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March 8, 2000

Robert E. Willis
Chief, Environmental Resources Branch
Portland District
U.S. Army Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Biological Opinion for Proposed Water Temperature Control Project at Cougar Dam in the McKenzie River Subbasin, Lane County, Oregon

Dear Mr. Willis:

Enclosed is a biological opinion prepared by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) (jointly, the Services) pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.)(ESA) on the proposed Water Temperature Control Project at Cougar Dam (Cougar WTC Project) on the South Fork of the McKenzie River. The Services conclude in this opinion that the impact of the proposed project is not likely to jeopardize the continued existence of listed or proposed species, nor is it likely to adversely modify proposed or designated critical habitat. Species addressed in this opinion include Upper Willamette River chinook salmon (*Oncorhynchus tshawytscha*), bull trout (*Salvelinus confluentus*), and the northern spotted owl (*Strix occidentalis caurina*), all of which are listed as threatened. Other listed or proposed species in the Willamette Basin either do not occur in the McKenzie River subbasin, or are not likely to be adversely affected by the proposed project. Critical habitat has been designated for Upper

Willamette River chinook salmon (February 16, 2000; 65 FR 7764) and the northern spotted owl within the project area.

The opinion was prepared by the Services in response to an October 27, 1999, Biological Assessment (BA) and request for formal consultation, and a February 7, 2000, amendment to the BA. This opinion constitutes formal consultation on the Cougar WTC Project for Upper Willamette River chinook salmon, bull trout, and the northern spotted owl. The Services believe that the Cougar WTC Project will ultimately improve conditions for Upper Willamette River chinook salmon and bull trout through at least partial restoration of natural water temperatures downstream of Cougar Dam. Nonetheless, the Services also believe that the construction of the project may result in incidental take of these two species, and of the northern spotted owl. Accordingly, the Services have provided a set of nondiscretionary "reasonable and prudent measures" in the accompanying opinion which we believe are necessary to minimize the likelihood of incidental take.

We appreciate the cooperation of your staff in completing this consultation. Please contact Cat Brown at USFWS (503.231.6179) or Lance Smith at NMFS (503.231.2307) if you have any questions about this consultation.

Sincerely,

Craig A. Ellis

Acting State Supervisor
U.S. Fish and Wildlife Service
Oregon State Office

Joe Blum

Assistant Administrator
for Habitat Conservation
National Marine Fisheries Service
Northwest Region

Enclosure

cc: Jeff Ziller, ODFW (Springfield)
Amy Unthank, Willamette NF, Supervisor's Office (Eugene)
Ray Rivera, Willamette NF, McKenzie Ranger District (McKenzie Bridge)
Tim Downey, Eugene Water and Electric Board (Eugene)

Endangered Species Act - Section 7
Consultation

Biological Opinion
on
Effects of Cougar Reservoir Water Temperature Control Project on Upper Willamette River Chinook Salmon, its Critical Habitat, Bull Trout, Northern Spotted Owl, and its Critical Habitat

Action Agency: U.S. Army Corps of Engineers

Consultation Conducted Jointly By:

National Marine Fisheries Service, Northwest Region
and
U. S. Fish and Wildlife Service, Pacific Region

Date Issued: March 8, 2000

USFWS Log Number: 1-7-00-F-106
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ATTACHMENT 1

The Habitat Approach: Implementation of the Endangered Species Act in the Context of Pacific Anadromous Salmonids and Habitat-Altering Actions. National Marine Fisheries Service, Northwest Region, Habitat Conservation Division, August 26, 1999.

I. BACKGROUND

On March 24, 1999, the National Marine Fisheries Service (NMFS) published its final decision to list the Upper Willamette River evolutionarily significant unit (ESU) of chinook salmon (*Oncorhynchus tshawytscha*) as threatened under the Federal Endangered Species Act (ESA). The effective date for the final listing was May 24, 1999, and the ESU is defined as "all naturally spawned populations of spring-run chinook salmon residing below impassable natural barriers" (64 FR 14308). Critical habitat for this ESU was designated on February 16, 2000 (65 FR 7764). Upper Willamette River chinook salmon and its critical habitat occur within the action area of this consultation.

The Upper Willamette River (ESU) of steelhead (*Oncorhynchus mykiss*) was listed as threatened under the ESA on March 25, 1999 (64 FR 14517) simultaneously with Upper Willamette chinook salmon, but its range does not include the action area for this consultation[1], and it is not addressed in this biological opinion.

The U.S. Fish and Wildlife Service (USFWS) determined threatened status for the Columbia River and Klamath River distinct population segments (DPS) of bull trout (*Salvelinus confluentus)* on June 10, 1998 (63 FR 31674). The Columbia River DPS includes bull trout in portions of Oregon, Washington, Idaho, and Montana, which encompasses the Willamette River and its tributaries. On November 1, 1999, the USFWS determined threatened status for all populations of bull trout within the coterminous United States (64 FR 58910). Critical habitat has not been proposed or designated.

The northern spotted owl (spotted owl) (*Strix occidentalis caurina*) was listed at threatened by the USFWS on June 26, 1990 (55 FR 26114). Critical habitat has been designated (57 FR 1796).

The bald eagle is listed as threatened in the conterminous United States. On June 6, 1999, the USFWS proposed to delist the species (64 FR 36454), but a final ruling has not yet been made.

On July 8, 1998, the USFWS published a proposed rule to list the contiguous United States DPS of the Canada lynx as a threatened species (63 FR 36993). The range of the lynx includes portions of Washington, Oregon, Idaho, Montana, Utah, Wyoming, Colorado, Minnesota, Wisconsin, Michigan, Maine, New Hampshire, Vermont, New York, Pennsylvania, and Massachusetts. The proposal was extended for six months on July 8, 1999 (64 FR 36836), and the comment period was reopened on August 18, 1999 (64 FR 44883). A final decision regarding the species is pending.

Coastal cutthroat trout (*Oncorhynchus clarki clarki*) in the upper Willamette River is currently a candidate for listing under the ESA.

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[1] See website http://www.nwr.noaa.gov/1salmon/salmesa/index.htm for detailed information and range maps for listed, proposed, and candidate anadromous salmonids.

A. Objective of this Consultation

Section 7(a)(2) of the ESA requires each Federal agency in consultation with NMFS and USFWS (the Services), to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Conferencing is required for proposed species when the action agency determines that its action is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. There is no requirement to confer on candidate species.

The U.S. Army Corps of Engineers (Corps) has proposed to construct the Cougar Reservoir Water Temperature Control (WTC) Project at Cougar Dam (the "proposed action") on the South Fork of the McKenzie River in Lane County, Oregon (Fig. 1), and has requested formal consultation from the Services due to effects of the project on Upper Willamette River chinook salmon (UW chinook salmon), bull trout, and the spotted owl. The purpose of the Cougar WTC project is to address long-standing environmental problems associated with the temperature of discharges below Cougar Dam.

The objective of this biological opinion is to address the effects of the proposed action on listed UW chinook salmon, bull trout, and the spotted owl, and to determine if this federal action by the Corps will jeopardize the continued existence of these species or adversely modify critical habitat.

B. Consultation History

In September 1994, the Corps submitted a Biological Assessment (BA) to the USFWS entitled "Bald Eagles, Northern Spotted Owls, Peregrine Falcons, Oregon Chub and Bull Trout, Willamette Temperature Control Project, Cougar and Blue River Projects." In response, USFWS provided a letter of concurrence dated November 14, 1994 (Ref. 1-7-94-I-515) . At the time, bull trout was classified as a Category I species for listing under the ESA. In its letter, the USFWS indicated that the Corps would need to "conference/formally consult on the impacts to bull trout expected to occur as a result of the proposed project" if bull trout were proposed or listed prior to project completion.

In 1999, as the Corps began to approach the construction period for the Cougar WTC project, numerous meetings were held and informal correspondence exchanged among the Corps, NMFS and USFWS. The Corps prepared a draft supplemental BA addressing the effects of construction of the Cougar WTC project for the Services' review in July 1999.

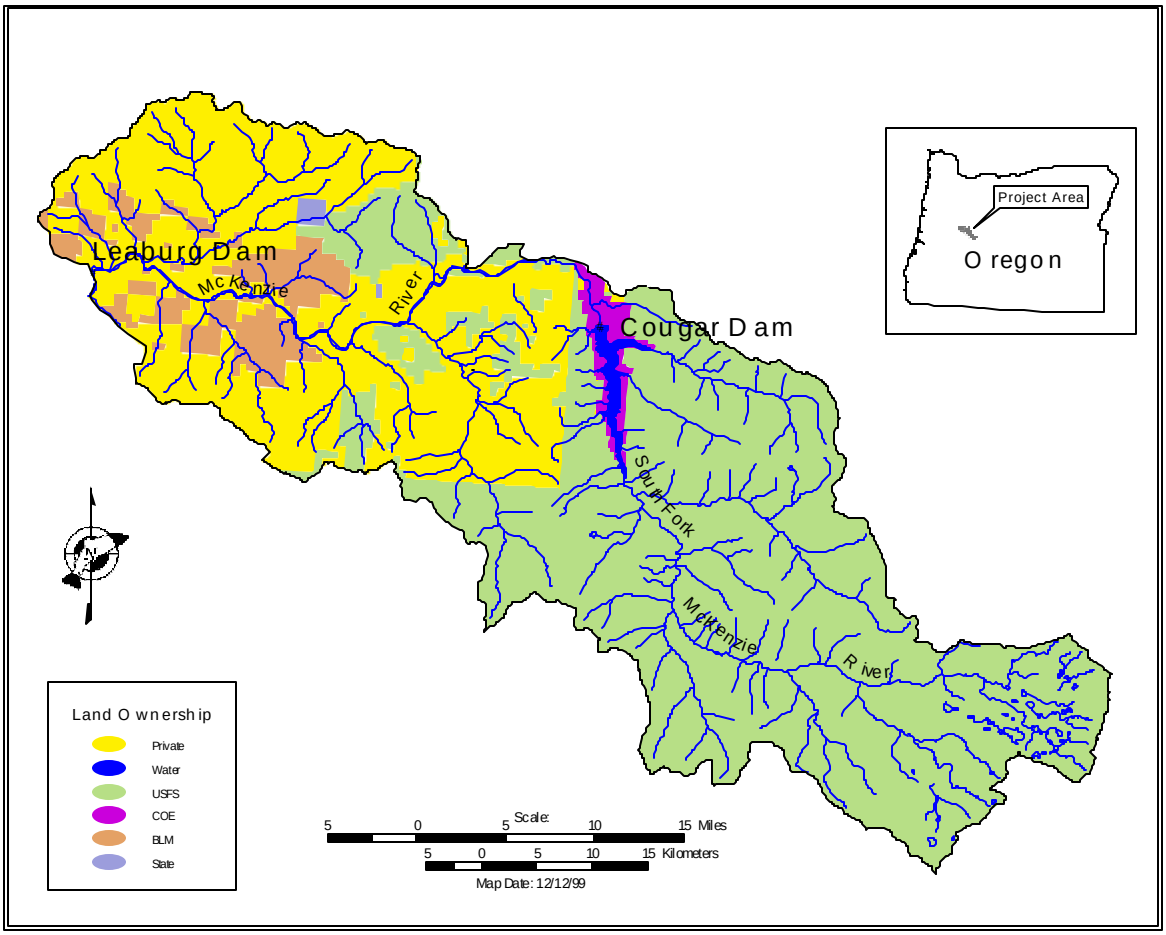

Figure 1. Location of Cougar Dam and action area for this consultation (action area defined in Section II.D. on p.12).

In October 1999, the Corps completed the final supplemental BA evaluating the potential effects of construction activities proposed under the Cougar WTC project on species currently listed or proposed for listing under the ESA, including bald eagle, spotted owl, bull trout, UW chinook salmon, and Canada lynx. The American peregrine falcon *(Falco peregrinus anatum*) was removed from the Federal List of Endangered and Threatened Wildlife on August 25, 1999 (64 FR 46542), thereby removing the requirement under Section 7 of the ESA to evaluate impacts to that species.

Potential effects to Oregon chub (*Oregonichthys crameri*) were addressed informally through discussions in November 1999 among USFWS, Oregon Department of Fish and Wildlife (ODFW), and Corps staff. The Oregon chub is not found in the McKenzie River drainage, but it could be affected by increased water releases from Corps reservoirs on the North Santiam and Middle Fork Willamette Rivers to compensate for a reduced volume of releases from Cougar Reservoir during the construction period. Discussions among USFWS, ODFW and Corps staff biologists concluded that

the effects to Oregon chub would be minor and were within normal project operations already covered by the USFWS's 1996 biological opinion (USFWS Log Number 1-7-95-F-112) to the Corps on its operation of the Willamette Valley flood control system (this 1996 biological opinion covered only Oregon chub).

On October 27, 1999, the Services received the Corps' final BA on the Cougar WTC project and a request for formal consultation under the ESA for UW chinook salmon, bull trout, and the spotted owl. The Corps also requested concurrence from USFWS that this proposed action is not likely to adversely affect the bald eagle and will have no effect on Canada lynx. On February 8, 2000, the Services received an amendment to the BA from the Corps describing the need to move additional sediment and debris (a total of approximately 20,000 to 30,000 cubic yards) within Cougar Reservoir beyond the quantity estimated (500 cubic yards) in the October 26, 1999, supplemental BA.

The USFWS issued a biological opinion under section 7 of the ESA on the adoption of Alternative 9 of the Northwest Forest Plan (Forest Plan) of the Final Supplemental Environmental Impact Statement by the Forest Service and Bureau of Land Management on February 10, 1994. In that opinion, the USFWS determined that Forest Plan implementation was not likely to jeopardize the continued existence of listed species or result in the adverse modification or destruction of designated critical habitat. However, USFWS was unable to fully assess incidental take of spotted owls, impacts to spotted owl critical habitat, or the impact to spotted owl dispersal outside of the Late-Successional Reserves (LSRs) which may result from implementing projects consistent with the Forest Plan. This was deferred to future consultations on site-specific actions. In addition, information about the newly developed LSRs and the intervening matrix lands were unavailable to the USFWS. For all of these reasons, additional consultation on Federal activities within the Forest Plan area is appropriate, including the project discussed herein.

Concurrent with the development of the BA for the construction of the Cougar WTC project, the Corps is developing a BA to address the effects of the ongoing operation of the 13 dams in the Willamette Valley Flood Control System. The Corps is expected to initiate consultation under section 7 with the Services for effects to all listed, proposed and candidate species in the near future. This larger consultation will analyze the effects of the long-term operation of the Cougar WTC project.

C. Concurrences

1. Bald Eagle

The Corps' BA states that there are no known nesting bald eagles in the McKenzie basin, although occasional wintering bald eagles do occur in the project vicinity. Summer drawdown of Cougar Reservoir for construction is expected to temporarily reduce the fish population in the reservoir. This loss would affect very few or possibly no eagles, and fish populations are expected to rebound after the construction period. Project-related impacts to other potential prey resources such as waterfowl will

also be minimal. Based on these facts, the USFWS concurs with the Corps' finding that construction of the Cougar WTC project is not likely to adversely affect bald eagles.

