (CKK) (D.D.C., April 30, 2002). Pursuant to that consent decree, the court issued an order vacating critical habitat designations for this species.

Middle Columbia River Steelhead. The Middle Columbia River (MCR) steelhead ESU, listed as threatened on March 25, 1999 (64 FR 14517), includes all natural-origin populations in the Columbia River Basin above the Wind River, Washington, and the Hood River, Oregon, including the Yakima River, Washington. This ESU includes the only populations of winter inland steelhead in the United States (in the Klickitat River, Washington, and Fifteenmile Creek, Oregon). Both the Deschutes River and Umatilla River hatchery stocks are included in the ESU, but are not listed.

General Life History. Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type.

In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby *et al.* 1996, Nickelson *et al.* 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson *et al.* 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson *et al.* 1992). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby *et al.* 1996, Nickelson *et al.* 1992), migrate to spawning areas, and then spawn in late winter or spring. Some adults do not, however, enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Multiple spawnings for steelhead range from 3% to 20% of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973), is required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966, Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood.

Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992).

Juveniles rear in freshwater from 1 to 4 years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after 2 years in freshwater (Busby *et al.* 1996). Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby *et al.* 1996). Age structure appears to be similar to other west coast steelhead, dominated by 4-year-old spawners (Busby *et al.* 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy *et al.* 1990, Pearcy 1992).

ESU Population Dynamics and Distribution. Life history information for MCR steelhead indicates that most fish smolt at 2 years of age and spend 1 to 2 years in salt water (*i.e.*, 1-ocean and 2-ocean fish, respectively). After re-entering freshwater, they may remain up to a year before spawning (Howell *et al.* 1985). Within the ESU, the Klickitat River is unusual in that it produces both summer and winter steelhead, and the summer steelhead are dominated by 2-ocean steelhead (most other rivers in this region produce about equal numbers of both 1- and 2-ocean steelhead).

Escapement to the Yakima, Umatilla, and Deschutes Subbasins have shown overall upward trends since 1995 (West Coast Salmon Biological Review Team 2003). The Yakima River is recovering from extremely low abundance in the early 1980s and is considerably below the interim recovery target. The John Day River probably represents the largest native, natural-spawning stock in the ESU. Estimates based on dam counts show an overall increase in steelhead abundance, with a relatively stable naturally-produced component. The West Coast Salmon Biological Review Team (2003) found that returns to the Yakima River, the Deschutes River, and portions of the John Day River had increased considerably since 1999 compared to the period from 1992-1997. NMFS, in proposing this ESU for listing as threatened under the ESA, cited low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline for naturally-producing stocks within the ESU.

Hatchery fish are widespread and stray to spawn naturally throughout the region. Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day rivers) to moderate (Umatilla and Deschutes rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks. One recent area of concern is the increase in the number of Snake River hatchery (and possibly wild) steelhead that stray and spawn naturally within the Deschutes River Basin. Studies have been proposed to evaluate hatchery programs within the Snake River Basin that experience high rates of straying into the Deschutes River and to make needed changes to minimize such straying to rivers within the MCR steelhead ESU.

The ESU is in the intermontane region and includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of rainfall annually (Jackson 1993). Vegetation is of the shrub-steppe province, reflecting the dry climate and harsh temperature extremes. Factors contributing to the decline of MCR steelhead include agricultural practices, especially grazing and water diversions/withdrawals. In addition, hydrosystem development has affected the ESU through loss of habitat above tributary hydro projects and through mortalities associated with migration through the Columbia River hydrosystem.

Deschutes River Basin Population Dynamics Distribution. The majority of this section was taken directly from the BA (BOR 2003). Nehlsen (1995) provided a fairly comprehensive review of historical steelhead runs and their environment in the Deschutes River Basin upstream from the Pelton-Round Butte Hydroelectric Project. Steelhead spawned in major tributaries of the upper Deschutes River above the Pelton-Round Butte Project (Squaw Creek and the Crooked River); historic occurrence of steelhead in the Metolius River is uncertain and equivocal (NPPC 1990; Lichatowich *et al.* 1998). Steelhead were documented up to 120 miles from the mouth of the Crooked River (Nehlsen 1995).

Fish passage for Chinook salmon and steelhead was attempted at the Pelton-Round Butte Project soon after its construction, with limited success. Passage of adults upstream was relatively successful, but from their upstream rearing habitats, downstream migrating smolts apparently became disoriented once they entered Lake Billy Chinook and did not move directly through the reservoir to an outlet. It became apparent in the late 1960s that upriver salmonid runs could not be sustained naturally with these facilities. Therefore, the efforts to maintain naturally-spawning salmonid populations upstream from Pelton-Round Butte were abandoned and hatchery compensation was initiated in 1968 (Nehlsen 1995). In 1970, Portland General Electric agreed to finance the operation of an anadromous fish hatchery at the base of Pelton-Round Butte Dam. The hatchery began operation in 1972 (NPPC 1990). However, the current FERC relicensing effort includes provisions for upstream and downstream fish passage at the Pelton-Round Butte Project, and the reintroduction of steelhead, Chinook salmon, and sockeye salmon (*O. nerka*) above the dams.

Deschutes River adult summer steelhead enter the lower river from June through October. Steelhead pass Sherars Falls from July through October, with peak movements normally occurring in late September. Summer steelhead spawn in the mainstem lower Deschutes River, the Warm Springs River system, Shitike Creek, Skookum Creek, Wapinitia Creek, Eagle Creek and Nena Creeks, the Trout Creek system, Bakeoven Creek system, and the Buck Hollow Creek system (CTWSR 1999). Warm Springs River is a significant steelhead producer, as is Shitike Creek (BOR 2003). Potential spawning habitat in the White River is limited to the lower 2 miles by an impassable falls. ODFW does not routinely survey the White River and is uncertain whether steelhead occur in this area (BOR 2003), although a 2001 Bureau of Land Management (BLM) and USFS biological assessment indicated that spawning occurs there (BLM and USFS

2001). The Warm Springs National Fish Hatchery operates a collection weir at RM 9 on the Warm Springs River, where it sorts migrating adult salmonids and retains sufficient fish for hatchery production. The hatchery releases wild steelhead back into the river to spawn naturally (BOR 2003). Good quality spawning habitat exists upstream from the Warm Springs National Fish Hatchery.

Spawning in the relatively warmer eastside tributaries, such as Trout Creek and Bakeoven Creek, occurs from January through mid-April. Spawning in the lower Deschutes River and the cooler westside tributaries such as Warm Springs River and Shitike Creek, may begin in mid-March and continues through May (Zimmerman and Reeves 2000a, CTWSR 1999). Based on spawning surveys on the mainstem Deschutes River, when water conditions allow, it appears that the majority of steelhead spawning occurs upstream of the White River. From 30 to 60% of steelhead spawning within the Deschutes Basin occurs in the Deschutes River[1]. Westside tributaries are generally colder than eastside tributaries since their flows mostly originate from snowmelt on the eastern slopes of the Cascades, while eastside tributaries are mostly groundwater fed (BOR 2003). Eastside tributaries also likely have reduced flows during the hotter part of the summer. Steelhead appear to be opportunistic and in some years ascend small tributaries during short periods of high water to spawn in late winter and spring. Zimmerman and Reeves (1997) found that intermittent tributaries like Tenmile Creek, a Trout Creek tributary, provide important rearing habitat for juvenile steelhead where they do not have to compete with resident rainbow trout. Fry observed in Tenmile Creek were larger than fry found in the Deschutes River. The majority of the juvenile steelhead rear for 2 years before smolting and emigrating to the ocean. However, smolt ages can vary from 1 to 4 years. Steelhead generally rear in the ocean for 2 years before returning to the Deschutes River system as adults to spawn.