2. Canada Lynx

Construction of the Cougar WTC project will occur during the summer, at the time of year when lynx are expected to have moved to higher elevations. Rock blasting will occur either underground or within a confined basin. The level of noise from blasting will not be sufficient to affect lynx foraging at elevations well above the reservoir in summer. Other aspects of the project, including lower instream flows in the South Fork McKenzie River and summer drawdown of the reservoir, would have no effect on lynx or its foraging habitat. Thus, no impacts to lynx are anticipated from the proposed action, and the USFWS concurs with the Corps' "no effect" determination.

II. PROPOSED ACTION

The proposed Cougar WTC project was described in the 1995 Feasibility Report and Final Environmental Impact Statement (EIS; USACE 1995), the Feature Design Memorandum (FDM; USACE 1998), and more briefly in the BA. The proposed project is to modify the Cougar Dam intake structure to provide control of the water temperature of the outflow. The project consists of attaching a new 302-foot tall, rectangular intake structure (a concrete wet well) to the upstream side of the existing intake structure. The new intake structure will be fitted with eight water temperature control ports and two bypass ports to allow selective withdrawal of water from different depths of the reservoir. In this biological opinion, construction of the new intake structure, and all associated activities such as managing water levels in the reservoir (i.e., through reopening and using the old diversion tunnel), monitoring, mitigation, trapping and handling fish for interim fish passage, etc., are collectively referred to as the Cougar WTC project. Construction will take place for approximately seven months (April through October) of each year for three or four years (2000 – 2003). This biological opinion addresses only construction impacts; the long-term operation of the Cougar WTC project will be addressed in a separate biological opinion for the Corps' Willamette Valley Flood Control System.

The new intake structure will permit control of the depth at which water is discharged from Cougar Reservoir. This capability will, in turn, permit control of the water temperature of the discharge. If desired, water can be discharged from multiple reservoir levels at the same time to blend waters of different temperatures. The new project will provide water temperature control for 95% of all average annual project outflows which corresponds to flows up to 2,000 cubic feet per second (cfs).

Several changes from the 1995 Feasibility Report and Final EIS have been proposed to the Cougar WTC project as a result of further design study. Design changes are discussed in a Feature Design Memorandum (FDM) completed for the project (USACE 1998). Major design features initially included in the Feasibility Report and Final EIS (USACE 1995) that have subsequently been dropped

because of impracticality include: (1) fish screening at the diversion tunnel entrance; and (2) extensive erosion control measures throughout the drained reservoir area. Some of these changes will alter the impacts previously described in the EIS. Those changes that alter impacts are discussed in a supplemental Environmental Assessment (EA; USACE 1999a).

An Environmental Coordination Task Force (ECTF) consisting of federal and state regulatory and resource agency representatives from NMFS, USFWS, Oregon Department of Fish and Wildlife, Willamette National Forest, the Corps, and possibly others, will be established to assist the Corps in reviewing studies and monitoring results associated with the Cougar WTC project. The ECTF will also assist the Corps in identifying needs for corrective action, formulating recommendations for facility design and corrective action, implementing corrective actions, and providing information concerning the project to their constituencies and to the public. This adaptive management approach means that some details of the proposed action are not yet defined because they will be determined by the ECTF depending on the prevailing circumstances.

Activities associated with the proposed action that may affect ESA listed species are project construction activities, monitoring, and mitigation. These, and the role of the ECTF, are described below.

A. Project Construction Activities

The project construction plan is fully described, scheduled, and diagramed in the FDM (USACE 1998). In the first year of construction (2000), the diversion works for lowering the pool will be developed. In the following years (2001-2002, and 2003 if necessary), the pool will be drawn down in the spring to elevation 1,375 feet (elevations are given in National Geodetic Vertical Datum, NGVD) and held at this elevation until the fall (approximately June through October), which is when construction of the new intake tower will take place. For purposes of this biological opinion, the components of project construction are described below as: (1) Preparation and use of staging area; (2) preparation and use of main diversion tunnel; (3) re-opening the Rush Creek diversion tunnel; (4) drawing down the reservoir; and (5) construction of new intake structure.

1. Preparation and Use of Staging Area

A 250,000-square-foot staging area located at river mile (RM) 2.5 of the South Fork McKenzie River (known as Strube Flat), will be used for disposal of rock and other construction materials. This was the staging area used when Cougar Dam was originally constructed. Construction specifications for the Cougar WTC project will include provisions for pollution prevention and cleanup, the removal of all equipment and supplies from construction sites upon completion of work, and the restoration of the staging area. In addition, specifications would prohibit the contractor from performing any excavation in the staging area. Biological monitoring, as described below, would be designed to detect impacts to fisheries resources that might occur as a result of accidental spills of fuel or other pollutants so that

corrective action could be taken.

2. Preparation and Use of Main Diversion Tunnel

The diversion tunnel used in the original construction of Cougar Dam will be re-opened to draw down the reservoir for construction. Preparation of this tunnel will be done during the first year (2000) by using explosives to remove the concrete plug, and blasting is planned for mid-April to mid-June, 2000. A single, final blast to tap the concrete plug is planned for February or March 2001. The downstream portal of the diversion tunnel will be cleaned of trees and shrubs, and the rock slope will be supported as necessary. The exit channel will be rehabilitated, including removing approximately 1,300 cubic yards (cy) of sediment fill materials that have been placed in the channel since the completion of the dam, and placing about 2,600 cy of riprap in areas where the original riprap has been removed or where it is undersized. A rock barrier fence will be constructed just above the break of slope. A crane will be used to lift equipment and remove spoils. Some rock drilling will occur but blasting to remove riprap or sediments will not be necessary.

In-water disposal will be used to dispose of all lake sediment material moved. An estimated 500 cy of lake sediment and debris will need to be removed from the upstream portal of the existing diversion tunnel (but up to 30,000 cy of additional sediment will be dredged from the area around the existing reservoir outlet structure - see "3. Re-opening Rush Creek Diversion Tunnel"). To provide access for continuing maintenance activities in the reservoir regulating outlet area, a permanent road will be built on existing fill that will cross a box culvert located just below the exit of the diversion tunnel before its flow enters the South Fork McKenzie River. No fish will be able to ascend into this area. A 120-foot long cofferdam, 12 feet high with an approximate footprint of 5,200 square feet will be located in the tailrace at the lower end of the diversion tunnel during the first year of construction. The cofferdam is needed to de-water the downstream portal of the diversion tunnel and will be removed after the first year of construction. No rock blasting will occur.

A new gate chamber will be constructed and flow control gates will be installed in the diversion tunnel. A by-pass channel, which was cut into the invert of the diversion tunnel to handle the flow during construction of the concrete plug, will be removed. A 350-foot section of the existing diversion tunnel will be lowered six feet by blasting.

3. Re-opening Rush Creek Diversion Tunnel

Rush Creek enters the reservoir near the intake structure. The embankment of Cougar Dam covers the lower portion of the Rock Creek ravine, preventing the flow of Rush Creek from entering the reservoir at pool elevations below 1505 feet NGVD. Hence during construction of the dam, Rush Creek was diverted into a tunnel leading to the main diversion tunnel intake. During construction of the new intake structure, Rush Creek must again be diverted. The old Rush Creek diversion tunnel will be used, but it must be dug out using blasting and mechanical removal (by clamshell dredge), and an intake portal

constructed. This work will be done between October 2000 and February 2001.

Re-opening the Rush Creek Diversion Tunnel will require dredging approximately 10,000 to 15,000 cy of sediment from in front of the upstream portal of the tunnel, and an additional 10,000 to 15,000 cy of sediment from the saddle between the existing reservoir outlet structure and the main reservoir. The dredged sediment will be transported by barge and redeposited in the reservoir on the eastern side the dam within a depression formed behind an old inundated road. Access to the diversion tunnel is needed for drainage of discharge from Rush Creek during the construction period, and removal of sediment from the saddle area will improve access to cold water in the reservoir's hypolimnion during summer. This, in turn, will improve long-term operational effectiveness regarding water temperature control below Cougar Dam.

4. Drawing Down the Reservoir

An unscreened diversion tunnel with a flow capacity of 1,200 cubic feet per second (cfs) at pool elevation 1,375 feet NGVD will be used to draw the reservoir down and pass inflow during the summer construction period (June through October). Discharge from the reservoir may also be managed by releases through the diversion tunnel during the flood control period (November through May) until the Cougar WTC project is completed (i.e., through 2003).

Initial reservoir drawdown will begin in fall 2000, and will follow the usual flood control drawdown schedule. Drawdown below normal Minimum Flood Control Pool elevation of 1,532 feet NGVD for construction activities will begin in February 2001, flow conditions permitting. Limiting the rate of reservoir drawdown to no more than three feet per day will reduce the risk of a bank failure. If bank failures occur, the Corps will attempt to minimize sedimentation by using silt fences, log booms, or other measures. The reservoir will be drawn down to elevation 1,375 feet NGVD during the summer construction period, and a residual reservoir will be maintained at this level. The residual pool at this elevation would have a length of approximately 7,700 feet (1.5 miles), a mean width of 650 feet (0.1 mile), a surface area of about 106 acres, and an approximate volume of 2,845 acre-feet. Mean depth at elevation 1,375 feet NGVD will be approximately 27 feet. Maximum depth at this elevation is 85 feet, which will occur at the entrance to the diversion tunnel.

The need to store a late-season (e.g., June) high flow event, however, could result in storage behind Cougar Dam at inflow levels below 1,200 cfs and subsequent raising of the pool above elevation 1,375 feet NGVD. At a pool elevation of 1,495 feet NGVD, with a maximum depth of approximately 200 feet, the construction area at the temperature control structure would begin to be inundated. The Corps may stop construction when the risk of inundation becomes too great. However, the Corps may be able to continue construction activities above completed work that has been inundated.

Drawdown to residual pool level will normally be completed by the end of May, and the summer construction period for the intake tower will extend from June through October during 2001 through

2003. High flow events either late in the spring or during the early fall may shorten the construction period. Normal flood control operations will resume in November. Summer flow in the South Fork McKenzie River below Cougar Dam would be equal to residual pool inflow and may be reduced from present minimum flows of 300 cfs. During drawdown, releases from other storage projects in the Willamette Basin will be made as needed to meet minimum flow requirements at Albany (5,000 cfs) and Salem (6,500 cfs) during the summer low flow period.

5. Construction of New Intake Structure

The intake structure construction area will be prepared at the beginning of the second year of the project (i.e., after drawdown in spring 2001) by first cleaning all rock slopes around it of loose debris, which will be removed with a crane. A roller-compacted concrete cofferdam will be constructed to provide adequate flood protection of the construction area during the construction season. The crest of the cofferdam will be at elevation 1,495 feet NGVD. The part of the cofferdam above the regulating outlet (RO) bench will be removed at the end of the construction work. Approximately 910 cy of rock will be removed from the existing RO bench. In addition, a thin sliver of rock (40 feet long and 60 feet high, or about 300 cy of rock) will be removed to make room for a new structural concrete wall to support the new RO trashrack; the existing trashrack bridge will be demolished and a new one constructed approximately 40 feet upstream.

The construction area is scheduled to be ready for work on the new intake structure to begin in the early part of the 2001 construction season. The contractor will attempt to complete the new intake structure during the following construction season (2002). If this is not possible, construction will continue and be completed in 2003.

B. Monitoring

Monitoring is described in the BA (p. 48-52) and the FDM (USACE 1998, p. 7-3 & 7-4). Water quality and biological monitoring will be conducted during the construction period to identify problems that may arise and to provide valuable information useful for future project planning and design.

Water quality parameters that will be monitored during and following the construction period above Cougar Dam in the South Fork include flow, water temperature and turbidity of inflow. Below the dam, flow, water temperature, turbidity, and dissolved oxygen (DO) of discharge will be monitored on an hourly or daily basis at existing U.S. Geological Survey (USGS) gaging stations. In addition to stream monitoring, water temperature, DO, turbidity, and other parameters (percent oxygen saturation, pH, total dissolved solids, conductivity, and oxidation-reduction potential) will be measured in the residual pool above Cougar Dam on a weekly basis at three or more sampling stations within the reservoir (USACE 1995). Flow, water temperature and turbidity conditions at inflow to the residual pool would be compared to conditions in the residual pool and below the dam. A daily log of stream and reservoir conditions, including any storm events, would be maintained along with a database of the

associated water quality parameters described above. Problem events would be reported by the Corps to Oregon Department of Environmental Quality (ODEQ), ODFW, NMFS, and USFWS, along with information about any corrective actions taken. Quarterly monitoring, annual progress, and final project reports regarding these conditions and actions would be prepared for the ECTF.

Biological monitoring of fish and wildlife resources will be conducted to detect and address unforeseen environmental (e.g., high discharge events, seismic events) or biological (e.g., unusual fish abundance) circumstances that might be influenced by construction activities. The proposed action includes a study, funded by the Corps and performed by ODFW, to examine bull trout migratory behavior, capture and handling techniques, and captive broodstock retention techniques. The Corps will ask the ECTF to review and comment on the study plan and on the results and recommendations from the study. USFWS approval of the study plan, and of any resulting course of action, would be required. The ECTF would serve as the central coordinating body for monitoring project activities and recommending to the Corps appropriate corrective actions that should be taken to protect fish and wildlife resources. The Corps would consider ECTF recommendations, and would formulate decisions regarding corrective actions to be taken in consultation with NMFS and USFWS.

The Corps and ODFW will monitor the drawdown of Cougar Reservoir and the area below Cougar Dam for potential impacts of construction activities on bull trout, UW chinook salmon and other fish species. The Corps and ODFW will experimentally trap bull trout (and, possibly, downstream-migrating juvenile UW chinook salmon) above, within, and below Cougar Reservoir during implementation of the Cougar WTC project (2000-2003). Experimental trapping would begin in 2000, one year before initial drawdown of Cougar Reservoir. Nearly continuous experimental trapping of bull trout will provide information needed for siting and design of permanent trap-and-haul facilities and for identification of alternative protective measures for bull trout that could be taken, if needed. Detailed annual study plans for this work will be developed cooperatively with ODFW and reviewed by representatives of the ECTF. Annual plans would be submitted by the Corps to USFWS and NMFS for approval.

During the construction period each year (June through October), the Corps will periodically survey conditions in the residual pool and in the South Fork McKenzie River up to a mile (or some other appropriate distance) below Cougar Dam. Results of monitoring would be reported in quarterly monitoring, annual progress, and final project reports to the Corps and to the ECTF. If necessary, the Corps or the Corps's contractor would implement measures to resolve problems associated with the proposed action. The Corps would consult with the ECTF accordingly.

Suitable habitat for spotted owls within one mile of the project site will be surveyed annually, using established protocol, to determine occupancy and nesting activity. Noise levels will be monitored at a recording station, which will be located in the Rush Creek drainage, approximately 2,000 feet from the Rush Creek diversion tunnel intake and the Cougar Reservoir intake structure.

C. Mitigation

Mitigation for the Cougar WTC construction project has two components: protection of bull trout in the residual pool, and interim fish passage around Cougar Dam.

1. Bull Trout Rescue

The plan for protecting bull trout trapped in the residual pool during the construction period is described in the BA (p. 38-40). Mitigation actions that could potentially be implemented to protect bull trout include trapping of adults and juveniles above Cougar Reservoir in an effort to reduce the number of bull trout occurring in the residual pool during the summer drawdown and construction period. The Corps will consult with USFWS to define mitigation actions necessary to protect bull trout during implementation of the Cougar WTC project.

Implementation of alternative protective actions for bull trout (i.e., trapping within or above the reservoir) during the construction phase of the Cougar WTC project will depend on whether the protection provided as a result of maintaining a residual pool behind Cougar Dam during the construction period proves to be an adequate protective measure. The decision to rescue bull trout will be made by USFWS in consultation with ODFW, the Corps and other members of the ECTF.

2. Interim Fish Passage

The Corps' long-term goals for the South Fork McKenzie River include restoration of connectivity for bull trout subpopulations above and below Cougar Dam, and re-establishment of a self-sustaining anadromous spring chinook salmon population above the reservoir. A plan for interim fish passage facilities has been developed as a short-term mitigation measure for the WTC project.

If the residual pool habitat is found to be benign following the initial drawdown period, mitigation could include supplementation of bull trout and UW chinook salmon spawning above the reservoir through trapping and transport of spawners from below Cougar Dam during subsequent drawdown and construction periods. The manner in which UW chinook salmon and bull trout will be trapped and handled in the South Fork both above and below the Cougar Dam during the course of the proposed action is described in the BA (p.40-42) and briefly in the FDM (USACE 1998, p.1-4).

a. Below the dam

Adult UW chinook salmon and bull trout (and possibly subadult bull trout if they are moving upstream) migrating up the South Fork will be captured at the site of the former fish trap located approximately 500 feet below the powerhouse (see FDM, Plate 6). A temporary fish barrier dam (weir) and trap will

be rebuilt on this site to prevent UW chinook salmon and bull trout
from going any further up the channel and into the project work area on the downstream face of the dam. Fish will be attracted into a fishway entrance and pass over a false weir into a holding tank, collect in the tank until it is lifted and transferred to a truck for transport to a release site. Fish may be measured or otherwise handled, and the adults separated from any juveniles, before they are released. Protocol for trapping and handling fish will be developed by the Corps and ODFW, reviewed and monitored by the ECTF, and approved by NMFS and USFWS. The trap will be used throughout the duration of the proposed action (i.e., until at least 2003).[2]

b. Above the dam

All unmarked adult spring chinook salmon in the McKenzie Basin are considered listed because it is not possible to distinguish unmarked hatchery fish from wild fish. Thus all unmarked adult spring chinook trapped and hauled above Cougar Dam, and all juveniles produced through natural spawning by these fish, are considered listed UW chinook salmon[3]. Thus trapping and handling of fish above the dam (i.e., those that are migrating downstream) would include UW chinook salmon juveniles. In order to determine if adult and juvenile bull trout should also be trapped and hauled downstream, studies may be conducted to identify safe trapping and handling techniques for this species. The methods used for this trapping, and protocol for handling trapped fish, will be developed by the Corps and ODFW, reviewed and monitored by the ECTF, and approved by NMFS and USFWS. Trapping and handling of UW chinook, and perhaps bull trout, above the dam and transporting them downstream around the dam will be done according to this protocol throughout the duration of the proposed action (i.e., until at least 2003).

D. Action Area

The Aaction area@ is defined as Aall areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.@ (50 CFR 402.02). The effects of the proposed

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[2] The question of long-term fish passage at Cougar Dam for UW chinook salmon and bull trout will not be resolved by completion of the Cougar WTC project. The Services are urging the Corps to design and construct upstream and downstream fish passage facilities at Cougar Dam as soon as possible. Options for these facilities are currently being considered in the Corps' Cougar Dam Fish Passage Evaluation Study, being done simultaneously with the WTC project and in coordination with USFWS, NMFS, and ODFW.

[3] In 1993 and 1996-99, ODFW released adult hatchery spring chinook spawners into habitat above Cougar Reservoir to provide food for bull trout, change the dynamics of nutrients in the upper watershed of the South Fork, and develop a landlocked chinook salmon fishery in Cougar Reservoir. Hatchery fish are included in the UW chinook salmon ESU but are not listed under the ESA (in this biological opinion, the term "UW chinook salmon" refers to the listed component of this ESU, unless otherwise noted). However, since it is not possible to positively identify unmarked hatchery adults as such, all unmarked adults are considered listed. ODFW's releases above Cougar Dam included unmarked adults (Dave Anderson, ODFW, personal communication), thus extending the range of the listed UW chinook ESU above the dam. All juvenile chinook salmon produced from natural spawning of marked and unmarked adults above the dam are considered as listed UW chinook salmon.

construction of the Cougar WTC project on UW chinook salmon and bull trout are concentrated in the South Fork below the dam and in the reservoir area. However, direct and indirect effects extend into the mainstem McKenzie River between its confluence with the South Fork and Leaburg Dam, as well as throughout the South Fork watershed. Including the terrestrial components of the South Fork watershed in the action area is necessary because this consultation covers the spotted owl. The action area is thus the McKenzie River between its confluence with the South Fork and Leaburg Dam, and the entire South Fork McKenzie River watershed, as shown in Figure 1 on p. 3.

III. LISTED SPECIES AND CRITICAL HABITAT

A. Status of the Species

1. UW Chinook Salmon

The only NMFS-listed species in the action area is UW chinook salmon, and detailed information on this ESU is provided in the status review of West Coast chinook salmon prepared by Myers et al. (1998) and in the final UW chinook salmon critical habitat rule (February 16, 2000 (65 FR 7764), hereby incorporated by reference. The UW chinook salmon ESU is defined as "all naturally spawned populations of spring-run chinook salmon residing below impassable natural barriers" (64 FR 14308). The section below does not include descriptions of hatchery production of spring chinook nor any aspect of fall chinook production or biology in the Willamette Basin.

Aspects of the life history of UW chinook salmon are discussed in the NMFS status review for West Coast chinook salmon (Myers et al. 1998). Adult UW chinook salmon enter the Columbia River in late winter through early spring (i.e., February through April), and enter the lower Willamette River beginning in February. The run peaks in April at Willamette Falls, with passage through the Willamette River above Willamette Falls occurring primarily from late April through July (Myers et al. 1998; Willis et al. 1995). UW chinook salmon begin to enter the McKenzie River as early as mid to late April when water temperatures reach 52-54°F. Most of these pre-spawners hold in pools of cool water between Hayden Bridge and Leaburg Dam until spawning time in the fall, but a significant proportion also migrate past Leaburg Dam in the early summer to hold in the upper river until spawning. The upper watershed (above Leaburg Dam) is managed by ODFW as a natural production area by minimizing the escapement of hatchery produced adults above the dam.

UW chinook salmon spawning in the McKenzie River formerly began in mid-August and lasted as late as the third week of October (Willis et al. 1995). It is now largely confined to September, but may extend into mid-October. Studies done for the Cougar WTC project and summarized in USFWS (1994) estimated that of the UW chinook salmon spawning above Leaburg Dam, 30% spawn in the mainstem McKenzie River below the confluence with the South Fork, 60% spawn in headwater areas above the confluence with the South Fork, and 10% spawn in the South Fork of the McKenzie River.

Aerial surveys of UW chinook salmon redds in the McKenzie Basin conducted by ODFW and the Eugene Water and Electric Board (EWEB) in 1995, 1996, and 1997 show a slightly different distribution: 30-40% of the redds were in the mainstem McKenzie River below the confluence with the South Fork, 45-55% of the redds were in headwater areas above the confluence with the South Fork, and 15-20% of the redds were in the South Fork (ODFW 1999).

Mainstem areas of large Willamette River tributaries (e.g., McKenzie, Santiam, Clackamas Rivers) where UW chinook salmon reproduce naturally in the Willamette Basin are very important for rearing habitat. The upper mainstem of the Willamette River itself may also be important for rearing (Willis et al. 1995). Murtagh et al. (1992) note that juvenile UW chinook salmon in the Clackamas River do not appear to use the tributaries as rearing areas. Studies by Everest et al. (1987) in Fish Creek, as an example, showed that most fry emigrate to the Clackamas River soon after emergence. Zakel and Reed (1984) observed the same type of behavior among UW chinook salmon juveniles in the McKenzie River.

In the McKenzie, UW chinook salmon begin to drift into downstream rearing habitat in the lower mainstem or in the upper Willamette River as early as one month after emergence. Life history strategies include rearing in lower tributaries of the McKenzie or in the McKenzie mainstem for from three to 16 months. Three major periods of juvenile emigration occur in the McKenzie. Based on migration patterns averaged over the period 1986-92 from data collected by EWEB at Leaburg Dam, fry emigrate to rearing habitat downstream in January through March, shortly after emergence. Subyearling smolts (i.e., ocean-type life history) emigrate primarily in October through December. Yearling smolts emigrate from the McKenzie during their second spring in March and April (Willis et al. 1995).

Samples collected at various locations within the McKenzie Subbasin between 1948 and 1968 showed that fry migration historically occurred from March through June, several months later than under current conditions of January through March. Likewise, subyearling smolt migrations that now peak in October and November historically occurred in January through March. Changes in juvenile migration timing may be due to the release of warm water from impoundments above spawning areas during the fall incubation period, and consequent acceleration of fry emergence and movement (USACE 1995, 1998).

2. Bull Trout

Bull trout populations are known to exhibit four distinct life history forms: resident, fluvial, adfluvial, and anadromous. Resident bull trout spend their entire life cycle in the same (or nearby) streams in which they were hatched. Fluvial and adfluvial populations spawn in tributary streams where the young rear from one to four years before migrating to either a lake (adfluvial) or a river (fluvial) where they grow to maturity (Fraley and Shepard 1989). Anadromous bull trout spawn in tributary streams, with major growth and maturation occurring in the ocean.

The historic range of the bull trout spanned seven states (Alaska, Montana, Idaho, Washington, Oregon, Nevada, and California) and two Canadian Provinces (British Columbia and Alberta) along the Rocky Mountain and Cascade Mountain ranges (Cavender 1978). In the United States, bull trout occur in rivers and tributaries throughout the Columbia Basin in Montana, Idaho, Washington, Oregon, and Nevada, as well as the Klamath Basin in Oregon, and several cross-boundary drainages in extreme southeast Alaska. In California, bull trout were historically found only in the McCloud River, which represented the southernmost extension of the species' range. Bull trout numbers steadily declined after completion of McCloud and Shasta Dams (Rode 1990). The last confirmed report of a bull trout in the McCloud River was in 1975, and the original population is now considered to be extirpated (Rode 1990).

Bull trout distribution has been reduced by an estimated 40-60 % since pre-settlement times, due primarily to local extirpations, habitat degradation, and isolating factors. The remaining distribution of bull trout is highly fragmented. Resident bull trout presently exist as isolated remnant populations in the headwaters of rivers that once supported larger, more fecund migratory forms. These remnant populations have a low likelihood of persistence (Reiman and McIntyre 1993). Many populations and life history forms of bull trout have been extirpated entirely.

Highly migratory, fluvial populations have been eliminated from the largest, most productive river systems across the species' range. Stream habitat alterations restricting or eliminating bull trout include obstructions to migration, degradation of water quality, especially increasing temperatures and increased amounts of fine sediments, alteration of natural stream flow patterns, and structural modification of stream habitat (such as channelization or removal of cover).

In Oregon, bull trout were historically found in the Willamette River and major tributaries on the west side of the Oregon Cascades, the Columbia and Snake Rivers and major tributaries east of the Cascades, and in streams of the Klamath basin (Goetz 1989). Currently, most bull trout populations are confined to headwater areas of tributaries to the Columbia, Snake, and Klamath rivers (Ratliff and Howell 1992). Major tributary basins containing bull trout populations include the Willamette, Hood, Deschutes, John Day, and Umatilla (Columbia River tributaries), and the Owyhee/Malheur, Burnt/Powder, and Grande Ronde/Imnaha Basins (Snake River tributaries). Of these eight major basins, large fluvial migratory bull trout are potentially stable in only one, the Grande Ronde, and virtually eliminated from the remaining seven, including the majority of the mainstem Columbia River. The only known increasing population of bull trout is an adfluvial population located in Lake Billy Chinook, that spawns and rears in the Metolius River and tributaries in the Deschutes Basin. In recognition of the precarious status of Oregon bull trout populations, harvest of bull trout is prohibited in all state waters with the exception of Lake Billy Chinook and Lake Simtustus in the Deschutes River Basin.

Juvenile bull trout average 50-70 mm (2-3 in) in length at age 1, 100-120 mm (4-5 in) at age 2, and 150-170 mm (6-7 in) at age 3 (Pratt 1992). Juveniles have a slender body form and exhibit the small

scalation typical of char. The back and upper sides are typically olive-green to brown with a white to dusky underside. The dorsal surface and sides are marked with faint pink spots. They lack the worm-like vermiculations and reddish fins commonly seen on brook trout (*Salvelinus fontinalis*). Spawning bull trout, especially males, turn bright red on the ventral surface with a dark olive-brown back and black markings on the head and jaw. The spots become a more vivid orange-red and the pectoral, pelvic, and anal fins are red-black with a white leading edge. The males develop a pronounced hook on the lower jaw. Bull trout have an obvious "notch" on the end of the nose above the tip of the lower jaw.

Bull trout spawn in the fall, primarily in September or October when water temperatures drop below 9ºC (48ºF). Typically, spawning occurs in gravel, in runs or tails of spring-fed pools. Adults hold in areas of deep pools and cover and migrate at night (Pratt 1992). After spawning, adfluvial adults return to the lower river and lake.

Bull trout eggs require very cold incubation temperatures for normal embryonic development (McPhail and Murray 1979). In natural conditions, hatching usually takes 100 to 145 days and newly-hatched fry, known as alevins, require 65 to 90 days to absorb their yolk sacs (Pratt 1992). Consequently, fry do not emerge from the gravel and begin feeding for 200 or more days after eggs are deposited (Fraley and Shepard 1989), usually in about mid-April.

Fraley and Shepard (1989) reported that juvenile bull trout were rarely observed in streams with summer maximum temperatures exceeding 15ºC (59ºF). Fry, and perhaps juveniles, grow faster in cool water (Pratt 1992). Juvenile bull trout are closely associated with the substrate, frequently living on or within the streambed cobble (Pratt 1992). Along the stream bottom, juvenile bull trout use small pockets of slow water near high velocity, food-bearing water. Adult bull trout, like the young, are strongly associated with the bottom, preferring deep pools in cold water rivers, as well as lakes and reservoirs (Thomas 1992).

Juvenile adfluvial fish typically spend one to three years in natal streams before migrating in spring, summer, or fall to a large lake. After traveling downstream to a larger system from their natal streams, subadult bull trout (age 3 to 6 years) grow rapidly but do not reach sexual maturity for several years. Growth of resident fish is much slower, with smaller adult sizes and older age at maturity.

Juvenile bull trout feed primarily on aquatic insects (Pratt 1992). Subadult bull trout rapidly convert to eating fish and, as the evolution of the head and skull suggest, adults are opportunistic and largely nondiscriminating fish predators. Historically, native sculpins (*Cottus* spp.), suckers (*Catostomus* spp.), and mountain whitefish (*Prosopium williamsoni*) were probably the dominant prey across most of the bull trout range. Today, throughout most of the bull trout's remaining range, introduced species, particularly kokanee (*Oncorhynchus nerka*) and yellow perch (*Perca flavescens*), are often key food items (Pratt 1992).