Where resident and anadromous forms of *O. mykiss* co-occur, the relationship between these two forms has been questioned as to whether resident *O. mykiss* contribute to the population dynamics and abundance of anadromous *O. mykiss* and provide a buffer against steelhead extinction. The two forms represent genetically distinct populations or two "ecophenotypes" within a single gene pool (Zimmerman and Reeves 2000a). Zimmerman and Reeves (2000a) reported that in the Deschutes River, based on microprobe analysis of Sr/Ca (strontium/calcium) ratio in otoliths, steelhead and rainbow trout are reproductively isolated. That is to say, adult steelhead from the Deschutes River that they tested were progeny of steelhead females and resident rainbow trout were progeny of resident rainbow trout females. There was also spatial and temporal separation of spawning in these two forms (Zimmerman and Reeves 2000b). Zimmerman and Reeves (2000b) also found that mainstem Deschutes River rearing habitat was primarily used by rainbow trout progeny and the lower ends of intermittent tributaries were exclusively used by steelhead progeny. Although the majority of juvenile steelhead rear in tributaries, some juvenile steelhead do rear in the mainstem Deschutes River. The mainstem Deschutes is likely more important for rearing juvenile steelhead during low water years when

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[1] Telephone conversation with Steve Pribyl, Oregon Department of Fish and Wildlife (October 9, 2003) (regarding spawning distribution of MCR steelhead in the lower Deschutes River).

flows in tributaries are low. Juvenile salmonids prefer shallower water than adult fish, because it provides suitable velocities, access to food, and security from predators (Bjornn and Reiser 1991). Since shallow water habitat is very limited in the lower Deschutes River, the very edges of the river with overhanging vegetation are important for rearing.

Evaluating the status of wild Deschutes River summer steelhead is a complex task because four different groups of steelhead occur in this basin (Chilcote 1998, NMFS 2000b). They include hatchery fish produced within the basin at Round Butte Hatchery, hatchery strays from the Snake and upper Columbia River Basins, wild strays also from these upriver locations, and wild fish produced within the Deschutes River Basin. The Deschutes River also contains conspecific resident rainbow/redband trout (Behnke 1992).

NMFS (2000a) believes that one of the most significant sources of risk to steelhead in the MCR ESU is the recent and dramatic increase in the percentage of hatchery fish escapement in the Deschutes River Basin. ODFW has estimated from capture of adult steelhead at Sherars Falls (RM 42) that in recent years, the percentage of hatchery steelhead strays in the Deschutes River has exceeded 70%, and many of these are believed to be long-distance strays from outside the ESU, based on differential marking (BOR 2003). Coincident with this increase in the percentage of strays was a corresponding decline in the abundance of native wild steelhead in the Deschutes River. NMFS (2000a) stated that in combination with the increasing trend in hatchery fish in the Deschutes River, estimates of increased proportions of hatchery fish in the John Day and Umatilla River Basins pose a risk to native wild steelhead due to negative effects of genetic and ecological interactions with hatchery fish. The downriver transportation of juvenile hatchery steelhead from upriver locations may contribute to increasing numbers of strays in the Deschutes River (NPPC 1990).

The number of adult steelhead captured at the Sherars Falls trap has fluctuated substantially since 1977, with a substantial increase in 2001 (Table 14) (BOR 2003). In 2001, 3,904 hatchery and 957 wild steelhead were captured there compared to 1,635 hatchery and 931 wild steelhead in 2000. The proportion of hatchery to wild steelhead in the Deschutes River has increased substantially since 1977, with over 80% of the fish being hatchery fish since 1991, except for 1999 and 2000. In 2001, 80.31% of the 4,861 steelhead captured at the Sherars Falls trap were hatchery-origin, while 19.69% were wild. In 1995, 90.56% of the 1,950 steelhead captured were hatchery-origin, which was the highest for the period of record.

Adult steelhead escapement estimates for the Deschutes River demonstrate a significant increase in out-of-basin strays since the early 1990s (BOR 2003). The percentage of stray hatchery fish as determined by fin marks at Sherars Falls has exceeded 70% of the hatchery component from 1993 to 2000 but decreased to 67.7% in 2001 (Table 15); 32.3% of the hatchery fish were of Round Butte Hatchery origin. From 1988 to 1992, stray hatchery-origin steelhead at the Sherars Falls trap ranged from 32.8 to 67.4%. During the same period (1988 to 1992) the percentage of wild fish ranged from 14.9 to 27.4% (Table 14). While some of the stray steelhead that enter the Deschutes River are known to leave and return eventually to their streams of origin elsewhere in the Columbia Basin before spawning (preliminary findings from a tagging study by Bjornn and

Jepson [NMFS 2000a]), the evidence suggests that the majority of the stray steelhead migrating past Sherars Falls spawn in the Deschutes River Basin. ODFW estimated recently that the percentage of wild fish in the Deschutes Basin that are strays is about 3% (BOR 2003) (Table 16).

Straying has been observed during periods when the water of the Deschutes River is cooler than that of the Columbia River. The cooler water provides a thermal refugium for upstream-migrating adult steelhead. Straying behavior may occur as steelhead seek cooler water, it may be associated with transportation, and may be an evolutionary adaptation that enhances survival (NMFS 2000b).

Table 14. Wild and hatchery steelhead captured at the Sherars Falls trap

Year	Wild	Hatchery	Total	% Wild	% Hatchery
1977	673	744	1417	47.49	52.51
1978	437	772	1209	36.15	63.85
1979	386	1142	1528	25.26	74.74
1980	461	1102	1563	29.49	70.51
1981	686	778	1464	46.86	53.14
1982	362	320	682	53.08	46.92
1983	417	934	1351	30.87	69.13
1984	238	422	660	36.06	63.94
1985	364	767	1131	32.18	67.82
1986	412	1424	1836	22.44	77.56
1987	372	785	1157	32.15	67.85
1988	374	992	1366	27.38	72.62
1989	455	1287	1742	26.12	73.88
1990	294	801	1095	26.85	73.15
1991	293	1278	1571	18.65	81.35
1992	196	1120	1316	14.89	85.11
1993	190	991	1181	16.09	83.91
1994	55	398	453	12.14	87.86
1995	184	1766	1950	9.44	90.56
1996	299	2311	2610	11.46	88.54

Year	Wild	Hatchery	Total	% Wild	% Hatchery
1997	166	1218	1384	11.99	88.01
1998	391	1645	2036	19.20	80.80
1999	695	1939	2634	26.39	73.61
2000	931	1635	2566	36.28	63.72
2001	957	3904	4861	19.69	80.31
Information adapted from Table 7 and 8 (ODFW 2002).					

Table 15. Number and percentage of Round Butte Hatchery-origin and stray hatchery-origin summer steelhead as determined by fin mark, captured at Sherars Falls trap, by year (BOR 2003)

	Round Butte Hatchery		Stray Hatchery-Origin	
Trap Year	Number	% Total Catch	Number	% Total Catch
1988	665	67.2	324	32.8
1989	521	40.5	776	59.5
1990	352	44.0	448	56.0
1991	417	32.6	861	67.4
1992	506	45.2	614	54.8
1993	196	19.8	795	80.2
1994	118	29.7	280	70.3
1995	458	25.9	1308	74.1
1996	649	28.1	1662	71.9
1997	280	23.0	936	77.0
1998	423	25.8	1220	74.3
1999	465	24.0	1474	76.0
2000	483	29.6	1147	70.4
2001	1262	32.3	2642	67.7

Table 16. Number and percentage of wild, stray, and Round Butte Hatchery-origin summer steelhead returning to the Pelton trap, by run year

	Wild Origin		Stray Hatchery		Round Butte Hatchery	
Run Year	**Number**	**%**	**Number**	**%**	**Number**	**%**
81-82	245	11.3	156	7.4	1760	81.3
82-83	344	16.7	167	8.8	1547	74.6
83-84	814	17.3	1452	33.0	2439	49.7
84-85	603	12.9	795	17.0	3278	71.1
85-86	686	14.4	943	19.7	3153	65.9
86-87	467	10.7	1538	33.4	2640	57.6
87-88	160	6.6	796	32.1	1484	61.3
88-89	123	7.4	300	17.7	1247	74.9
89-90	136	9.1	524	35.2	829	55.7
90-91	82	7.4	428	35.8	606	56.8
91-92	101	4.4	849	36.7	1365	58.9
92-93	59	3.6	427	26.0	1157	70.4
93-94	65	12.0	288	53.0	190	35.0
94-95	27	2.0	642	53.0	753	45.0
95-96	32	1.6	976	48.6	1000	49.8
96-97	126	2.2	2001	34.9	3605	62.9
97-98	194	3.8	2459	48.3	2440	47.9
98-99	155	6.0	1284	49.9	1135	44.1
99-00	83	4.4	768	40.4	1050	55.2
00-01	114	4.1	1103	39.2	1593	56.7
01-02	282	3.2	3674	41.3	4942	55.5

Annual steelhead redd counts were implemented in 1988 on Trout Creek, and in 1990 on Buck Hollow and Bakeoven Creeks. Redd counts on these streams have exhibited an increasing trend from 1990 to 2002 (Tables 17, 18, and 19). In Buck Hollow Creek, although the same sites were not surveyed every year, early in the time series starting in 1990, redd counts were low, ranging from 8 to 85 from 1990 to 1996; from 1997 to 2002, redd counts increased and ranged from 110 to 445. The number of redds decreased to 221 in 2002. If one looks at one site such as the Powerline/Mouth site, the number of redds ranges from 7 in 1994 to 241 in 2001. Overall, the increase in number of redds from 1997 to 2002 compared to the number of redds from 1990 to 1996 seems to indicate an increase in the number of spawning steelhead. In Bakeoven Creek, there was also a low number of redds from 1990 to 1996 with a steady increase from 1997 to 2002, with a high of 480 redds in 2001, followed by a decrease to 214 in 2002. In Trout Creek, starting in 1994, redd numbers per mile are low until 2000, when the number increases dramatically from that seen from 1994 to 1999, reaching a high of 16.3 per mile in 2001, with a decrease to 13.3 in 2002. This is the same temporal pattern of recently increased numbers of redds documented in Buck Hollow and Bakeoven Creeks, although units differ. Increases in number of redds is likely due to improved stream habitat conditions and ocean conditions. These counts include redds from both wild and hatchery summer steelhead.