Bull trout are habitat specialists, especially with regard to preferred conditions for reproduction. While a small fraction of available stream habitat within a drainage or subbasin may be used for spawning and rearing, a much more extensive area may be utilized as foraging habitat, or seasonally as migration corridors to other waters. Structural diversity is a prime component of good bull trout rearing streams (Pratt 1992). Several authors have observed highest juvenile densities in streams with diverse cobble substrate and low percentage of fine sediments (Shepard et al. 1984, Pratt 1992).

Persistence of migratory life history forms and maintenance or re-establishment of stream migration corridors is crucial to the viability of bull trout populations (Reiman and McIntyre 1993). Migratory bull trout facilitate the interchange of genetic material between populations, ensuring sufficient variability within populations. Migratory forms also provide a mechanism for reestablishing local populations that have been extirpated. Migratory forms are more fecund and larger than smaller non-native brook trout, potentially reducing the risks associated with hybridization (Reiman and McIntyre 1993). The greater fecundity of these larger fish enhances the ability of a population to persist in the presence of introduced fishes.

3. Spotted Owl

A detailed account of the taxonomy, ecology, and reproductive characteristics of the spotted owl is found in the 1987 and 1990 Fish and Wildlife Service Status Reviews (USDI 1987, 1990); the 1989 Status Review Supplement (USDI 1989); the Interagency Scientific Committee (ISC) Report (Thomas et al. 1990); and the final rule designating the spotted owl as a threatened species (55 FR 26114). There are approximately 5,899 pairs of spotted owls and resident singles (activity centers) and approximately 8.1 million acres of suitable habitat currently estimated across the range of the species (George Mayfield, USFWS, Portland, Oregon, personal communication, 1998). Recent demography studies indicate that the population is declining (Forsman et al. 1996, Franklin et al. 1999). These demographic studies are ongoing and data analysis recurs every three years. The most recent analysis indicates that, while still declining, the degree and extent of the decline may be less severe than previously thought (Franklin et al. 1999). While the population decline is expected to continue as spotted owl sites with severely degraded habitat conditions become inactive, implementation of the Forest Plan is expected to abate the decline by protecting all spotted owl sites within Late-Successional Reserves (LSRs) (USDI 1994). The Forest Plan will provide for the conservation of the species by allowing non-suitable, but capable, habitat to regenerate within the LSRs, allowing the population to increase and stabilize across its range.

The 1990 Spotted Owl Status Review Committee stated that population size is primarily a function of the amount and distribution of available habitat (USDI 1990). In developing a conservation strategy for late-successional forest-associated species including the spotted owl, the Departments of the Interior and Agriculture developed a network of forest reserves across the Pacific Northwest. This reserve network is designed to protect late-successional forest species where habitat conditions are relatively intact, and provide for the regeneration of late-successional forest habitat where it is limited and the

reliant plant and wildlife populations are low.

While populations of late-successional forest species are expected to decline in the managed forest matrix, they are expected to stabilize and eventually increase within LSRs in response to improving habitat conditions over the next 50 to 100 years. Hence, the Forest Plan is expected to provide for a more stable and better distributed population of late-successional forest species over time.

Prior to the implementation of the Forest Plan, late-successional forests were increasingly fragmented due to development, timber harvest, and stochastic natural and human induced actions. The spotted owl was listed as a threatened species in response to widespread habitat loss across its entire range. The Forest Ecosystem Management Team report, the FSEIS, and the Record of Decision detail the impacts of these natural and human induced actions on late-successional forests and related species, such as the spotted owl (USDA et al. 1993; USDA and USDI 1994a and 1994b.).

B. Critical Habitat

1. UW Chinook Salmon

Critical habitat for UW chinook salmon was designated by NMFS on February 16, 2000 (65 FR 7764). Critical habitat for UW chinook salmon encompasses its current freshwater and estuarine range, including all waterways, substrate, and adjacent riparian zones below longstanding, impassible, natural barriers. Critical habitat includes historic UW chinook salmon habitat above Cougar Dam on the South Fork McKenzie River and above other currently impassable Corps projects such Dexter Dam on the Middle Fork Willamette River because unmarked adult spring chinook have been trapped and hauled above them in recent years, resulting in natural spawning above these dams (February 16, 2000; 65 FR 7764).

UW chinook salmon's life cycle can be separated into five essential habitat types: (1) Juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. Habitat types 1 and 5 are often located in small headwater streams, while habitat types 2 and 4 include these tributaries as well as mainstem reaches and estuarine zones. Growth and development to adulthood (habitat type 3) occurs primarily in near- and off-shore marine waters, although final maturation takes place in freshwater tributaries when the adults return to spawn. Within all of these habitat types, essential features of UW chinook salmon critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (February 16, 2000; 65 FR 7764).

2. Bull Trout

In its final rule listing the Columbia River DPS of bull trout on June 10, 1998 (63 FR 31674), USFWS

found that the designation of critical habitat was not determinable based on the best available information. Thus bull trout critical habitat is not proposed or designated at this time.

3. Spotted Owl

Critical habitat for the spotted owl has been designated in the states of California, Oregon and Washington. The USFWS has determined that the physical and biological habitat features, referred to as the primary constituent elements, that support nesting, roosting, foraging, and dispersal are essential to the conservation of the spotted owl. Spotted owl nesting and roosting habitat typically includes moderate to high canopy closure, multi-species canopy with large overstory trees, a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence), large snags, large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for owls to fly. Spotted owls use a wider array of forest types for foraging and dispersal, including more open and fragmented habitat (57 FR 1796).

IV. EVALUATING PROPOSED ACTIONS

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). The Services must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the following: (1) defining the biological requirements of the listed species, ESU or DPS; (2) describing the current status of the listed species, ESU or DPS and their habitats under the environmental baseline; (3) evaluating the effects of the proposed action on the listed species, ESU or DPS; (4) considering the cumulative effects on the listed species, ESU or DPS; and (5) determining if the proposed action, together with the cumulative effects, is likely to jeopardize the continued existence of the listed species, ESU or DPS or result in the destruction or adverse modification of its designated critical habitat. The way NMFS applies these steps for species under their jurisdiction is described in more detail in Attachment 1.

This analysis is set within the dual context of the species' biological requirements and the existing conditions under the environmental baseline. The analysis takes into consideration an overall picture of the beneficial and detrimental activities taking place within the action area. If a jeopardy or destruction/adverse modification of critical habitat determination is made, then the Services must identify any reasonable and prudent alternatives to the proposed action.

A. Biological Requirements

As noted above, the first step in the method the Services use for applying the ESA standards of section 7 (a)(2) to listed species is to define the species' biological requirements that are most relevant to each consultation. The Services also consider the current status of the listed species taking into account

population size, trends, distribution and genetic diversity. To assess the current status of the listed species, the Services start with the information used to make their determinations to list the particular species for ESA protection (such as the chinook salmon status review, Myers et al. 1998), and then consider any new data that are relevant to those determinations.

The relevant biological requirements are those necessary for the listed species to survive and recover to naturally reproducing population levels at which protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed species, enhance its capacity to adapt to various environmental conditions, and allow it to become self-sustaining in the natural environment.

For this consultation, the Services find that the biological requirements of UW chinook salmon, bull trout, and spotted owl are best expressed in terms of: (1) characteristics of the subpopulations of listed UW chinook salmon, bull trout, and spotted owl within the action area; and (2) environmental factors that define the habitat qualities necessary for survival and recovery of listed UW chinook salmon, bull trout, and spotted owl within the action area. These characteristics are defined for UW chinook salmon in NMFS (1996, 1999) and for bull trout in USFWS (1998).

B. Environmental Baseline

1. Status of the Species Within the Action Area

a. UW Chinook Salmon Population Baseline

The combined historic annual run size of spring chinook salmon in the Willamette and Sandy Basins (i.e., Upper Willamette ESU plus part of Lower Columbia ESU) is estimated to have been several hundred thousand adults (ODFW 1995). Mattson (1948) stated "[t]he size of the Willamette River spring chinook runs before 1946 was never ascertained, but estimates based on egg takes at the various salmon hatcheries indicate that the runs of two decades past were approximately five times as great as those of the present", or over a quarter million spawners. The Oregon Fish Commission estimated that the largest UW chinook salmon run into the McKenzie River Subbasin for years they had data was approximately 46,000 adults in 1941. This estimate was based on an assumption that 39% of the UW chinook salmon adults over Willamette Falls were bound for the McKenzie (Mattson 1948, USACE 1995).

Because of the strong hatchery influence on McKenzie River spring chinook since the 1940s, the following population trends reflect combined abundances of hatchery and naturally produced fish (thus the term "UW chinook salmon" is not used except where appropriate). The estimated run size of spring chinook into the McKenzie Subbasin from 1945-60 was about 18,000 adults, with a high of 38,000 in 1953 and a low of 6,000 in 1950 (USACE 1995).

Since 1970, estimated annual returns of spring chinook adults to the McKenzie River averaged 5,861 fish from 1970 to 1979, 6,183 fish from 1980 to 1989, and 6,480 fish from 1990 through 1998. From 1970 through 1998, the spring chinook adult returns to the McKenzie River have comprised from 10.9% (1984) to 25.5% (1993) of the estimated escapement of spring chinook over Willamette Falls (ODFW, Springfield). Within the McKenzie Subbasin, the annual returns of spring chinook adults above Leaburg Dam at river mile 35 averaged 2,599 fish from 1970 to 1979, 2,493 fish from 1980 to 1989, and 2,950 fish from 1990 through 1998, or 40-45% of the total spring chinook returning adults to the McKenzie.

Since 1994, ODFW has estimated the proportion of spring chinook salmon returning to Leaburg Dam that are naturally produced (i.e., UW chinook salmon). The proportion of naturally produced spawners has increased from approximately 54% in 1994 to 72% in 1999 (84% in 1997; from BA and Jeff Ziller, ODFW, Springfield). Multiplying this estimate by the total number of returning spring chinook spawners at Leaburg gives an estimate of the number of UW chinook salmon spawners escaping into the upper McKenzie, and for the period 1994 through 1999 these estimates range from 824 in 1994 to 1,443 in 1998. The abundance of naturally produced spring chinook (UW chinook salmon) adults above Leaburg Dam averaged approximately 1,104 fish from 1994 through 1999. Approximately 10-20% of the chinook salmon above Leaburg Dam spawn in the South Fork of the McKenzie, 30-40% spawn in the mainstem McKenzie River below the confluence with the South Fork, and 45-60% spawn in headwater areas above the confluence with the South Fork up to Trail Bridge Dam (USFWS 1994, ODFW 1999).

At present most of the natural production of UW chinook salmon occurs in the McKenzie River Subbasin (final listing rule, 64 FR 14308). The upper watershed (i.e., above Leaburg Dam) is managed by ODFW as a natural production area by minimizing the escapement of hatchery produced adults above the dam. Natural spawning occurs both above and below the dam but is probably concentrated above it (ODFW 1995). UW chinook salmon redd counts from aerial surveys in the McKenzie River and redd counts from the Carmen-Smith spawning channel (located just below the impassable Trail Bridge Dam at river mile 78) both indicate a fluctuating but strong level of natural spawning from the mid 1960's to the present above Leaburg Dam (ODFW 1999).

i. Mainstem McKenzie: South Fork Confluence-Leaburg Dam

Adult UW chinook salmon migrate past Leaburg Dam and into the upper McKenzie River Basin in early summer, then hold in deep holes in the mainstem until spawning in September. Approximately 30-40% of these fish spawn in the mainstem McKenzie River below the confluence with the South Fork, with most or all spawning occurring in September (USFWS 1994, ODFW 1999).

ii. South Fork McKenzie River

Under its authority granted by the Fish and Wildlife Coordination Act, the USFWS conducted a survey

of fish and wildlife resources affected by Cougar Dam before the project was constructed, providing some historical information on UW chinook salmon in the South Fork of the McKenzie River (USFWS 1959). This report states that prior to 1958 (no beginning point indicated), an average of approximately 2,000 adult spring chinook salmon entered the South Fork annually to spawn. This average was more than doubled in 1958 when about 4,300 adult spring chinook salmon entered the South Fork. USFWS calculated that the spawning habitat available in the South Fork at the time would accommodate 5,360 adult spring chinook salmon. Prior to USFWS's study, the Corps estimated the South Fork could support a run of 6,000 adult spring chinook salmon, and a 1937-38 survey by the Bureau of Commercial Fisheries (predecessor of NMFS) estimated spawning area available for "at least 13,000 salmon" (Willamette National Forest [WNF] 1994).

UW chinook salmon currently have volitional access to 4.5 miles of the South Fork McKenzie River below the dam. Adult UW chinook salmon are thought to delay entering the South Fork due to unnatural water temperatures in the late summer and early fall caused by Cougar Dam (e.g., warming temperatures from reservoir releases after Labor Day when water temperatures would be naturally decreasing). Despite this, it has been estimated that the South Fork provides 10-20% of the UW chinook salmon spawning habitat above Leaburg Dam, based on spawning habitat area and redd counts (USFWS 1994, ODFW 1999). However, much higher pre-spawning mortalities of female UW chinook salmon in the South Fork (23%) than in areas unaffected by altered water temperatures (5%) may mean that the productivity of the South Fork is lower than its proportion of spawning habitat and redds would suggest. In addition, alteration of water temperatures by the dam during incubation has accelerated the emergence timing of UW chinook salmon fry by up to 85 days in the South Fork, most likely reducing fry survival (WNF 1994). The gross reduction in available spawning and rearing habitat, together with the degraded water temperatures and subsequent alterations in emergence timing, have severely depressed the production of UW chinook salmon in the South Fork.

In recent years small numbers of unmarked adult spring chinook salmon (considered by ODFW to be hatchery-produced but included in the listed UW chinook salmon ESU[3]) have been trapped and hauled above Cougar Dam, thus extending the ESU's range into historic spring chinook habitat above the dam. Natural spawning of the marked and unmarked adults released above the dam has resulted in some production of juvenile spring chinook salmon, all of which are considered listed UW chinook salmon. Because there are no juvenile passage facilities at Cougar Dam, outmigrating juvenile UW chinook salmon pass through the turbines, resulting in high mortality (Jeff Ziller, ODFW, personal communication).

b. Bull Trout Population Baseline

Bull trout were historically found throughout much of the Willamette Basin, including the North and South Santiam Rivers, the Clackamas River, Middle and North Forks of the Willamette River and the McKenzie River (Buchanan et al. 1997). With the exception of populations that persists in the McKenzie River and a small reintroduced population in the Middle Fork Willamette River above Hills

Creek Reservoir, bull trout have been extirpated from the Willamette Basin. Reasons for the decline of bull trout in the Willamette Basin include habitat degradation, passage barriers, overharvest, chemical treatment projects, and hybridization and competition with non-native brook trout (Ratliff and Howell 1992).

Based on the presence of Cougar and Trailbridge Dams as barriers, USFWS recognizes three subpopulations of bull trout in the McKenzie River Basin as follows: (1) McKenzie River and tributaries from the mouth up to Trailbridge Dam; (2) McKenzie River and tributaries above Trailbridge Dam; and (3) South Fork McKenzie River, upstream of Cougar Reservoir. Mature bull trout in the entire McKenzie River system are suspected to number fewer than 300 individuals.

Bull trout spawning in the McKenzie River system usually occurs from early September to early October in cold, stable, spring-fed creeks. In the South Fork McKenzie River, bull trout are known to spawn only in Roaring River upstream of Cougar Reservoir. ODFW surveys in 1999 detected as many as 41 adult bull trout and 10 redds in Roaring River (Jeff Ziller, ODFW, Springfield, personal communication, October 1999). There may be as many as 500-1,000 juvenile (age 2 +) bull trout in the reservoir and South Fork above the dam (Jeff Ziller, ODFW, Springfield, personal communication, January 2000).

In the mainstem McKenzie River subpopulation, bull trout are known to spawn only in Anderson and Olallie Creeks, both of which are upstream of the confluence with the South Fork. ODFW surveys in 1999 indicate a stable bull trout population in Anderson Creek, with as many as 242 mature bull trout and approximately 80 redds; Olallie Creek has a smaller spawning population with only nine redds detected in 1999 (Jeff Ziller, ODFW, Springfield, personal communication, September 1999). Bull trout abundance in the South Fork McKenzie River below Cougar Dam is unknown; adults are occasionally detected, or caught by anglers, but there is no known spawning habitat. Adult bull trout migrate throughout the McKenzie River and may be found anywhere in the mainstem, as far down as the McKenzie's confluence with the Willamette River, where an individual bull trout was recently caught by ODFW.

c. Spotted Owl Population Baseline

Approximately 739 known activity centers occur within the Willamette National Forest. Of these, 299 (40%) are located in land allocations which are generally protected from habitat-altering activities.

Four spotted owl activity areas are located within the immediate project area. Two of these sites are located more than one mile from Cougar Dam. Prior to 1995, a third site was located in the Rush Creek watershed, approximately 0.75 mile from the project area. In 1998, a fourth spotted owl activity area was established in the Rush Creek watershed. Nesting was confirmed at this site in 1988, but not in 1999. The nest is located adjacent to a gated Forest Service road, approximately 2,000 feet from the Rush Creek diversion tunnel intake.

2. Factors Affecting Species Environment Within the Action Area

a. UW Chinook Salmon Habitat Baseline

As noted above, approximately 10-20% of the chinook salmon above Leaburg Dam spawn in the South Fork of the McKenzie below Cougar Dam, 30-40% spawn in the mainstem McKenzie River below the confluence with the South Fork, and 45-60% spawn in headwater areas above the confluence with the South Fork up to Trail Bridge Dam (USFWS 1994, ODFW 1999). In addition, fish that spawn upstream of the South Fork confluence may hold throughout the summer in deep holes between Leaburg Dam and the South Fork confluence before moving up to their spawning habitat. Rearing habitat within the action area for juvenile UW chinook salmon is provided by side channels and river margins along the mainstem and, to a lesser degree, the South Fork (WNF 1995). Because of the significantly greater impact of Cougar Dam on the South Fork, the habitat baseline for UW chinook salmon is described below separately for the South Fork and the mainstem between the South Fork confluence and Leaburg Dam. The habitat baseline of the South Fork is primarily a result of the construction and operation of Cougar Dam, while the habitat baseline of the South Fork confluence-Leaburg Dam reach of the mainstem is a result of many human activities. The UW chinook salmon habitat baseline description is followed by a section describing the link between current habitat conditions in these areas and UW chinook salmon life history stages.

i. South Fork below Cougar Dam

The purpose of the proposed action is to improve water temperature conditions in the summer and fall that have been degraded by the operation of Cougar Dam. These effects have been especially pronounced downstream of the dam in the South Fork, and have led to the current degraded condition of the water temperature baseline. Cougar Dam is managed by the Corps primarily for flood control but also for secondary purposes such as recreation and instream flows. Thus the reservoir is kept at its minimum flood control pool from November through January to provide room for potential floodwaters, then filled up nearly to full pool from February through May to provide recreation in the summer and stored water for instream flows and other purposes. The reservoir is drawn back down to minimum flood control pool in September and October to complete the cycle. This seasonal regulation schedule of the reservoir elevation is commonly known as the “rule curve” (USACE 1995).

Because water can only be released from the bottom of Cougar Dam and water temperatures in the reservoir during the summer are strongly stratified, this management scenario results in water being released in the spring and summer that is up to . 10°F colder (Fig.8, USACE 1995) than pre-project conditions in the South Fork. The water in the upper portion of the reservoir is heated throughout the summer, and as the deeper, colder water is released, the water temperature in the reservoir gradually increases and the different layers of water mix. This results in water releases that are warming throughout the fall when pre-project water temperatures would have been cooling, culminating in

October releases being up to . 10°F warmer (Fig.8, USACE 1995) than pre-project water temperatures in the South Fork. The resulting water temperature baseline is described in numerous reports, most of which have been done for the proposed action (U.S. Geological Survey [USGS] 1988; NMFS 1990; USFWS 1990, 1994; WNF 1994; USACE 1990, 1991a, 1991b, 1995, 1999a).

The management of Cougar Dam for flood control (i.e., adherence to the rule curve described above) has resulted in major changes to the flow regime of the South Fork below the dam. From November through January when the reservoir is kept at minimum flood control pool, flows below the dam are variable in order to maintain the reservoir at this elevation to provide flood control capacity. If there is a high flow event, the reservoir level will increase to hold back the floodwaters, and the flows below the dam in the South Fork may actually decrease to 100 cfs to reduce flooding downstream of the confluence of the South Fork and mainstem. From February through May the reservoir is filled and generally 300 cfs are released into the South Fork, at least four times less than pre-dam flows during this period of naturally increasing flows due to spring melt-off. From late May until early September, near full pool is maintained and 200 cfs is released to maintain minimum flows in the South Fork, when pre-dam flows would have been slowly decreasing. The largest departure from pre-dam flow regimes occurs in September and October, when flows in the South Fork would naturally be at their lowest until the onset of rains. This is when the reservoir is drawn back down to minimum flood control pool, resulting in South Fork flows below the dam increasing to 800-1,000 cfs - at least twice as high as pre-project flows at this time of the year (WNF 1994, USACE 1995).

The disruption of the flow regime by the operation Cougar Dam and subsequent effects on the hydrologic process in the South Fork has had a major impact on UW chinook salmon physical habitat below the dam. The environmental baseline in the South Fork watershed is described in detail in a Watershed Analysis report by Willamette National Forest (WNF 1994). In addition to blocking the vast majority of historical UW chinook salmon habitat in the South Fork, Cougar Dam has also degraded the 4.5 mile reach of the South Fork below the dam through disruption of hydrologic and geomorphic processes. As an example, the 1964 flood (130-year flood) occurred the year following dam closure, thus high flows and accompanying sediment were held back from the 4.5 mile reach below the dam, effectively discharging the equivalent of a 2-year flood. Depriving this reach of high flows and sediment resulted in a 43% decrease in cobble and gravel within the first year of the dam's operation due to substrates being sluiced out and not replaced (WNF 1994). This is a typical channel response to dam construction (Kondolf 1997).

Historical habitat changes and the current environmental baseline for UW chinook salmon habitat in the South Fork below Cougar Dam are a continuum and are thus summarized together below. Historical stream channel changes in this reach were documented by WNF (1994) using analysis of aerial photos taken in 1939, 1953, 1959, 1967, 1979, and 1990. These photos show that the channel has gradually changed from a system of multiple substrate types, abundant large woody debris, and active side channels, to a simplified, narrow channel. Depriving this reach of high flows and sediment has resulted in

the following channel and floodplain trends: (1) abandonment of secondary channels; (2) transformation of depositional bars into floodplains; and (3) transformation of old floodplains into terraces. This in turn has led to a shift in riparian vegetation patterns, such as the establishment of shrubs and alders in former secondary channels and on previously barren bars along the low water channel margin within the main channel (WNF 1994).

ii. South Fork above Cougar Dam

The environmental baseline of the South Fork above the dam is described in detail in a Watershed Analysis report by Willamette National Forest (WNF 1994). The South Fork of the McKenzie flows from its headwaters in the High Cascades for 16 miles where it joins with a major spring-fed tributary, Roaring River. The South Fork then flows for another 12 miles to Cougar Reservoir, which is approximately five miles long. The three primary characteristics of UW chinook salmon habitat above the dam that appear to be most outside the range of natural variability in the South Fork watershed are: (1) reduced habitat complexity in the main South Fork; (2) inundation of historic spawning habitat by the reservoir; and (3) the migratory blockage caused by the dam. Current habitat complexity is described below.

Although habitat complexity is influenced by many factors, the 1964 flood appears to have been the predominant event affecting channel changes within the watershed during the last century, with the exception of significant impacts attributed to the removal (salvage) of large woody debris. Aerial photo analysis during six time intervals from 1939-1990 indicate that the South Fork has been in a slow process of recovery since the flood in 1964. Channel complexity in the earliest photo series indicated a much more complex stream channel than the one present following the flood. Aggressive salvage of large woody debris from the main channel and side channels from 1964 through the early 1980's resulted in further simplification of the stream channel, in part by reducing the number and length of side channels. This has resulted in loss of deep pool habitat and large wood which provide cover and maintain optimal stream temperatures (WNF 1994).

Habitat complexity may also be reduced in Roaring River due to the location of Forest Road 19, forest salvage activities in the lower reach, and riparian degradation due to designated and dispersed camping areas next to the Roaring River. The reduction in habitat complexity within the main South Fork has lowered the capability of the habitat to produce salmon, trout, and other aquatic species. The reduction in side channel habitat throughout the main South Fork equates to a loss in critical salmonid rearing habitat. Main South Fork pool habitat has been reduced from 1937-1938 levels by approximately 60%-90% (WNF 1994).

iii. Mainstem: South Fork Confluence-Leaburg Dam

USGS (1988) studied the effects of Cougar and Blue River Dams on the water temperatures in the mainstem of the McKenzie River from the South Fork confluence (river mile 59.7) to Vida (river mile

47.7). Based on modeling for an "average" year, the study found that Cougar Dam alone resulted in (compared to pre-project conditions) a maximum water temperature decrease at Vida from July through September of 2.0°F, and a maximum increase in October of 2.4°F. The model showed that the average water temperature decrease due to Cougar Dam alone (compared to pre-project conditions) at Vida over 101 days in the summer and early fall was . 1.37°F, and the average water temperature increase over 57 days in the fall was . 1.75°F (Table 7, USGS 1988)

The management of Cougar Dam for flood control (i.e., adherence to the rule curve described above) has also resulted in changes to the flow regime of the mainstem McKenzie River below its confluence with the South Fork (river mile 59.7). This is a reflection of the flow regime changes in the South Fork described above, as dampened by the influence of mainstem flows above the South Fork confluence. Since the project was built, there has been a 30 to 50% reduction in flows at Vida (river mile 47.7) from February through June, and a corresponding increase in flows during August through October (USACE 1995).

The disruption of the flow regime by the operation of Cougar Dam and subsequent effects on the hydrologic process in the mainstem between the South Fork confluence and Leaburg Dam have likely affected UW chinook salmon physical habitat, for the same reasons described above for the South Fork but to a lesser degree (EA Engineering 1991). For example, the bedload coarsening in the mainstem between 1937 and 1991 reported by Sedell et al. (1992) may have been partially caused by sediment interception at Cougar Dam as well as by EWEB's Carmen-Smith-Trail Bridge Dams on the upper mainstem. However, the habitat baseline along this reach of the mainstem has also been affected by many other human activities typical of riparian corridors of large Pacific Northwest rivers, such as road construction, riprapping, other dams (i.e., Leaburg), large wood removal from the channel, timber harvest, farming, grazing, landscaping, and residential development (Weyerhaeuser 1994). Some of the resulting simplification in channel morphology and fish habitat complexity has been documented by Minear (1994).

iv. The Habitat Baseline and UW Chinook Salmon Life Cycle

The relevance of the habitat baseline to UW chinook salmon is clarified by linking current conditions to life history stages: As described above, the management of Cougar Dam results in colder than natural stream temperatures in August and September below the dam, followed by a sudden temperature increase as the summer pool is drained such that stream temperatures are warmer than natural in October. As adult UW chinook salmon approach the South Fork on their spawning migration in the late summer, they delay entering the stream because of the cold temperatures or spawn elsewhere. Of those that do enter the South Fork, prespawning mortality is approximately five times as high as fish spawning in the mainstem above the confluence of the South Fork.

Substantial UW chinook salmon spawning still occurs in the South Fork, but the warmer water temperatures during egg incubation in October and November result in fry emergence as early as the first

week in December. Historically, UW chinook salmon fry emergence occurred in February through March thus the early emerging fry are now faced with a much longer period of unfavorable wintertime conditions (USACE 1995, 1998). To make matters worse, winter flow releases from the dam are much smaller than historic flows at this time of the year due to flood control, and because reservoir filling for summertime recreation begins in February. Thus side channels that historically provided rearing habitat for fry during the winter are not connected to the main channel (WNF 1994).

b. Bull Trout Habitat Baseline

Very little historical data exist for bull trout in the McKenzie River and thus historical information on critical spawning, rearing and over-wintering habitat is generally unknown. Recent habitat and population surveys by USFS and ODFW indicate that the remaining spawning and rearing habitat in the McKenzie Basin exists in headwater streams fed by springs originating from the High Cascades, comparatively young geologic formations between three and six thousand years old (WNF 1995). Snow melt filtering through the younger rock provides clear, cold, constant water temperatures necessary for bull trout spawning, egg incubation and rearing (WNF 1995). Buchanan et al. (1997) reported that water temperatures in streams used by spawning McKenzie River bull trout ranged from 5 to 8°C.

Ratliff and Howell (1992) list habitat degradation, passage barriers, over-harvest, chemical treatment projects, and hybridization and competition with non-native brook trout as possible suppressing factors for bull trout populations in the Willamette Basin. The Willamette National Forest, South Fork McKenzie Watershed Analysis (WNF 1994) outlined the following five habitat variables particularly important for maintaining viable populations of bull trout: stream channel stability; habitat complexity; substrate composition; temperature; and migratory corridors. The following is a summary of known information regarding the past and current habitat conditions for the two sub-populations of bull trout in the McKenzie Basin which fall within the action area.

i. McKenzie River below Trail Bridge Dam

The lower McKenzie sub-population consists of migratory (fluvial) fish that are known to spawn in only two spring-fed tributaries, Anderson and Olallie creeks (Buchanan et al. 1997). Spawning takes place in late August, September and October. Prior to August 1995, spawning habitat in Olallie Creek was limited to less than one kilometer of stream below an unpassable culvert at State Highway 126. Passage was restored in 1995 in a collaborative project between the Oregon Department of Fish and Wildlife, Willamette National Forest, Eugene Water and Electric Board, Oregon Department of Transportation, and the Oregon Council Federation of Flyfishers (WNF, McKenzie Ranger District 1995). The self-cleaning culvert provided access to an additional 3.2 km of spawning and rearing habitat (Buchanan et al. 1997). Adult bull trout rear in the mainstem McKenzie from below Leaburg Dam up to Trail Bridge Dam, and then stage in the Mainstem McKenzie River in July, August and early September (Buchanan et al.1997). Recent radio tagging studies in the McKenzie indicate that adult bull trout show a

propensity to return after spawning each year to the same over-wintering area and that they begin moving upstream to staging areas as early as May and June (ODFW 1998).