Table 17. Buck Hollow Creek summer steelhead redd survey results by year

Section	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Hauser/ Bronx	-	-	-	-	-	-	-	4	0	2	5	-	-
Bronx/ Finnegan	-	-	-	-	-	-	-	-	-	1	2	1	3
Finnegan/ Mays	-	-	-	-	-	-	-	-	-	5	5	39	1
Spears/ Bronx	-	-	-	-	-	-	5	-	-	-	-	-	-
Bronx/Mays	5	-	-	3	-	0	3	7	10	-	-	-	-
Mays/ Powerline	7	-	-	5	1	5	9	63	36	37	64	164	78
Powerline/ Mouth	73	72	34	40	7	64	48	62	133	107	34	241	-
Powerline/ Webb fence	-	-	-	-	-	-	-	-	-	-	-	-	139
Total	85	72	34	48	8	69	65	136	179	152	110	445	221
Information adapted from ODFW 2002 Table 11.													

Table 18. Bakeoven Creek summer steelhead redd survey results by year

Section	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sugarloaf	1	0	-	2	-	7	14	18	11	33	22	154	23
Powerline	21	8	9	19	13	13	21	39	57	56	61	326	191
Total	22	8	9	21	13	20	35	57	68	89	83	480	214

Section	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
All survey dates were in March except for 1993, 1994, and 1997 when surveys were conducted in April. Information adapted from ODFW 2002 Table 12.													

Table 19. Trout Creek summer steelhead redds per mile by year

Year	Miles Surveyed	Number of Redds	Redds Per Mile
1988	9.40	23	2.5
1989	10.50	23	2.2
1990	14.40	42	2.9
1991	16.90	16	1.1
1992	16.40	6	0.4
1993	28.20	15	0.5
1994	16.25	0	0.0
1995	18.25	8	0.4
1996	12.50	14	1.1
1997	23.50	50	2.1
1998	21.00	44	2.1
1999	22.95	59	2.6
2000	54.10	461	8.5
2001	36.60	595	16.3
2002	65.20	866	13.3
Starting in 1993, surveys were conducted only above the confluence with Foley Creek. Data should not be compared before and after 1993. 1996 data all downstream from Foley Creek. Information adapted from ODFW 2002 Table 13.			

NMFS has set interim abundance and productivity targets for naturally-produced Deschutes River steelhead population. The target is 6,300 naturally-produced spawners below Pelton Dam, and since the MCR steelhead ESU is below recovery levels, lambda will need to be greater than 1.0 over a 40-48 year period.[2] The NPPC (1990) noted that the objective for summer steelhead is to provide 5,000 to 11,000 fish for recreational and Tribal fisheries, and a spawning escapement of 10,000 natural spawners and 600 to 1,000 hatchery brood stock all through a

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[2] Letter from Bob Lohn, NMFS, to Frank L. Cassidy, Northwest Power Planning Council (April 4, 2002) (setting interim abundance and productivity targets).

return of 16,000 to 22,000 summer steelhead annually to the Deschutes River. These levels of wild and hatchery adult steelhead returns have not yet been achieved (Table 14).

Environmental Baseline in the Action Area

The environmental baseline is defined as "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 C.F.R. 402.02). In step 2, NMFS evaluates the relevance of the environmental baseline in the action area to the species' current status. In describing the environmental baseline, NMFS evaluates key habitat components and the listed Pacific salmon ESUs affected by the proposed action.

One of the most notable components of the environmental baseline in the action area is the presence of the Pelton/Round Butte hydroelectric project that limits anadromous fish access to the upper portion of the basin. As a result, anadromous fish can only access the lower 100.1 miles of the Deschutes River and its downstream tributaries. The construction of Pelton Dam and re-regulating dam began in 1956 and was completed in 1958, and Round Butte Dam was constructed between 1962 and 1964 (Nehlsen 1995). As noted above, passage of adults was successful at the project, but smolts were unable to successfully find their way out of Lake Billy Chinook, so hatchery compensation was initiated in 1968 (Nehlsen 1995). Since MCR steelhead are limited to the lower 100.1 miles of the Deschutes River, the environmental baseline description will focus on this portion of the action area.

The Pelton-Round Butte Project is a run-of-river project, which means that it is operated so that the outflow equals the inflow within ±10%. Language in the new FERC license currently undergoing consultation states that the licensees will hold river flows below the reregulating dam to within ±10% of the measured Project inflow under most conditions. Conditions or events where this criteria would not be followed include days with measured inflow in excess of 6,000 cfs or emergency situations. A flow of 6,000 cfs has been historically exceeded about 12% of the time over the period of record. Inflows of this magnitude occur during storm events or the spring runoff season. The licensees shall be allowed to not follow the run-of-river provision when inflows are above this level because the Pelton-Round Butte Project must be operated to ensure the structural safety of its facilities and to protect downstream life and property during flood events. Otherwise, the facilities will be operated in a run-of-river fashion that has a minimal effect on flow volumes.

The lower Deschutes River is a remarkably uniform and stable river (Fassnacht *et al.* 2002). Henshaw *et al.* (1914, cited in O'Connor *et al.* 1999) recognized the uniform and stable flows in the Deschutes River and O'Connor *et al.* (1999) attributed the steady flow of the Deschutes River to "the poorly integrated drainage system in the southern and western portions of the Deschutes Basin, and the substantial groundwater storage in the young volcanic fields along the flanks of the Cascade Range." Daily average streamflows in cfs in the lower Deschutes River on a monthly basis for the period 1990 to 2001 at USGS streamflow gaging stations at Madras and Moody, at RM 100.1 and 1.4, respectively, are shown in Table 18. The period 1990 to 2001 was selected to represent current conditions, and includes some wet, dry, and "normal" water years. This more recent time period does not include some extremely dry years that occurred in the 1930s, but does encompass a range of flow conditions and reflects current baseline environmental conditions and operations for this consultation. Table 20 illustrates the relatively uniform and stable flow regime in the lower Deschutes River. With inflows into the lower Deschutes River from several major and numerous minor tributaries, the measured flows at the USGS Moody gage are higher than at the Madras gage, as expected. Irrigation diversions from the lower Deschutes River are primarily from tributaries.

Table 20. Daily average streamflow (cfs) and exceedance flows on a monthly basis for the Deschutes River near Madras for water years 1990-2001

Gage Location	% Excee-dance	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Deschutes River - Near Madras													
Average		5185	5523	5378	5067	4456	4296	3968	3917	3955	4290	4699	5010
Near Madras	90%	3708	4053	4023	4055	3952	3906	3739	3637	3643	3424	3586	3566
	50%	3977	4305	4525	4591	4836	4775	4149	4081	3923	3777	3832	3773
	10%	5410	5714	7253	9600	8974	7732	7643	5807	5899	4863	4695	4911
Information from: http://www.wrd.state.or.us/													

Fassnacht (1997) notes that the stable nature of the lower Deschutes River is apparent in its channel morphology and vegetation growth. There are very few meander bends and point bars which are more common in active alluvial channels. The point bars that are present are very well vegetated, indicating that they are several years old. Alluvial fans from tributaries constrain the river and are very stable with mature vegetation covering them (Fassnacht 1997). As a result of this channel and flow stability, riparian vegetation is not subject to the scouring effects found in more flashy systems, and vegetation does not experience drought conditions during summer months due to the constancy of base flow (Minear 1999). Therefore, there are grasses, sedges, cattails, willows, and alder at the edge of the river that provide excellent overhead cover and complex edge rearing habitat. Shallow water juvenile habitat is a significant limiting factor in the lower Deschutes River, because of rapidly increasing depths along the banks, so the habitat complexity provided by the overhanging vegetation is very important to rearing salmonids. This complex habitat along the banks of the Deschutes River will be referred to as edge rearing habitat throughout the rest of the document.