Although the mainstem of the McKenzie River may appear relatively pristine to the casual observer, a number of studies have shown that it has been degraded during the last century. Minear (1994) found that between 1949 and 1986, the number and total length of side channels along the mainstem declined, indicating possible channel downcutting and abandonment of side channels. Sedell et al. (1992) found that larger substrates were more abundant in the upper mainstem in 1991 than in 1937, indicating that bedload coarsening has occurred. The Willamette National Forest (WNF 1995) reported that the interception of large woody debris by upstream dams has resulted in simplification of stream structure through loss of scour sources, flow deflection, and sediment storage capability. Minear (1994) and WNF (1995) found that simplification of stream structure has occurred in the last several decades in the mainstem McKenzie River due to reduced quantities of large woody debris, channelization by riprap and roads, and alteration of riparian vegetation. Degradation of riparian areas along the mainstem has, and is, occurring due to recreation, primarily camping (WNF 1995).

The physical habitat, water quality and food base in the South Fork McKenzie between Cougar Dam and the mainstem McKenzie has been significantly altered by the construction and operation of the dam since 1964 (WNF 1994). The effects of the dam on the general ecology of the South Fork, and to a lesser degree to the mainstem McKenzie, has been described above in the chinook habitat baseline section as well as in numerous reports, many done for the proposed action (USGS 1988; NMFS 1990; USFWS 1990, 1994; WNF 1994; USACE 1990, 1991a, 1991b, 1995, 1999). Despite the lack of spawning and rearing habitat, a reduced stable food base and the altered temperature regime, recent surveys by ODFW indicate that bull trout are utilizing the South Fork below Cougar Dam (Jeff Ziller, ODFW Springfield, personal communication, January, 2000).

ii. McKenzie River above Trail Bridge Dam

Trail Bridge Dam, constructed in 1963 on the upper McKenzie, effectively isolated a subpopulation of bull trout from the population downstream. The remaining habitat includes the 73 acre reservoir, two miles of the McKenzie River up to Tamolich Falls (a natural barrier), and several tributaries including Smith River and Sweetwater Creek (WNF 1995). Buchanan et al. (1997) reported that this sub-population is severely limited by lack of spawning habitat and is at “high-risk” of extinction. Documentation of bull trout spawning in the McKenzie River above Trail Bridge Dam is limited to the observed presence of seven redds in 1996 and three each in 1997 and 1998, all in the McKenzie (ODFW 1997, 1998). Sweetwater Creek, a historical spawning stream for bull trout which now empties directly into the reservoir, was funneled through an impassable culvert when State Highway 126 was built concurrent with the construction of Trail Bridge Dam. The addition of a new culvert with fish passage in 1993, coupled with the stocking of bull trout fry from Anderson Creek, should help establish future spawning (Buchanan et al. 1997). USFS biologists observed adult bull trout ascending Sweetwater Creek during the fall of 1999, but no redds were observed in subsequent surveys (Jeff

Ziller, ODFW Springfield, personal communication, January, 2000). Factors influencing this population are similar to those affecting the other two remaining sub-populations of bull trout in the Willamette Basin: incidental harvest, small population size, fragmented habitat, competition with exotics and habitat degradation.

iii. South Fork McKenzie River above Cougar Dam

The environmental baseline in the South Fork watershed is described in detail in a Watershed Analysis report by Willamette National Forest (WNF 1994). The South Fork of the McKenzie flows from its headwaters in the High Cascades for 16 miles where it joins with a major spring-fed tributary, Roaring River. The South Fork then flows for another 12 miles to Cougar Reservoir, which is approximately five miles long, and five more miles to its confluence with the mainstem of the McKenzie for a total length of 38 miles (WNF 1994). Bull trout in the South Fork McKenzie River are isolated by Cougar Dam, which has no downstream or upstream passage facilities. The only known spawning occurs in Roaring River, and no resident life history form has been identified within the area (Buchanan et al. 1997). Adults and sub-adults are thought to rear in the reservoir; adults move up out of the reservoir to staging areas in the South Fork as early as May. Spawning occurs generally from early September through October after which movement is thought to be fairly rapid back downstream to the reservoir (Jeff Ziller, ODFW Springfield, personal communication, October, 2000).

Characteristics that appear to be most outside the range of natural variability in the South Fork watershed are habitat complexity in the main South Fork and the migratory corridor which has been disrupted by Cougar Dam (WNF 1994). Although habitat complexity is influenced by many factors, the 1964 flood appears to have been the predominant event affecting channel changes within the watershed during the last century, with the exception of significant impacts attributed to the removal (salvage) of large woody debris. Aerial photo analysis during six time intervals from 1939-1990 indicate that the South Fork has been in a slow process of recovery since the flood in 1964. Channel complexity in the earliest photo series indicated a much more complex stream channel than the one present following the flood. Aggressive salvage of large woody debris from the main channel and side channels from 1964 through the early 1980's resulted in further simplification of the stream channel, in part by reducing the number and length of side channels (WNF 1994).

The main factors affecting bull trout in the South Fork in terms of habitat complexity are the loss of deep pool habitat and large wood which provide cover and maintain optimal stream temperatures. Habitat complexity may be reduced in Roaring River due to the location of Forest Road 19, forest salvage activities in the lower reach, and riparian degradation due to designated and dispersed camping areas next to the Roaring River (WNF 1994). The reduction in habitat complexity within the main South Fork has lowered the capability of the habitat to produce salmon, trout, and other aquatic species. The reduction in side channel habitat throughout the main South Fork equates to a loss in critical salmonid rearing habitat. Main South Fork pool habitat has been reduced from 1937-1938 levels by approximately 60%-90% (WNF 1994). Available spawning habitat is also reduced according to

Buchanan et al. (1997), who reported that the bull trout population above Cougar Dam is severely limited by lack of spawning habitat.

Relative rates of sediment introduced to the South Fork from tributaries in pre-managed (1800-1950) and managed (1950-present) time periods were examined in the South Fork Watershed Analysis (WNF 1994). Rates, locations and causes of sediment yield to the main channel were found to have changed over time for a number of reasons. In the pre-management time period, the majority of introduced sediment was a result of fire and landslides in many of the sub-watersheds. Recovery from fire in these areas has reduced the relative amount of contributed sediment to the main channel. In the managed time period from 1950 to present, sedimentation has been the result of timber harvest activities and associated road building in combination with natural disturbances such as fire, floods and landslides.

Tier 1, Key Watershed designation under the President's Northwest Forest Plan for the majority of the South Fork watershed plays a role in a regional conservation strategy for maintaining aquatic ecosystems and the species that have evolved in them (WNF 1994). However, past natural and human disturbance has, and continues to, significantly affect the watershed. Prior to 1900, the South Fork watershed was largely shaped by natural processes including flooding, landslides, fire and other natural disturbances. Forest Road 19 was built in 1934, opening up the watershed to recreation and timber harvest. The early 1950's saw new road access into the watershed which led to significant human disturbance including timber harvest, campgrounds, grazing and fire lookouts. A decade later saw increased timber harvest and associated road networks, as well as the construction of Cougar Dam in the early 1960's (WNF 1994). Timber harvest levels continued to increase, peaking in the 1970's and 1980's and dropping to current levels following the implementation of the President's Northwest Forest Plan in the 1990's.

Historical stream temperature data for the South Fork show the correlation between past timber harvest levels and stream temperatures (WNF 1994). Temperature data for the South Fork was collected at the gaging station above the reservoir for water years 1958-1987. Corresponding graphs (Fig. 38, 39 in WNF 1994) display the total number of days, and number of consecutive days, by year, that South Fork temperatures exceeded 58ºF, clearly illustrating a general trend of increasing temperatures peaking in the late 1970's through early 1980's and declining into the late 1980's. Reduced harvest and stream buffers left on harvest units beginning in the mid 1980's should ensure a continued decline in high stream temperatures that result from timber harvest (WNF 1994).

Although Cougar reservoir is generally acknowledged as important habitat to the South Fork sub-population of bull trout, little information exists as to how bull trout use the reservoir, how many are present, at what time of year, and the nature of their forage base. Forthcoming studies by the Army Corps of Engineers and the Oregon Department of Fish and Wildlife, as well as ongoing radio-tagging of adult bull trout, will help clarify the role of the reservoir to bull trout in the South Fork McKenzie.

c. Spotted Owl Habitat Baseline

Cougar Dam and Reservoir are within the Willamette National Forest. Of the 1,686,000 acres of the Willamette National Forest in Federal ownership, 1,421,000 acres are capable of supporting suitable spotted owl habitat. Capable habitat does not include large bodies of water, serpentine soils, or other land types incapable of supporting spotted owl habitat. Of this, about 740,000 acres is currently suitable spotted owl habitat (suitable habitat is defined generally as stands with trees of 21" dbh or greater with 40 percent or greater canopy closure, although other areas may also provide spotted owl habitat). Of the acres of "capable" habitat, 779,000 acres (57%) are now protected within an allocation that is not expected to alter its suitability as spotted owl habitat, although only 61 percent (451,500 acres) of the protected capable habitat is currently suitable spotted owl habitat. These figures suggest that as spotted owl habitat regenerates within the land allocations protected from habitat removal, the amount of suitable habitat within the action area will increase from 451,500 acres to a maximum of 779,000 acres (recognizing that some percentage of protected capable habitat will likely be unsuitable due to dynamic disturbance regimes and stochastic events likely to occur at any given time in the future). The quality and distribution of spotted owl habitat is expected to improve as the fragmented habitat scattered across the matrix is replaced by more contiguous older-forest habitat within LSRs.

Table 1 depicts the status of the spotted owl and its habitat within the Willamette National Forest. This information can be found in the Willamette Province Fiscal Year 2000 Habitat Modification Biological Assessment For Effects To Spotted Owl and Bald Eagles.

Table 1. Status of the Spotted Owl and its Habitat Within the Willamette National Forest

	Total	Total Protected (% of Total) [1]	Total Unprotected (% of Total) [2]
Acres Within Boundary	1,797,795	958,321 (53%)	839,474 (47%)
Acres of Ownership	1,686,004	958,321 (57%)	727,683 (43%)
Suitable Habitat-Capable Acres	1,421,020	779,008 (55%)	642,012 (45%)
Suitable Habitat- Current Acres	740,053	451,509 (61%)	288,544 (39%)
Critical Habitat- Capable Suitable Acres	671,041	400,335 (60%)	270,706 (40%)
Critical Habitat- Current Suitable Acres	348,657	228,652 (66%)	120,005 (34%)
Spotted Owl Activity Centers	739	299 (40%)	440 (60%)

[1] Acres in this column are comprised of LSR, 100-acre LSRs, Congressionally Withdrawn Areas, Riparian Reserves, District Designated Reserves, and Scenic Area Open Spaces. Spotted owl data are comprised of large LSR and wildernesses only. These figures include those owl activity centers whose centers fall within the LSR or the wilderness. The 1.2 mile radius surrounding the activity center may actually extend into unprotected areas.

[2] Acres AND spotted owl data in this column are comprised of Matrix, AMA, and Administratively Withdrawn Areas.

V. ANALYSIS OF EFFECTS ON LISTED SPECIES AND CRITICAL HABITAT

The proposed action is the construction of the Cougar WTC project by the Corps, but not the operation of Cougar Dam beyond the construction period. This consultation addresses the effects of construction and related monitoring and mitigation on UW chinook salmon, bull trout and spotted owl. These short-term effects are analyzed in three different ways: (1) direct effects on listed fish and wildlife; (2) effects on habitat of listed fish and wildlife; and (3) effects on spotted owl critical habitat and UW chinook salmon critical habitat . See Table 2 for a summary of impacts to listed species from the proposed action.

Table 2. Effects to listed species resulting from construction of the Cougar WTC project, monitoring and mitigation (continued on next page).

Activity	Impact	Effects to Listed Species*		
		Chinook	Bull Trout	Spotted Owl
Construction Phase				
1. Preparation and Use of Staging Area	none			
2. Preparation of Main Diversion Tunnel	noise from blasting to reopen the diversion tunnel			D
	increased sedimentation from in-water dredging and disposal of material removed in opening tunnel	H	H	
3. Re-opening Rush Creek Diversion Tunnel	noise from blasting			D
	increased sedimentation from in-water dredging and disposal of material removed in opening tunnel	H	H	
4. Drawing Down the Reservoir	reduced reservoir pool size (May - October, 2001-2003)	H	H	
	altered flows and temperature in South Fork below Cougar Dam	H	H	
	increased turbidity in residual pool and South Fork below Cougar Dam	H	H	
	increased temperature in residual pool	H	H	
	entrainment through unscreened diversion tunnel	D	D	

Activity	Impact	Effects to Listed Species*		
		Chinook	Bull Trout	Spotted Owl
	migration barrier/ sedimentation at upstream end of residual pool	D	D	
5. Construction of New Intake Structure	sedimentation associated with construction of cofferdam	H	H	
	sedimentation from construction of new trashrack	H	H	
	noise from construction			D
Monitoring				
1. Water quality monitoring	none			
2. Experimental fish trapping	capture and handling of fish	D	D	
3. Noise monitoring	none			
Mitigation				
1. Bull trout rescue from residual pool	capture, handling and relocation of fish		D	
2. Installation and use of temporary trap and haul facilities for interim fish passage	capture, handling and relocation of fish	D	D	

* D = direct effect on listed species, H = effect to habitat of listed species

A. Direct Effects on Listed Species

1. UW Chinook and Bull Trout

Direct effects on listed fishes will occur during construction, monitoring and mitigation.

a. Construction

i. Entrainment into the diversion tunnel

The structure and volume of the residual pool would be such that it would stratify during the summer construction period. Corps modeling shows fairly uniform temperatures of 60ºF-62ºF during the summer months occurring at and below a depth of about 35 feet. Although there is a lack of information concerning the distribution of bull trout within Cougar Reservoir, most species avoid the upper, warm

layer of water and distribute near the thermocline where the water is both cool and well oxygenated. Bull trout require particularly cold water; temperatures above 59ºF are likely to limit bull trout distribution (Fraley and Shepard 1989). Recent information regarding migratory behavior of bull trout suggests that adults overwintering in Cougar Reservoir may move upstream into spawning areas in the upper watershed above the reservoir during April and May (USACE 1999b). Given the likely water temperature conditions in the residual pool after mid-June and the preferred temperature range of bull trout, we expect few adult bull trout to remain in the residual pool during the construction period. However, it is possible that subadults will remain in the reservoir.