Instream flow studies for the lower Deschutes River in the 1960s indicated that while flows in the lower Deschutes River may be mostly adequate to sustain anadromous salmonid populations (*e.g.*, steelhead), improved (or higher) flows would be beneficial to habitat maintenance and would increase usable spawning habitat (BOR 2003). The lower Deschutes River is fortunate to have fairly stable and uniform flows (NPPC 1990, Fassnacht *et al.* 2002). While drought may also have contributed to reduced steelhead production, this may be less important as a factor contributing to decline, partly because during the same time period the resident/redband trout population has apparently remained stable. There remains the concern by ODFW that there may be the loss in reproductive capacity of wild Deschutes River steelhead due to genetic mixing with large numbers of out-of-basin, out-of-ESU strays, as well as reduced survival of wild fish due to interactions between hatchery and wild steelhead (ODFW 2003).

Some human activities that have degraded aquatic habitats or affected native fish populations in the action area include stream channelization, elimination of wetlands, construction of dams and levees, construction of roads, timber harvest, water withdrawals, unscreened water diversions, agriculture, livestock grazing, urbanization, outdoor recreation, fire exclusion/suppression, artificial fish propagation, fish harvest, and introduction of non-native species (Henjum *et al.* 1994; Rhodes *et al.* 1994; National Research Council 1996; Spence *et al.* 1996; and Lee *et al.* 1997). Land management and development activities have: (1) Reduced connectivity (*i.e.*, the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields, degrading spawning and rearing habitat; (3) reduced large woody material that traps sediment, stabilizes streambanks, and helps form pools; (4) reduced vegetative canopy that minimizes solar heating of streams; (5) caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations; (6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; and (7) altered floodplain function, water tables and base flows (Henjum *et al.* 1994; McIntosh *et al.* 1994; Rhodes *et al.* 1994; Wissmar *et al.* 1994; National Research Council 1996; Spence *et al.* 1996; and Lee *et al.* 1997).

Lower Deschutes Habitat Baseline Indicators

Temperature.. Water temperature data for the lower Deschutes River near Madras, Oregon, for the period 1972 to 1988 were compiled by Huntington *et al.* (1999) and provide a reasonably comprehensive assessment of recent water temperatures (Table 21). These average water temperatures are less than the ODEQ criteria of 64°F (17.8°C) for anadromous salmonids.

The White River below Lower Falls is listed as exceeding the water temperature standard of 64˚F (17.8˚C) for 100, 58, and 72 days in 1992, 1993, and 1994, respectively. However, ODFW has not documented use of the lower 2 miles of the White River by steelhead. Raymond *et al.* (1998) reported that the river temperature during their May study period averaged 12.5˚C and about 16˚C in July. Deschutes River water temperatures increased downstream from the Pelton Reregulating Dam to the mouth by about 2.5˚C in May and September, and by 7.5˚C in July. Water temperatures for spawning, incubation, and early rearing are suitable in this reach of the river. The Deschutes River from its mouth upstream to the White River is 303(d) listed for pH and summer water temperature.

Table 21. Mean weekly water temperatures for the lower Deschutes River at the USGS gage near Madras, Oregon, from 1972-1988

Month	Number of Weeks	Mean Weekly	Standard Error
October	54	12.5°C	0.10
November	59	10.3°C	0.10
December	61	8.1°C	0.11
January	63	6.6°C	0.09
February	60	6.2°C	0.07
March	68	6.9°C	0.08
April	68	8.0°C	0.09
May	68	9.6°C	0.10
June	69	11.3°C	0.13
July	62	12.7°C	0.14
August	58	13.5°C	0.11
September	52	13.6°C	0.09
Data extracted from Huntington *et al.* 1999, Table 6.			

Sediment/Turbidity. O'Connor *et al.* (2002) provide an extensive review of sediment sources and the sediment budget of the Deschutes River Basin. There are low rates of sediment delivery to the Deschutes River due to steady streamflows with low sediment supply. Sediment recruitment has been reduced by diversions, lakes, and dams. Sources of sediment to the lower Deschutes River are limited (Fassnacht and Grant 1995). Trout Creek, Warm Springs River, and the White River are likely the principal sources of sediment to the lower Deschutes River (O'Connor *et al.* 2002). The White River gaging station at Tygh Valley recorded an annual suspended sediment load of 108,821.96 tons during the 1983 water year (Fassnacht and Grant 1995), one of the major contributors of sediment to the lower Deschutes River since sediment contributions from the Crooked River are now for the most part retained in Lake Billy Chinook. The White River transports large quantities of glacial material to the lower Deschutes River (BOR 2003). The White River has a major influence on downstream aquatic habitat in the Deschutes River, because of the tremendous amount of sediment it contributes. The White River confluence is at river mile 46.4 on the Deschutes River.

Chemical Contamination/Nutrients. Water quality in the lower Deschutes River in large part is driven by operation of the Pelton-Round Butte Project and the seasonal dynamics of environmental conditions in the reservoirs. The water quality in the Pelton-Round Butte Project reservoirs is generally good, even though there are phosphorous and silicon inputs from natural sources in tributaries to the reservoirs and introduced nitrogen from upstream anthropogenic activities that create seasonal algal blooms that somewhat degrade reservoir water quality. The reservoirs of the Pelton-Round Butte Project retain water from the nutrient rich tributaries, the Deschutes, Crooked, and Metolius Rivers in the epilimnion during the summer when biological activity is at its peak, and discharge cooler water with lower nutrient concentrations downstream. Groundwater recharge offsets some of the adverse effects of upstream uses on water quality in the reservoirs.

A 3-year limnological study of the Pelton-Round Butte Project found that the concentration of nitrogen in the Deschutes River downstream from the project was lower than the expected concentration (PGE 2002). Pollutants from agricultural activity and private land use in the Wapinitia Project area have a minimal affect on water quality in the lower Deschutes River.

From the Pelton Reregulating Dam to the mouth of the White River, the Deschutes River is on the Oregon DEQ 303(d) list of water quality limited waterbodies because it fails to meet the dissolved oxygen standard for spawning salmonids (11 mg/L or 95% saturation) from 1 October to 31 July (Lewis and Raymond 2000). Dissolved oxygen levels have sometimes been below the existing standard for coldwater aquatic life (8 mg/L or 90% saturation) from mid-summer to early fall (Lewis and Raymond 2000). Lewis and Raymond (2000) reported that mean ambient dissolved oxygen concentrations for four sites in the Deschutes River from just downstream from the Pelton Reregulating Dam to Trout Creek increased from 7.46 to 9.22 mg/L in September 1999. Under various spill scenarios, dissolved oxygen concentrations increased, but not proportional to the volume of spill. Spill provided some re-aeration of the river water, but the effect diminished progressively downstream.

Physical Barriers. Access to the upper Deschutes River and other tributaries was eliminated with the construction of Pelton Dam. Except for some attempts at passing adult fish around the Pelton-Round Butte Project in the 1960s and an ongoing hatchery steelhead operation, steelhead are now restricted to the lower Deschutes River downstream from Pelton Reregulating Dam at RM 100.1. Steelhead have unrestricted access to the major and minor tributaries to the lower Deschutes River, such as Shitike Creek, Warm Springs River, Trout Creek, Bakeoven Creek, and Buck Hollow Creeks.

Substrate. Aney *et al.* (1967) reported that the lower Deschutes River is mostly coarse rubble, boulders, and bedrock. They note that in the 100-mile lower river, gravel areas for suitable fish spawning make up less than 1% of the total stream bottom. The highest amount of spawning gravel is in the reach of the lower river downstream from the Pelton-Round Butte Complex to Shitike Creek, where about 9% of the total streambed is suitable for spawning. Areas downstream from Shitike Creek have substantially less suitable spawning gravels as a percentage of the total streambed. Tributaries downstream contribute sediment that reduces the quality of spawning habitat. The White River and other tributaries contribute substantial sediment in the form of silt and sand. Some areas of the river near the mouth and between Maupin and Twin Tunnels is nearly all basalt bedrock.

Large Woody Debris. Large woody debris >50 feet in length is sparse in the lower Deschutes River (Minear 1999). In 1995, 13 occurrences of very large wood were recorded in the 100 miles of the lower Deschutes River, compared to 7 pieces in 1944. Most of this wood was in the main channel of the river, and more was associated with curves than straight sections of the channel. Large wood (>13 feet in length), not including estimated pieces of wood in logjams and rootwads, was more abundant in the upper 30 miles of the lower river and less so between RM 50 and 70, and had an overall density of 31.5 pieces per river mile (Minear 1999). By including the estimated amount of wood pieces in logjams and rootwads, the amount of wood increased to 53.4 pieces per mile. Most of this large wood (88%) occurred in the main channel. However, after the 1996 flood event, less wood was present in the upper 50 miles of river compared to the lower 50 miles of river, and there was less wood overall, 24.5 pieces per river mile compared to 31.5 before the flood. Minear (1999) described the source of large woody debris to the lower Deschutes River, its composition, and stated that the results of her study indicated that there is a greater abundance of large wood in the lower Deschutes River than is typical of other streams in the region. One possible reason for this is that the constant base flow of the river does not subject the riparian vegetation to annual periods of desiccation that occurs in many other high desert streams, so the relatively abundant riparian vegetation, including white alder and cottonwood, contribute to a greater supply of in-channel wood.

Width/Depth Ratio. The channel width of the lower Deschutes River averaged 219 feet and increased with distance downstream (Minear 1999). Aney *et al.* (1967) reported a lower Deschutes River average width of 236 feet, with a range from 30 to 560 feet. Sherars Falls is the most constrained point on the lower river. No data on depth in the Deschutes River were available comparable to the width information reported by Aney *et al.* (1967).

Streambank Condition. Over 100 years of livestock grazing seriously degraded the streambanks of the lower Deschutes River and caused extensive loss of riparian vegetation. Grazing has been excluded from the lower 25 miles of the lower river since 1985, and riparian vegetation has increased substantially since that time (Minear 1999). Also, in the 1990s Bureau of Land Management grazing strategies along the Deschutes River were changed from season-long grazing to late-winter/early-spring grazing which has led to improved riparian condition. At 14 sites along the lower Deschutes River, from RM 87.0 (the mouth of Trout Creek) to RM 30.5, Minear (1999) reported improved riparian conditions at 10 sites, and no change at 4 sites, relative to historic conditions documented in old photographs. Some of the riparian white alder and cottonwood contribute to the large wood found in the river.

Floodplain Connectivity. The river is mostly constrained in a deep canyon and has a relatively limited floodplain.

Change in Peak/Base Flows. The Deschutes River is unique in that it is a high desert stream originating from snowmelt on the east side of the Cascade Mountains, with some snowmelt-sourced tributaries on the west side and some smaller groundwater-fed tributaries on the east side. Fassnacht *et al.* (2002) reported that the lower Deschutes River has a relatively uniform and stable flow. One report indicated that the difference from minimum to maximum flow at the mouth of the Deschutes River was only about 6 times, indicating a very stable and steady flow. Some large floods have occurred historically; in recent times large flood events have occurred in 1964, 1996, and 2000, with 1996 being the largest with an instantaneous flow of 70,300 cfs on 8 February. Table 20 shows daily mean flows in cfs on a monthly basis on the Deschutes River near Madras along with 10, 50, and 90% exceedance values.

Increase in Drainage Network. Since the lower Deschutes River is a component of a relatively stable watershed and is constrained in a relatively steep and stable canyon, there is little opportunity for any increase or change in the drainage network at this time.

Road Density and Location. The lower 25 miles of the Deschutes River is nearly roadless; there is a gravel road on the east side restricted to authorized vehicle use only, but open to hikers, bicyclists, and horseback riders. An unrestricted road exists from near Sherars Falls to Mack's Canyon for recreational access to the river, and there is a paved highway along the river from Sherars Falls to Maupin. There are some gravel access roads upstream from Maupin, but in general the river has limited road access.

Disturbance History. In the early part of the 20th century, two competing companies attempted to build railroads up both sides of the canyon from the Columbia River. The railroad curently operates mostly on the west bank to approximately 12 miles north of Madras. Sidecasting of material during railroad construction may have altered the riverine geomorphology, but it is unknown to what degree this occurred. Minear (1999) indicated that the railroad construction may have been the greatest anthropogenic impact in history on the lower Deschutes River. Livestock grazing has disturbed the watershed, especially the riparian area, as has road construction. Riparian condition along the lower Deschutes River has improved with the restriction of livestock grazing in some reaches of the lower river and the changing of grazing strategies from season-long grazing to late-winter/early-spring grazing (BOR 2003).

Other Section 7 Consultations in Action Area. Activities associated with the lower Deschutes River that have undergone Section7 consultation are limited to BLM activities that include: The guide and outfitter program; emergency boat removal; road maintenance; trail maintenance; campground, day use area, and boat ramp maintenance; and annual MCR steelhead spawning surveys. Incidental take associated with these activities consists of the disturbance of spawning adult steelhead, frightening of juvenile MCR steelhead from cover so they are more susceptible to predation, recreationists potentially stepping on redds, and some minimal amount of take may also result from the transport of sediment to the Deschutes River resulting from routine road maintenance. These effects are largely unquantifiable. In addition, the BLM has completed informal consultation on reopening the Jones Canyon boat ramp. The FERC relicensing of the Pelton/Round Butte Project is undergoing consultation. The relicensing of this project includes providing fish passage over the project.

Other Factors Influencing MCR Steelhead. Although the environmental baseline is limited to the action area, it is helpful to understand effects to MCR steelhead that occur outside of the action area. Pacific salmon populations are substantially affected by variation in the freshwater and marine environments. Ocean conditions are a key factor in the productivity of Pacific salmon populations. Stochastic events in freshwater (flooding, drought, snowpack conditions, volcanic eruptions, *etc.*) can play an important role in a species' survival and recovery, but those effects tend to be localized compared to the effects associated with the ocean. The survival and recovery of these species depends on their ability to persist through periods of low natural survival due to ocean conditions, climatic conditions, and other conditions outside the action area. Freshwater survival is particularly important during these periods because enough smolts must be produced so that a sufficient number of adults can survive to complete their oceanic migration, return to spawn, and perpetuate the species. Therefore it is important to maintain or restore key habitat components to sustain the ESU through these periods. Additional details about the importance of freshwater survival to Pacific salmon populations can be found in Federal Caucus (2000), NMFS (2000c), and Oregon Progress Board (2000).

Analysis of Effects

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 C.F.R. 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing the value of habitat for meeting the species' biological requirements. Indirect effects are defined in 50 C.F.R. 402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species or critical habitat of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification" (50 C.F.R. 403.02). "Interdependent actions are those that have no independent utility apart from the action under consideration" (50 C.F.R. 402.02).

In step 3 of the jeopardy analysis, NMFS evaluates the effects of proposed actions on listed species and seeks to answer the question of whether the species can be expected to survive with an adequate potential for recovery.

Habitat Effects. The effects discussion will be focused on the lower Deschutes River, since the upstream limit of MCR steelhead distribution is the Pelton/Round Butte hydroelectric project. The BA on the continued operation and maintenance of the Deschutes River Basin projects and the supplemental information provided by the BOR on January 20, 2004 provide an analysis of the effects of the proposed action on listed species in the action area. The analysis uses the MPI and procedures in NMFS (1996), the information in the BA, including modeled flow effects of the proposed action, and supplemental information to evaluate elements of the proposed action that have the potential to affect the listed fish or key habitat components. NMFS has used additional information developed as part of the FERC relicensing process to evaluate the implications of the proposed action flow effects (PGE 2001).

The primary effects on MCR steelhead resulting from the ongoing operation and maintenance of the Deschutes River Basin projects are flow related. In the BA, the BOR evaluated project effects by modeling and comparing flows resulting from two scenarios using the MODSIM model. The first scenario modeled flows resulting from implementation of the proposed action ("with BOR"), and the second scenario modeled flows that would result without the proposed action ("without BOR"). The "without BOR" scenario represents the hydrology without operating BOR facilities, including Crane Prairie, Wickiup, Haystack, Prineville, and Wasco Reservoirs and Dams, North Unit Main Canal, and Crooked River Feed Canal. In addition, the "without BOR" scenario represents the hydrology without the following interrelated and interdependent actions: (1) Diversion of Crane Prairie, Haystack, and Wasco Reservoir storage water, and (2) diversion of natural flow water by the North Unit Main Canal, the Crooked River Feed Canal, and the Crooked River Pumping Plant. In the "without BOR" scenario, non-BOR facilities are still operated, including Ochoco and Crescent Lake Reservoirs and Dams, Walker Canal, Arnold Canal, Central Oregon Canal, Bend Feed Canal, North Canal (Pilot Butte), Tumalo, Lone Pine, and Swalley Irrigation Districts, and the Pelton-Round Butte Hydropower Complex. All actions associated with Ochoco Reservoir are still occurring in the "without BOR" scenario, due to its OID ownership. However, Ochoco Reservoir is drawn on more heavily in the "without BOR" scenario because of the removal of Prineville Reservoir.