In the BA, the Corps predicts that residual pool temperatures are likely to be uniform below a depth of 35 feet, and it is at this depth, or deeper, that prey species for bull trout would be most abundant. Therefore, any bull trout (and any rearing juvenile UW chinook) remaining in the residual pool during the construction period could occur in the vicinity of the unscreened intake to the diversion tunnel (at 85 feet deep). This could result in entrainment into the diversion tunnel during the construction period. It is also possible that adult bull trout that attempt to migrate downstream will be attracted to the flows exiting through the diversion tunnel intake. Fish entrained into the diversion tunnel are expected to be harmed or killed due to the pressure and volume of water passing through the tunnel.

ii. Migration barrier

Based on pre-dam data, mean water temperatures of flow in the South Fork McKenzie River at the site of Cougar Reservoir were approximately 42ºF in April, 45ºF in May, 50ºF in June, and 54ºF in July; average temperatures begin to drop again after July (USACE 1999b). Adult bull trout prefer stream temperatures at or below 55ºF, and their distribution may be limited at temperatures above 59ºF (Fraley and Shepard 1989). As a result, it is unlikely that bull trout would migrate from the residual pool into headwater areas above Cougar Reservoir after mid-June (i.e., most migration would have occurred earlier in the year). The Corps predicts that sand and larger material would be deposited before reaching the residual pool or within the first 500 to 1,000 feet within the 1.5 mile-long pool. Thus, those fish that attempt to migrate into the headwaters during the construction period may find sediment deposits at the upstream end of the residual pool blocking the way. Fish trapped in the reservoir during the summer could be harmed or killed by unacceptably high water temperatures.

b. Monitoring

i. Capture and handling

The Corps and ODFW will monitor the drawdown of Cougar Reservoir and the area below Cougar Dam for potential impacts of construction activities on bull trout, UW chinook salmon and other fish species. The proposed action includes a study, funded by the Corps and performed by ODFW, to examine bull trout migratory behavior, capture and handling techniques, and captive broodstock retention techniques. The Corps and ODFW will experimentally trap bull trout (and, possibly,

downstream-migrating juvenile UW chinook salmon) above, within, and below Cougar Reservoir during implementation of the Cougar WTC project (2000-2003). Experimental trapping would begin in 2000, one year before initial drawdown of Cougar Reservoir. Capture and handling of bull trout and UW chinook salmon will result in harassment, and possibly harm and mortality.

c. Mitigation

i. Capture and handling for bull trout rescue

Depending on the success of ODFW's study of bull trout habitat use within the residual pool and the actual water quality in the residual pool during the construction period each year, it may be necessary to "rescue" bull trout from potentially lethal conditions in the residual pool. The decision to rescue and move bull trout will be made by USFWS in consultation with ODFW, the Corps and other members of the ECTF. Capture and handling of bull trout will result in harassment, and possibly harm and mortality.

ii. Capture and handling for interim fish passage

(a) Below the dam

Adult UW chinook salmon, bull trout of all ages, and other species migrating up the South Fork will be trapped and hauled above the dam for release either in the residual pool or the South Fork above the residual pool, as described in the Proposed Action section. Adult fish traps such as the one conceptually proposed by the Corps for capturing adult UW chinook salmon and bull trout moving up the South Fork present several problems for these fish. The proposed trap would consist of a weir across the river to guide the fish into the trap, where they will be collected and transferred to a truck for transport to a release site.

Upon encountering a weir leading to a fish trap, some fish return downstream rather then entering the trap (trap rejection). Trap rejection by chinook salmon has been documented in the Pacific Northwest at similar weirs and traps. For example, at weirs on the Imnaha River (Oregon), Rapid River (Idaho), South Fork Salmon River (Idaho), and Chiwawa River (Washington), half or more of adult chinook salmon tagged or observed downstream of the weirs did not enter the traps despite an abundance of high quality spawning habitat above the weirs that was used historically by this species (NMFS 1993). Redistribution of chinook salmon spawning downstream following weir and trap installation has also been documented on the Twisp and Tucanon Rivers in Washington (Hevlin and Rainey, 1993). This research on the effects of weirs and traps on adult salmon and steelhead suggests that trap rejection is common even at the newest and best designed facilities (such as those on Twisp and Chiwawa Rivers), often resulting in redistribution of spawning downstream to habitat that may be relatively poor quality.

The weir will be designed to guide adult fish into the trap and prevent them from continuing upstream into

the tailrace at the base of the dam. However, depending on the design of the weir, adult fish can jump over or through it when it is damaged or clogged by debris, damaged or overtopped by high flows, and/or during cleaning. Clogging with debris causes water to flow over, rather than through, the weir, or the weir to collapse, in either case allowing fish to move above it. For example, since the weir on the Elk Creek fish trap in the Rogue Basin was installed by the Corps in 1992, it has been damaged badly enough by debris or high flows to allow adult fish to pass over or through it up to ten days per year; even with a clean weir, high flows overtop the barrier and allow fish to leap or swim over the barrier (NMFS 1997). These problems can be avoided with a well-designed weir because the flow below Cougar Dam is controlled and has little debris, but the trapped fish will still be subjected to crowding, handling, and hauling, all of which are stressful to fish.

Some trap rejection by UW chinook salmon and bull trout is likely to occur, resulting in distribution of redds either in the South Fork or elsewhere in the upper McKenzie different than that which would occur in the absence of Cougar Dam. However, the trap will be an improvement over the current condition of no passage, thus the proposed action is expected to reduce the spawning redistribution originally caused by the construction of the dam. But while trapping adult UW chinook salmon and bull trout below Cougar Dam for release above the dam will provide access to historic habitat for UW chinook salmon, and connectivity for currently separated bull trout populations, this trapping and handling of fish will result in some stress and possibly mortality (if the facility does not operate as intended) that is not currently occurring. Thus any stress or mortality caused by fish trapping and handling is an effect of the action. As described in the Proposed Action section, protocols for trapping and handling fish will be developed by the Corps and ODFW, reviewed and monitored by the ECTF, and approved by NMFS and USFWS. The subsequent protocols are expected to minimize stress and the likelihood of mortality due to operation of the trap and handling of fish.

Interim passage of adult UW chinook salmon past Cougar Dam will result indirectly in harassment, harm or mortality of juvenile UW chinook salmon if the adults successfully reproduce above the dam because the juveniles must pass the dam on their downstream migration (i.e., if there were no interim passage of adults above the dam, there would not be any juveniles to be taken as they pass downstream through the dam). The migrating juveniles would pass through the dam either via the turbine intakes or the diversion tunnel, both routes of which are likely to cause high rates of injury and mortality. However, any juveniles that safely pass the dam will increase the number of juvenile UW chinook salmon that are currently being produced (i.e., none) in the abundant and nearly pristine habitat above the dam.

(b) Above the dam

Before downstream-migrating juvenile UW chinook salmon and bull trout (all ages) are trapped above the dam and transported to a release site below the dam, studies may be conducted to identify safe trapping and handling techniques for bull trout because little is known about how this species reacts to trapping and hauling. The methods used for this trapping, and protocol for handling trapped fish, will be developed by the Corps and ODFW, reviewed and monitored by the ECTF, and approved by NMFS

and USFWS. Trapping and handling of UW chinook, and perhaps bull trout, above the dam and transporting them downstream around the dam will be done according to this protocol. This will result in harm, harassment and possibly mortality of fish trapped and handled.

2. Spotted Owl

Direct effects to spotted owls will occur during construction due to noise disturbance from construction of access roads and coffer dams, demolition of the intake structure and trash racks, rock drilling to stabilize slopes and place dynamite, and excavation of rock by blasting and mechanical means. The potential direct effects of noise on wildlife can include fright/flight behavior, agitation, stress, avoidance of foraging or other important behavior including nest abandonment. The BA states that under most circumstances, more than one piece of equipment will be operating simultaneously, and noise from construction is expected to be greater than that emitted by the single loudest piece of equipment. If all of the equipment were operated at the same time and location, the expected noise level generated at the site would be about 100 dBA (e.g., A-weighted decibel scale) at 50 feet.

The main threat to the spotted owl is the loss of habitat across its range in the Pacific Northwest. Therefore, additional loss of habitat, even if not currently used by spotted owls, is considered an adverse affect to the species. Spotted owl habitat consists of two components: suitable habitat (nesting, roosting, foraging) and dispersal habitat. Because the BA states that no suitable or dispersal habitat for the spotted owl will be altered, this opinion will address the direct effect of disturbance caused by construction, demolition, rock drilling and excavation of rock by blasting and mechanical means.

Activities occurring in or around suitable habitat may affect spotted owls. Although there is little detailed information concerning the vulnerability of spotted owls to disturbance effects, research on a variety of other bird species suggests that such effects are possible (Henson and Grant 1991; Reijnen et al. 1995; Rodgers and Smith 1995). Activities that may result in above ambient noise levels include rock crushing, blasting, road hauling, aircraft/helicopters, heavy equipment and hydraulic hammers. Such studies have shown that disturbance can affect productivity in a number of ways: nest abandonment; egg and hatchling mortality due to exposure and predation; longer periods of incubation; premature fledgling or nest evacuation; depressed feeding rates of adults and offspring; reduced body mass or slower growth of nestlings; and avoidance of otherwise suitable habitat.

Activities which may result in above ambient noise levels that are implemented during the spotted owl nesting seasons within 0.25 mile of suitable habitat may adversely affect these species by interfering with essential foraging or nesting behaviors. Generally, such effects are considered to be of much less importance than the loss of suitable habitat; however, the potential effects of disturbance on the survival and recovery of the species cannot be ignored.

According to the BA, the proposed action will not remove spotted owl nesting, roosting, foraging or dispersal habitat. However, noise from traffic, equipment, construction, and blasting has the potential to

disturb spotted owl foraging, roosting and nesting behavior. Rock material will be removed by blasting at three sites: the main diversion tunnel, Rush Creek diversion tunnel, and the Cougar Reservoir intake structure. Use of equipment such as rock drills, cranes, and dozers will emit additional noise.

The Rush Creek spotted owl activity area is approximately 0.7 miles south of the exit portal for the main diversion tunnel. The BA indicates that blasting to reopen the tunnel will occur inside the diversion tunnel (i.e., underground) 600 feet or more from the portal. The loudest vehicles (e.g., crane, tractors, backhoes) and equipment (e.g., rock drill, jackhammer) would generate a maximum 100 dBA at 50 feet.

The Rush Creek spotted owl activity area is approximately 2,000 feet south of the intake portal for the Rush Creek diversion tunnel. Excavation of the intake portal will occur from late-March to mid-June 2001. The intake is at the bottom of a 260-foot deep canyon. If large boulders are encountered in the diversion tunnel shaft, blasting will be necessary to break apart the rock into smaller pieces that can then be removed by hand. Because these shots will occur inside the tunnel, the expected sound level at the surface would be 100 dBC (e.g., C-weighted decible scale).

The Rush Creek spotted owl activity area is approximately 2,800 feet south of the Cougar Lake intake structure. The structure is positioned within a narrow cut at the back of a horseshoe shaped basin. Blasting to excavate the regulating outlet bench and penstock channel will occur from early-April through mid-July 2001. Vehicles and heavy equipment will be used within a 300-foot-radius of the existing intake structure from mid-March to mid-July 2001.

Three additional spotted owl activity areas occur within 2 miles of Cougar Reservoir. Two are at least one mile from the project site and one is more than 1.5 miles away from the project site. Blasting will occur from mid-April to mid-June at the Rush Creek diversion tunnel and from early-April to mid-July at the Cougar Reservoir intake structure. The number and frequency of shots to re-open the Rush Creek diversion tunnel will not be known until boulders are encountered. A total of nine shots will occur at the intake structure, at a frequency of two shots per week, over a two-month period. All blasting will be completed by mid-July 2001. Maximum anticipated noise levels at the Rush Creek spotted owl activity area from blasting would be 86 dBC. Modifying factors such as break in line-of-sight, topography, and vegetation would reduce this level of noise at least 15 dBC. Although blasting noise would be below the Oregon Department of Environmental Quality standard (i.e., 93-98 dBC), it is not known if this level would protect spotted owls from potential disturbance.

B. Effects to Habitat of Listed Species

1. UW Chinook and Bull Trout

Effects to habitat of listed fishes which will occur during construction include increased turbidity, loss of habitat area in the reservoir, increased temperatures in the residual pool, and reduced flows in the South Fork McKenzie River below the dam.

a. Turbidity

Since the dam was closed in late 1963, fine sediment has collected behind Cougar Dam in the reservoir pool below the depth of the regulating outlet and power penstock intake (at elevations 1,479 feet NGVD and 1,419 feet NGVD, respectively) down to the diversion tunnel entrance depth of 1,290 feet. Turbidity profiles measured at Cougar Reservoir in the summer of 1971 showed increased turbidity below the level of the outlet, and turbidity at the bottom was 20 milligrams of suspended sediments per liter (mg/l, also known as Jackson Turbidity Units[4]; USACE 1995). Since a residual pool 85 feet deep would be retained, not all of this turbid water would be discharged. During initial drawdown of the reservoir, the BA predicts turbidity in the discharge resulting from initial drawdown would have a duration of ten days or less. Bull trout resident in the residual pool could be harmed by increased turbidity.

Turbidity levels sampled below Cougar Dam in 1992 and 1994 showed a range of 0.6 to 2.9 Nephelometric Turbidity Units (NTUs; USACE 1995). The BA estimates that turbidity below Cougar Dam during initial drawdown may increase by as much as ten-fold above current average conditions (i.e., up to approximately six to 30 NTUs). Assuming that one NTU is roughly equivalent to five mg/l (see footnote 4 below), the short-term initial turbidity event that would occur upon drawdown of Cougar Reservoir would presumably be in the range of from 30 to 150 mg/l of suspended sediment.

Additional dredging required to open the upstream portal of the Rush Creek diversion and to remove sediment from the saddle between the reservoir outlet structure and the main reservoir will entail dredging 20,000 to 30,000 cy of sediment. Dredging will occur between mid-October 2000 and February 2001. This sediment will be disposed of within the reservoir at a site expected to contain the sediment without allowing re-suspension and entrainment of the deposited sediment into the bypass tunnel during subsequent reservoir drawdown. In the supplemental information provided by the Corps on this aspect of the project, the analysis showed that the dredged sediment is likely to be mostly granular in size and should settle to the bottom of the reservoir at the disposal site. Less than five percent of the dredged

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[4] There is no clear relationship between mg/l and the commonly used turbidity measurement of Nephelometric Turbidity Units (NTUs), but Bell (1990) suggested that a 5 NTU increase in turbidity is associated with an increase in suspended sediment concentration of approximately 5-25 mg/l. Likewise, Bjornn and Reiser (1991) estimated that turbidities in the 25-50 NTU range are equivalent to 125-275 mg/l of suspended bentonite clay. A relationship of 1 NTU to 5 mg/l of suspended sediment is thus used in this analysis.

sediment will likely be silt, which will not settle out, and will add to existing turbidity in the reservoir. Depending on assumptions regarding dispersion rates in the water column, turbidity levels in the immediate vicinity of the dredge could range from less than 20 mg/l (JTU's) to as much as 400 mg/l. This dredging will occur during the winter in the first year of construction, when reservoir volume will be very large in comparison to the localized areas of increased turbidity caused by dredging and deposition.

In addition to sediment mobilized by dredging and initial drawdown from the reservoir substrate, drawdown may also result in increased risk of a bank failure within the newly exposed reservoir area that could also contribute to the annual sediment load. Most transport of sediment would occur in winter or spring (November through May) during high-flow events. USACE (1998) conducted a sediment transport analysis that showed the residual pool would retain all sediment transported from upstream with the exception of very fine colloidal material (i.e., clay particles, less than 0.01 mm in diameter) that can be easily transported at the flow levels that would occur below Cougar Dam. However, construction of the coffer dam in the tailrace to dewater the work area may cause some turbidity below the dam.