Flows for the two scenarios were modeled at five locations on the Deschutes River including: Immediately below Wickiup Reservoir, below Bend, near Culver, near Madras, and at Moody; and at two locations on the Crooked River including: Below Bowman Dam and below the NUID pumps at Terrebonne. For this effects analysis, emphasis will be placed on flow effects on the Deschutes River near Madras which is downstream of the Pelton/Round Butte Project. One way to display the effects of the proposed action on streamflows is to compare the modeled average monthly flows for the "with BOR" scenario to the "without BOR" flows at the average monthly 10, 50, and 90% exceedance levels. Table 22 shows modeled average monthly flows at these exceedance levels for the two scenarios on the Deschutes River near Madras.

Table 22. Modeled flows in the Deschutes River near Madras, Oregon

Percent Exceedance	With Reclamation (cfs)	Without Reclamation (cfs)	Flow Effects due to the Proposed Action (cfs)	Percent Change in Flows due to Proposed Action
October				
10	4928	5337	-409	-7.66
50	4201	4593	-392	-8.53
90	3719	4098	-379	-9.25
November				
10	5420	6133	-713	-11.63
50	4635	5208	-573	-11.00
90	4268	4701	-433	-9.21
December				
10	6372	6956	-584	-8.40
50	5144	5526	-382	-6.91
90	4156	4620	-464	-10.04
January				
10	6883	7356	-473	-6.43
50	5395	5652	-257	-4.55
90	4171	4559	-388	-8.51
February				
10	7816	8292	-476	-5.74
50	5548	6001	-453	-7.55
90	4174	4415	-241	-5.46
March				
10	7873	8636	-763	-8.84
50	5170	5931	-761	-12.83
90	4061	4748	-687	-14.47
April				
10	6956	7583	-627	-8.27
50	5090	5822	-732	-12.57
90	3900	4260	-360	-8.45

Percent Exceedance	With Reclamation (cfs)	Without Reclamation (cfs)	Flow Effects due to the Proposed Action (cfs)	Percent Change in Flows due to Proposed Action
May				
10	5631	6213	-582	-9.37
50	4399	4734	-335	-7.08
90	3707	3835	-128	-3.34
June				
10	5199	5759	-560	-9.72
50	4181	4231	-50	-1.18
90	3749	3615	134	3.71
July				
10	4863	5110	-247	-4.83
50	4212	4119	93	2.26
90	3861	3716	145	3.90
August				
10	4649	4778	-129	-2.70
50	4074	3963	111	2.80
90	3653	3474	179	5.15
September				
10	4623	4755	-132	-2.78
50	4007	3999	8	0.20
90	3522	3432	90	2.62

Although the approach of modeling and comparing the “with BOR” and “without BOR” scenarios does not reveal the variability inherent in the actual flows, or distinguish flow differences on a year by year basis, this approach does reveal the magnitude and trends of the flow effects of the proposed action. As displayed in Table 22, the greatest effect of the proposed action is a reduction in average monthly flows from October through May. At the 50% exceedance level the reduction in average monthly flows due to the proposed action ranges from 4.55 % (257 cfs) in January to 12.83 % (761 cfs) in March. The “with BOR” scenario also results in a small reduction in the 50% exceedance average monthly flow for June of 1.18%. The “with BOR” scenario results in an increase in the 50% exceedance average monthly flows for July and August of 2.26 and 2.80 %. These increases function to provide some additional edge rearing habitat in July and August, and also function to moderate summer water temperatures.

Edge rearing habitat consists of that habitat along the banks of the lower Deschutes River with complex riparian vegetation consisting of grasses, sedges, rushes, cattails, willows, and alder.

The reduction in flow from October through May alters the availability of edge rearing habitat and spawning habitat. Decreased flows result in a lesser amount of vegetated complex edge rearing habitat being inundated. PGE (2001) documents the change in water surface elevation, total width, and wetted perimeter at various flows at five sites between the Pelton/Round Butte Project and Trout Creek. Changes are documented at 500 cfs increments for flows between 3,500 cfs and 8,000 cfs. As noted above in the environmental baseline section, shallow water habitat is limited, but what is available is of high quality. For this analysis to determine the degree to which edge rearing habitat is affected by changes in flow, the focus was placed on the change in wetted perimeter. Since changes in wetted perimeter are only documented for 500 cfs increments in the PGE study, the results do not correspond perfectly to the modeled flow scenarios. Therefore, changes in wetted perimeter at 500 cfs increments were adjusted according to the modeled flow reductions. For example, the modeled flow reduction of 392 cfs in October is 78.4% of 500cfs, so the change in wetted perimeter of 2.97 feet from 4,500 cfs to 4,000 cfs was multiplied by 0.784 to get a more accurate change in wetted perimeter of 2.33 feet due to the proposed action. The adjusted change in wetted perimeter due to the proposed action ranges from 1.66 feet in December to 3.88 feet in November.

The five sites analyzed in the PGE study span a distance of 7.8 miles (41,184 feet) on the lower Deschutes River, from Trout Creek upstream to the reregulating dam. The effect of the proposed action on edge rearing habitat was determined by calculating the area of river edge bottom that would be dried up at various flows. This was done by averaging the change in wetted perimeter for various flows across the five sites and multiplying it by 41,184 feet (7.8 miles). The result is an area representing the reduction in edge rearing habitat as displayed in Table 23.

Table 23. Edge rearing habitat change at different flow levels on 7.8 miles of the lower Deschutes River between the Pelton/Round Butte Project and Trout Creek

Month	Avg. Monthly 50% Exceedance Flow w/o BOR (cfs)	Avg. Monthly 50% Exceedance Flow "with BOR" (cfs)	Comparison Flow w/o BOR from PGE Study (cfs)	Comparison Flow "with BOR" from PGE Study (cfs)	Reduction in Edge Rearing Habitat for 500 cfs increments (square feet)	Adjusted Reduction in Edge Rearing Habitat (square feet)
October	4,593	4,201	4,500	4,000	122,316	95,958
November	5,208	4,635	5,000	4,500	139,614	159,793
December	5,526	5,144	5,500	5,000	89,781	68,365
February	6,001	5,548	6,000	5,500	87,310	79,073
March	5,931	5,170	6,000	5,000	177,091	134,671
April	5,822	5,090	6,000	5,000	177,091	129,317

*January was not included, because PGE study flows were not similar enough for comparison.

Table 21 shows that a significant reduction in edge rearing habitat in at least 7.8 miles of the lower Deschutes River results from a reduction in flows. To put it into perspective, over these 7.8 miles, the reduction in edge rearing habitat area created by a reduction in average monthly flows under the "with BOR" scenario ranges from 68,365 square feet in December to 159,763 square feet in November. This is a reduction representing only 7.8 miles of the lower Deschutes River, while the lower Deschutes River action area is 100 miles in length, therefore reductions in habitat are likely to be considerably greater. Extending these reductions downstream to the mouth would result in a total reduction in edge rearing habitat ranging from 883,566 square feet in December to 2,048,629 square feet in November. As edge rearing habitat is reduced, juvenile MCR steelhead occupying that habitat will be forced to seek out new habitat, and competition with juvenile resident rainbow trout for remaining habitat will increase. While seeking new habitat juvenile steelhead will become more vulnerable to predation. Some juvenile steelhead may be forced to occupy below optimal habitat resulting in reduced growth or increased risk to predation.

Although, according to Table 21, the reduction in juvenile edge rearing habitat resulting from the "with BOR" scenario is greatest in March and April, the greatest effect to juvenile MCR steelhead likely occurs in October and November when flows are lower. As documented in the environmental baseline, there are grasses, sedges, rushes, cattails, willows, and alder up to the edge of the river that provide excellent overhead cover and complex edge rearing habitat. This vegetation is immediately adjacent to the river during low flows (3,500-3,800 cfs),[3] so a

[3] Flow values were selected based on visual observation of available edge rearing habitat at 3,700 cfs and FERC relicensing minimum October and November target flows on a weekly basis of 3,800 cfs.

reduction in flow completely dries out some of this habitat. At higher flows (>5,500 cfs), this complex vegetation would be inundated so a reduction in flow would decrease the depth around this vegetation but not completely dry it out. Therefore, the effect of a decrease in flow resulting from the proposed action in October and November, when flows are relatively low, is of a greater magnitude than a reduction at other times of the year when flows are higher.

Changes in flow volume alters the availability of steelhead spawning habitat. PGE (2001) contains an analysis of the variation in available steelhead spawning area with flow variations at six cross-sections in active spawning areas between the Pelton/Round Butte Project and Trout Creek. Availability of spawning area was based on suitable spawning depth (13 to 33 inches) and suitable spawning velocity (1.25 to 3.3 feet per second). Spawning area was evaluated at 1,000 cfs increments starting at 3,500 cfs and going up to 6,500 cfs. As flow increased from 3,500 cfs to 4,500 cfs spawning area increased at three of the cross sections and decreased at three of the cross sections. As flow increased from 4,500 cfs to 5,500 cfs spawning area increased at one cross section, decreased at three cross sections, and stayed approximately the same at two cross sections. As flow increased from 5,500 cfs to 6,500 cfs spawning area increased at one cross section and decreased at five cross sections. Based on these results, there is not a clear direct relationship between flow and available spawning area. In fact, only half of the cross sections showed an increase in spawning area with a flow increase from 3,500 cfs to 4,500 cfs, and above 4,500 cfs flow increases generally resulted in a decrease in spawning area. When spawning is occurring in March, April, and May in the lower Deschutes, modeled average monthly flows at the 50% exceedance level for the "with BOR" scenario are 5,170 cfs, 5,090 cfs, and 4,399 cfs. The PGE (2001) available spawning area analysis indicated that an increase in flows over these levels would likely decrease available spawning area, so the reduction in flows "with BOR" may actually increase available spawning area.

Based on the effects to juvenile edge rearing habitat described above, the proposed action will have a negative effect on the survival and recovery of MCR steelhead.

Cumulative Effects. Cumulative effects are defined in 50 C.F.R. 402.02 as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." These activities within the action area also have the potential to adversely affect the listed species and critical habitat. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being reviewed through separate Section7 consultation processes. Federal actions that have already undergone Section7 consultations have been added to the description of the environmental baseline in the action area.

The Endangered Species Consultation Handbook describes this standard as follows: indicators of actions 'reasonably certain to occur' may include, but are not limited to approval of the action by state, Tribal or local agencies or governments (*e.g.*, permits, grants); indications by state, Tribal or local agencies or governments that granting authority for the action is imminent; project sponsors' assurance the action will proceed; obligation of venture capital; or initiation of contracts. The more state, Tribal or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less there is a reasonable certainty the project will be authorized.

There are, of course, numerous non-Federal activities that have occurred in the action area in the past, which have contributed to both the adverse and positive effects of the environmental baseline. This step of the analysis for application of the ESA Section7(a)(2) standards requires the consideration of which of those past activities are "reasonably certain to occur" in the future within the action area.

First of all, any of these actions that involve Federal approval, funding, or other involvement are not considered "cumulative effects" for this analysis (see ESA definition, above). This Federal involvement will trigger ESA Section7(a)(2) consultation in the future. Once the consultation on those actions is completed the effects may be considered part of the environmental baseline, consistent with the ESA regulatory definition of "effects of the action" (50 C.F.R. 402.02). Thus, for example, state efforts to improve water quality in compliance with the Federal Clean Water Act would not be considered because of the involvement of the EPA, until separate ESA consultations are completed. Other examples include irrigation water withdrawals involving the Forest Service (right-of-way permits for irrigation canals) or agricultural practices that receive Federal funding through the U.S. Department of Agriculture.

Next, actions that do not involve Federal activities must meet the "reasonably certain to occur" test for NMFS to consider their effects in this Opinion. NMFS finds that few, if any, of the future adverse or beneficial state, Tribal or private actions qualify for consideration in this analysis as "cumulative effects." One exception is the proposed amendment to the Upper Deschutes, Crooked, and Metolius River Subbasin Fish Management Plans by ODFW. The amendment is proposed in support of the reintroduction of anadromous fish above the Pelton/Round Butte Project as part of the FERC relicensing process.

Economic diversification has contributed to population growth and movement, and this trend is likely to continue. Such population trends will result in greater overall and localized demands for electricity, water, and buildable land in the action area; will affect water quality directly and indirectly; and will increase the need for transportation, communication, and other infrastructure. In particular, the population of Bend and the surrounding area is increasing. According to the U.S. Census Bureau, from April 1, 2000 to July 1, 2001 the population of Deschutes County increased by 5.7% while the population of the State of Oregon increased by only 1.5%. The impacts associated with these economic and population demands will probably affect habitat features such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect will likely be negative, unless carefully planned for and mitigated.

Conclusions

The fourth step in NMFS' approach to determine jeopardy is to determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival and recovery in the wild. For the jeopardy determination, NMFS uses the consultation regulations and, where appropriate, the Habitat Approach (NMFS 1999) to determine whether actions would further degrade the environmental baseline or hinder attainment of PFC at a spatial scale relevant to the listed ESU. The analysis must be applied at a spatial resolution wherein the actual effects of the action on the species can be determined.

Based on the habitat effects described above, the proposed action will not appreciably reduce the survival and recovery of ESA-listed species. As described above in the effects section, the ongoing operation and maintenance of the Deschutes Basin Projects will reduce juvenile MCR steelhead edge rearing habitat from October through May. However, the greatest effect is realized in October and November at low flows when accessibility to the most complex edge rearing habitat along the banks of the lower Deschutes River is reduced. Flows are high enough during the remaining months to provide access to the most complex edge rearing habitat. The reduction of flows in the lower Deschutes River during March, April, and May does not reduce available spawning habitat and may actually increase available spawning habitat. Finally, the majority of juvenile MCR steelhead rear in the tributary streams while juveniles rearing in the Deschutes River are primarily resident rainbow trout. NMFS does not find any greater mainstem Columbia River effects than those described in the FCRPS Opinion. In reaching these determinations, NMFS used the best scientific and commercial data available.

After reviewing the current status of the listed species, the environmental baseline for the action area, the effects of the proposed actions, and cumulative effects in the action area, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of MCR steelhead.

Conservation Recommendations

Conservation recommendations are defined as "discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information" (50 CFR 402.02). Section 7 (a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. The conservation recommendations listed below are consistent with these obligations, and therefore should be implemented by the action agency.

1. The BOR should coordinate with COID, NUID, Arnold ID, OID, and JFDIC to plan and implement water conservation measures.

2. The BOR should permanently allocate a portion of the uncontracted volume of Prineville Reservoir for fisheries benefits.

3. The BOR should actively participate in planning efforts to reestablish spawning populations of anadromous fish throughout the Deschutes Basin upstream of the Pelton/Round Butte Project. The BOR should assist efforts to provide fish passage

through the Pelton/Round Butte Project's dams and reservoirs and, in anticipation of future passage, begin restoring anadromous fish habitat in upstream areas.

For NMFS to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit ESA-listed salmon and steelhead or their habitats, NMFS requests notification of the achievement of any conservation recommendations when the BOR submits its annual monitoring report.

Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required if: (1) The amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending conclusion of the reinitiated consultation; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; (4) a new species is listed or critical habitat is designated that may be affected by the action. In addition, for this action, consultation must be reinitiated if fish passage is established at the Pelton/Round Butte Project;[4] or (2) BOR and NMFS determine that reinitiation is necessary after reviewing the Deschutes River Basin Projects 10 years after the signature date of this document.

Incidental Take Statement

Section 9(a)(1) of the ESA prohibits the taking of ESA-listed species without a specific permit or exemption. Protective regulations adopted pursuant to Section 4(d) extends the prohibition to threatened species. Among other things, an action that harasses, wounds, or kills an individual of an ESA-listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 C.F.R. 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 C.F.R. 402.02). Section 7(o)(2) exempts any taking that meets the terms and conditions of a written incidental take statement from the taking prohibition.

Amount or Extent of Take

NMFS expects take to occur because of proposed actions that will harm or harass individuals of the ESUs considered in this consultation that are likely to be present in the action area during part of the year when some effects of the proposed action will occur. Although NMFS expects the habitat-related effects of these actions to cause some level of incidental take within the action area, this take cannot be accurately quantified as a number of fish taken. In such circumstances, NMFS provides a habitat surrogate to quantify the extent of incidental take. The habitat

[4] Fish passage is considered to be established when the first smolts to be successfully passed downstream through the Pelton/Round Butte Project return as adults and are passed above the project to spawn naturally.

indicator used to define the extent of take is the reduction in edge rearing habitat throughout the length of the lower Deschutes River. In particular, the continued operation and maintenance of the Deschutes River Basin Projects will result in reduced survival and production owing to a reduction in area of edge rearing habitat for the lower Deschutes River between the Pelton/Round Butte project and the mouth (100 miles) of up to 1,230,231 square feet in October and 2,048,629 square feet in November. Authorized take is limited to the reduced juvenile survival and condition resulting from the loss of that rearing habitat area. If the proposed action results in more than this amount or extent of take, the action agency must reinitiate consultation. The authorized take includes only take caused by the proposed action within the action area as defined in this Opinion.

Reasonable and Prudent Measures

Reasonable and prudent measures are nondiscretionary measures to avoid or minimize take that must be carried out by cooperators for the exemption in Section 7(o)(2) to apply. The BOR has the continuing duty to regulate the activities covered in this incidental take statement where discretionary Federal involvement or control over the action has been retained or is authorized by law. The protective coverage of Section 7(o)(2) may lapse if the BOR fails to exercise its discretion to require adherence to terms and conditions of the incidental take statement, or to exercise that discretion as necessary to retain the oversight to ensure compliance with these terms and conditions. Similarly, if any applicant fails to act in accordance with the terms and conditions of the incidental take statement, protective coverage may lapse. The following reasonable and prudent measures are necessary and appropriate to minimize the impact on ESA-listed species of incidental taking caused by the proposed action.

The BOR shall:

1. Minimize incidental take by providing irrigation and flood control releases from upstream projects which will ensure streamflows on a weekly basis[5] of 1,700 cfs into Lake Billy Chinook in October and November.

2. Provide monitoring and reporting as necessary to ensure that the allowed amount and extent of take is not exceeded, and that the impact of the take is minimized as intended by this Opinion.

Terms and Conditions

To be exempt from the prohibitions of Section 9 of the ESA, the BOR must comply with the following terms and conditions that implement the reasonable and prudent measures described

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[5] Minimum stream flows on a weekly basis is the measure used for minimum streamflows in the FERC relicensing of the Pelton Round Butte Hydroelectric Project. For this consultation it is calculated as the arithmetic mean of the daily mean streamflow over a 7 day period. Periods for calculating flows are October 1-7, 8-14, 15-21, 22-28, 29-November 4, November 5-11, 12-18, 19-25, and 26-31.

above. Partial compliance with these terms and conditions may invalidate this take exemption, result in more take than anticipated, and lead NMFS to a different conclusion regarding whether the proposed action will result in jeopardy.

1. To implement Reasonable and Prudent Measure 1 (minimum streamflows), the BOR shall continue its authorized irrigation and flood control releases from Bowman Dam on the Crooked River and Wickiup Dam on the Deschutes River to ensure a minimum stream flow on a weekly basis of 1,700 cfs between the gage on the Deschutes River near Culver, and the gage on the Crooked River below Opal Springs near Culver[6] during October and November. However, it is not necessary to meet this requirement under the following circumstances:

    a. When water availability in October and November of a given year is limited due to drought conditions or low runoff into upstream projects, as measured by:
        i. Prineville Reservoir content below 50,000 acre-feet on September 30 of that year, or;
        ii. combined Prineville and Wickiup Reservoirs content below 80,000 acre-feet on September 30 of that year, or;
        iii. the previous 12 months of precipitation totals on September 30 for either Derr or Ochoco Meadows SNOTEL sites are less than 19 inches.

        If projections on September 1 indicate that any of the above three scenarios may occur, BOR will notify NMFS, and coordinate to develop appropriate alternative October and November releases from Bowman and Wickiup Dams. Written approval of alternative operations from NMFS is required prior to their implementation.
    b. When maintenance of Bowman or Wickiup Dams or related structures is required, for routine periodic or human health and safety reasons, which necessitates very low or zero flow below Bowman or Wickiup Dams.
    c. When a downstream search and rescue effort requires reduction in release from Bowman or Wickiup Dam.

2. To implement Reasonable and Prudent Measure 2 (monitoring), the BOR shall submit an annual monitoring report by January 31 of each year. Each monitoring report will include the following information.

    a. Monitor the level of incidental take by reporting minimum stream flows on a weekly basis for October and November at the gage on the Deschutes River near Culver and the gage on the Crooked River below Opal Springs near Culver. The

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[6] Based on flow data from the 1990 to 2001 period of record, it appears that a combined flow between 1,700 and 1,800 cfs between the gage on the Deschutes River near Culver and the gage on the Crooked River below Opal Springs near Culver is sufficient to provide at least 3,500 cfs on the Deschutes River near Madras.

extent of incidental take will not be exceeded as long as combined minimum stream flow on a weekly basis at these gages[7] is at least 1,680 cfs.

b. Submit a copy of the annual report to the Oregon State Habitat Office of NMFS.

Oregon State Director
Habitat Conservation Division
National Marine Fisheries Service
Attn: 2003/01270
525 NE Oregon Street
Portland, OR 97232

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

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

The Pacific Fishery Management Council identified EFH for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook (*O. tshawytscha*) salmon and coho (*O. kisutch*) salmon (PFMC 1999). The habitat requirements of Chinook and coho have been evaluated and found to be the same as the habitat requirements of MCR steelhead. As described in detail in the ESA portion of this document, the proposed action may result in an adverse effect of reducing access to complex edge rearing habitat, particularly during October and November when flows are already low.

Additional potential adverse effects on EFH not addressed in the Effects of the Action include a reduction of flow resulting from the project in EFH above the Pelton/Round Butte Project. EFH above the Pelton/Round Butte Project extends a short distance above Lake Billy Chinook in the Crooked River, to Opal Springs Dam and in the Deschutes River upstream to steelhead falls.

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[7] The BOR MODSIM modeling effort used flow data from water years 1962 through 1999. The lowest combined minimum stream flow on a weekly basis between the gage on the Deschutes River near Culver and the gage on the Crooked River below Opal Springs near Culver during this period in October and November was slightly greater than 1,680 cfs. Therefore, it is assumed that as long as the combined flow on a weekly basis at these gage sites is greater than 1,680 cfs then the reduction in edge rearing habitat of 1,230,231 square feet in October and 2,048,629 square feet in November will not be exceeded.

The proposed action reduces 50% exceedance flows throughout the year at the gage on the Deschutes River near Culver. According to the MODSIM modeling exercise, the "with BOR" scenario reduces the 50% exceedance flows at the gage on the Deschutes River near Culver by a minimum of 49 cfs in July and by a maximum of 635 cfs in November. The proposed action generally reduces flow during the winter and spring and increases flow during the summer and fall on the Crooked River above Lake Billy Chinook. A reduction in flow can reduce juvenile rearing habitat, and adult spawning and holding habitat. However, Chinook salmon cannot access this EFH because there is no passage at Pelton/Round Butte Dam, so the species is not realizing the consequences of these flow reductions.

EFH Conservation Recommendations

NMFS believes that the following conservation measures are necessary to avoid, mitigate, or offset the impact that the proposed action has on EFH.

1. Term and Condition 1 will minimize the effects of flow reductions on access to edge rearing habitat by providing sufficient flows for juveniles to access the most complex edge rearing habitat.

2. Term and Condition 2.a will monitor the effect of the proposed action on EFH.

These conservation measures may not fully address the adverse effects to EFH upstream of the Pelton/Round Butte project, but NMFS has no further conservation recommendations at this time because this habitat is not accessible to Chinook salmon. Once fish passage is established at the Pelton/Round Butte Project, the BOR will need to reinitiate EFH consultation.

Statutory Response Requirement

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

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

Supplemental Consultation

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

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

Utility: This document records the results of an interagency consultation. The information presented in this document is useful to two agencies of the Federal government (NMFS and the BOR), the residents of Crook, Deschutes, Jefferson, and Wasco Counties, Oregon, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information is beneficial to citizens of Crook, Deschutes, Jefferson, and Wasco Counties because the underlying projects affect natural resources at various sites within these counties. The information presented in these documents and sued in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

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

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

Objectivity:

***Information Product Category*:** Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA

Regulations, 50 C.F.R. 402.01 *et seq*., and the MSA implementing regulations regarding EFH, 50 C.F.R. 600.920(j).

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

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

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

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