Within the residual pool, the Corps' sediment transport analysis (USACE 1998) indicated that sand and larger material would be deposited before reaching the residual pool or within the first 500 to 1,000 feet within the 1.5 mile-long pool, primarily during winter high-flow events. Based on a minimum residual pool detention time of only 17 hours and particle size-specific terminal fall velocities, it was estimated that approximately 90% of the finer silt (between 0.01 and 0.074 mm in diameter) would settle out fairly quickly within the residual pool (or larger reservoir), leaving only clay particles (less than 0.01 mm in diameter) in suspension. Observations reported in the BA of turbidity levels that occurred when the Corps drew down Detroit Reservoir on the North Santiam River also suggest that highly turbid conditions are unlikely to develop in the Cougar residual pool under normal flow conditions

In most streams supporting salmonids, there are periods when the water is relatively turbid and contains variable amounts of suspended sediments, even in pristine watersheds. Larger juveniles and adult salmon and trout appear to be little affected by temporarily high concentrations of suspended sediments that occur during most storms and episodes of snowmelt (Bjornn and Reiser 1991). Many fishes, including salmon and trout, are able to withstand turbidities of up to several thousand mg/l for relatively short time periods of a week or less (Newcombe and Jensen 1996; Newcombe and MacDonald 1991; both cited in BA). Lloyd (1987; cited in BA) found that salmon and trout were able to tolerate concentrations of turbidity ranging from approximately 80 to 100 mg/l for extended periods. Berg and Northcote (1985, in Bjornn and Reiser 1991) reported that feeding and territorial behavior of juvenile chinook salmon were disrupted by exposures of several days to turbid water of less than 60 NTUs (about 300 mg/l).

Newly emerged salmonid fry appear to be considerably more susceptible to turbidity than are older fish (Bjornn and Reiser 1991). Turbidities of 25-50 NTUs (125-275 mg/l) reduced growth and caused more young coho salmon and steelhead to emigrate from laboratory streams than did clear water (Sigler et al. 1984). Also, Newcombe and Jensen (1996; cited in BA) noted mortality of alevins (sac-fry stage) at suspended sediment concentrations as low as four NTUs (20 mg/l) when exposed for four days.

Thus, mortality or injury to pre-spawners and larger juvenile UW chinook salmon and bull trout from initial or subsequent high turbidity levels below Cougar Dam and in the residual pool during the proposed action are unlikely. However, avoidance behavior below the dam, such as a delay by spawners in entering the South Fork due to turbidity, is likely if high turbidity levels coincide with spawning migrations. Juveniles and subadults may also avoid entering the South Fork from the mainstem during these periods of high turbidity. Effects of turbidity from the proposed action, both during dredging and initial drawdown or from occasional short-duration high turbidity events, are likely to cause the mortality of a significant number of fertilized eggs and emergent UW chinook salmon fry in the South Fork below the dam since these turbidity events may coincide with these life stages and there is significant spawning of UW chinook salmon in this reach.

Increased levels of turbidity can affect the quality of spawning habitat (i.e., through gravel compaction) and rearing habitat (i.e., depressing production of benthic aquatic organisms used as food). Turbidity levels would increase below Cougar Dam immediately following initial drawdown (most likely during February through March 2001) and, perhaps, intermittently during runoff events under drawdown conditions in June through October.

b. Reduced reservoir pool size

Cougar Reservoir provides important rearing habitat for bull trout and possibly UW chinook salmon. The reservoir extends six miles up the South Fork McKenzie River from Cougar Dam, and is 1,315 acres in size. During construction, Cougar Reservoir will be drawn down to elevation 1,375 feet NGVD during the summer, and a residual pool at this elevation would have a length of approximately 7,700 feet (1.5 miles), a mean width of 650 feet (0.1 mile), a surface area of about 106 acres, and an approximate volume of 2,845 acre-feet. Mean depth at elevation 1,375 feet NGVD will be approximately 27 feet. Maximum depth at this elevation is 85 feet, which will occur at the entrance to the diversion tunnel.

Loss of habitat area in the reservoir will coincide with the time of year that bull trout and juvenile UW chinook salmon are least likely to inhabit the pool. Mature bull trout migrate from Cougar Reservoir into headwater spawning areas above the reservoir during April and May (USACE 1999b). However, surveys by ODFW (1997) have shown that not all adult bull trout spawn every year; as a result, some bull trout may remain in the residual pool following drawdown. Subadults (age 2-3) may also remain in the residual pool. Thus, loss of reduced reservoir area could harm a portion of the bull trout subpopulation above Cougar Dam though loss of habitat and concomitant reduction in prey availability.

c. Increased temperature in the residual pool

Corps modeling predicts that the residual pool will stratify during the summer construction period, with fairly uniform temperatures of 60°F-62°F during the summer months occurring at and below a depth of about 35 feet. Bull trout require particularly cold water; temperatures above 59°F are likely to limit bull trout distribution (Fraley and Shepard 1989). Although adult spawners are likely migrate into the South

Fork above the reservoir before temperatures become unfavorable, non-breeding adults and subadults which remain in the reservoir may be harmed or killed by unfavorable temperatures in the residual pool.

d. Altered flows and temperature in South Fork McKenzie River below Cougar Dam

Natural stream flow volume, similar to conditions occurring prior to construction and operation of Cougar Dam, will occur below the dam during reservoir drawdown for the WTC project construction activities (approximately June through October), unless there is a need to implement flood management procedures, but the occurrence of flood flows from mid-June through October is unlikely. Normally, inflows to Cougar Reservoir range between approximately 50 and 1,000 cfs during this time period.

Therefore, there will be times during August and September in average to low flow years when discharge below Cougar Dam falls below the current minimum instream flow of 300 cfs recommended by ODFW. Modeling results indicated that flows below 300 cfs during the construction period are likely to occur from five to eight times annually (USACE 1995). Since this is the spawning period for UW chinook salmon, the decreased flows caused by the proposed project may reduce the amount of spawning habitat available in the South Fork. Approximately 15-20% of the UW chinook salmon redds counted in recent years above Leaburg Dam were in the South Fork (ODFW 1999).

Summer flows in the mainstem McKenzie River at Vida (approximately nine river miles above Leaburg Dam) would be reduced by about 5-20% during construction in average to low flow years (USACE 1995). The Corps currently attempts to provide minimum flows of 2,500 cfs in the McKenzie River at Vida for fisheries enhancement, but flows often drop below this level under current operating conditions. During the proposed action, flows will likely drop below 2,500 cfs more often than in years past during average to low flow years. Current summer flow augmentation requirements of 5,000 cfs at Albany and 6,500 cfs at Salem can be met at all times with water from other reservoirs unless the Willamette Basin experiences extreme drought conditions with record low flows (USACE 1995).

USACE (1995) describes expected effects on water temperature resulting from loss of riparian cover through the reservoir area under drawdown conditions. Flow and temperature modeling indicated that flows released from the residual pool above the dam would average approximately 58-63°F daily (about 3-6°F warmer than inflow temperatures) during the hottest summer month (i.e., August) during drawdowns done for project construction (2001-2002, and possibly 2003).

Thus the likely effects of the proposed action to fish habitat below the dam can be summarized as: (1) re-establishment of a natural flow regime (i.e., discharge equal to residual pool inflow) up to 1,200 cfs at a pool elevation of 1,375 feet NGVD; (2) more natural water temperature conditions (i.e., discharge 3-6°F warmer than inflow in summer and the same as inflow in spring and fall); and (3) periods of turbidity

associated with initial drawdown in addition to subsequent erosion in the pool area and irregular natural runoff events. The effects of these flow and water temperature changes on UW chinook salmon and bull trout are described below. The effects of turbidity increases were addressed above.

Since the re-establishment of a natural flow regime is likely to result in low flows less than the current minimum of 300 cfs in the South Fork during UW chinook salmon spawning season, spawning habitat may be reduced for this species. However, these flow levels will be equivalent to those that would have occurred if the Cougar project had never been built, and adults in the South Fork have access to other spawning habitat located elsewhere within the McKenzie Basin. The same logic applies to the expected reduction in low flows in the mainstem McKenzie River at Vida (5-20% flow reduction) because of the abundance of high quality spawning habitat in the mainstem McKenzie above the confluence with the South Fork. Juvenile UW chinook salmon typically emigrate to rearing habitat located downstream in mainstem areas of the McKenzie and upper Willamette rivers, thus the resulting reduction in available rearing habitat in the mainstem McKenzie above Leaburg Dam may have some effect on juveniles, but these will be the flows that existed before the construction of Cougar Dam. Flow management below the dam after the completion of the Cougar WTC project will be determined by the ongoing consultation on the continued operation of the Corps' Willamette Valley Flood Control System.

Stream temperatures during UW chinook salmon summer migration and fall spawning periods will be improved and more natural (i.e., warmer in summer and cooler in fall) than current environmental conditions under all flow conditions occurring during construction activities. Pre-spawner mortality rates in the McKenzie Basin have been estimated at 5% in the McKenzie River above the confluence with the South Fork, 23% in the South Fork, and 18% downstream of the confluence with the South Fork (USACE 1995). The much higher mortality rates in the action area are attributed to the water temperature effects of the dam as currently operated. Thus improved, more natural, summer water temperatures in the South Fork during the construction period are anticipated to result in increased pre-spawner survival rates that more closely approximate survival rates observed elsewhere in the McKenzie Basin.

Stream temperatures during UW chinook salmon incubation and emergence will be improved and more natural (i.e., cooler in the fall and winter) than current environmental conditions under all flow conditions occurring during construction activities. UW chinook salmon fry survival is thought to be currently very low due to early emergence (USACE 1995). Thus improved, more natural, fall and winter water temperatures in the South Fork and the mainstem during the construction period, and after project completion (since this is the purpose of the project) are anticipated to result in increased fry survival rates that more closely approximate survival rates observed elsewhere in the McKenzie Basin.

Cooler fall temperatures could also attract more bull trout into the South Fork McKenzie River from the mainstem McKenzie River. Although cooler water temperatures would be beneficial to bull trout, if adults that would have spawned in the upper McKenzie instead enter the South Fork, where no spawning habitat is believed to exist below the dam, spawning opportunities for that year could be lost.

2. Spotted Owl

Spotted owl habitat will not be affected as a result of the proposed project.

C. Effects to Critical Habitat

1. UW Chinook Salmon Critical Habitat

During the implementation of the proposed action (2000-2003), all ten of the essential features of UW chinook salmon critical habitat will likely be affected: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions. Substrate and water quality (excluding water temperature) are likely to be adversely affected by turbidity both downstream of Cougar Dam, as described above under "Effects to Habitat of Listed Species, Turbidity", and upstream of the dam as described above under "Effects to Habitat of Listed Species, Reduced reservoir pool size". The flow-related essential features (water quantity, velocity, cover/shelter, and space), water temperature, and food (invertebrate production related to flow and temperature) are likely to be improved below the dam, as described above under "Effects to Habitat of Listed Species, Altered flows and stream temperatures...", but adversely affected above the dam in the reservoir pool area as described above under "Direct Effects on Listed Species, Migration barrier". Riparian vegetation is likely to be adversely affected by clearing of the staging and construction areas due to ground disturbance and clearing, possibly resulting in some erosion, turbidity, and possible sedimentation. Upstream passage conditions for adults will be improved through interim fish passage, assuming that some passage to currently unused historic habitat via trap-and-haul is better than no passage. Under the same assumption, downstream passage conditions for juveniles will be improved if the experimental downstream trap-and-haul is implemented.

2. Spotted Owl Critical Habitat

The proposed project will have no effect on spotted owl Critical Habitat.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. Therefore, these actions are not considered cumulative to the proposed action.

The BA for the Cougar WTC project provided a discussion of the following non-federal activities likely to occur in the project area: industrial forest management on private lands, recreation, hydropower production, and urban and rural development. The Services do not consider hydropower production to be a cumulative effect, since any hydropower project in the basin must secure a license from the Federal Energy Regulatory Commission, and such licenses must go through independent section 7 review, as stated above.

A. Industrial Forest Management

Over 90% of the McKenzie River Subbasin is currently in forest uses. Private industrial forest owners hold almost half of the productive timber land, covering approximately 29% of the basin (USFS 1994). Since 1991 there has most likely been an increase in the rate of timber harvest on private lands.

As of 1988, one fourth of industrial forestland was in the mature (trees of age 80-200 years) or old (trees older than 200 years) growth categories. These stands contain trees of sufficient size (>21 inches DBH) to contribute at present to large woody debris in streams, which is important in the development of cover and habitat complexity (Cramer et al. 1997).

The potential of the South Fork McKenzie River watershed to contribute major volumes of large logs to the local economy is limited. Less than one fourth of the South Fork is currently available for timber production because of the large proportion in non-harvestable allocations such as Wilderness, Late Successional Reserves, and Riparian Reserves under the Forest Plan. On those lands that are harvestable, concentrated harvest has resulted in a high proportion of early and young stands (USFS 1994). It is likely that riparian habitat and stream conditions in the South Fork McKenzie River watershed will continue to improve into the foreseeable future.

B. Recreation

A variety of recreational opportunities are available throughout the watershed. In particular, the corridor adjacent to the river in the South Fork watershed provides access to developed campgrounds and numerous dispersed campsites (USFS 1994). Recreationists make use of Cougar Reservoir for boating and fishing.

ODFW has reported that bull trout are regularly, but not commonly, caught by anglers fishing below Cougar Dam, in Cougar Reservoir and in the South Fork about the reservoir. However, bull trout are somewhat protected from harvest by state fishing regulations, which require their release. The extent of mortality to South Fork McKenzie River bull trout from illegal harvest and incidental catch and release is largely unknown, but thought to be declining due to increased law enforcement and educational programs.

Regulated fisheries for salmon, steelhead and trout also occur in the McKenzie River Basin. ODFW

instituted a marked-fish-only (i.e., hatchery fish) harvest of spring chinook on the McKenzie River in 1995. ODFW has identified key spring chinook natural production areas within the McKenzie Basin, has developed plans for mass marking of hatchery fish, and has implemented more strict control of procedures affecting the genetic attributes of salmon reared at McKenzie Hatchery (Cramer et al. 1996). Consequently, it is unlikely that hatchery and regulated harvest programs within the McKenzie Subbasin will threaten the persistence of the listed species occurring there.

C. Urban and Rural Development

Riparian area fragmentation, placement of riprap revetment for flood protection, infrastructure development (e.g., roads), and water quality degradation, particularly from non-point sources and stormwater runoff, are problems associated with urban and rural development in the McKenzie River Basin (John Runyon, McKenzie River Watershed Council, personal communication). The McKenzie River Watershed Council is preparing a detailed analysis of these factors and their report should be available in about one year. They have developed an Action Plan that includes actions for long-term protection of water quality, actions for fish and wildlife habitat monitoring, recommendations for recreation and human habitat use within the watershed, and recommendations for watershed educational activities (Cramer et al. 1996).

The Services assume that management impacts from non-Federal activities which have degraded or hindered recovery of anadromous fish habitat will continue in the short-term at similar intensities as in recent years. This assumption may be conservative in the long-term, given development of non-Federal conservation programs, such as the Oregon Plan for Salmon and Watersheds, and possible development of habitat conservation plans with non-Federal entities to fulfill the requirements of section 10 of the ESA.

VII. CONCLUSION

After reviewing the current status of UW chinook, bull trout, and spotted owl, the environmental baseline for the action area, the effects of the proposed Cougar Reservoir WTC project, and the cumulative effects, it is the Services' biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of UW chinook, the Columbia River bull trout DPS, or spotted owl, and is not likely to destroy or adversely modify critical habitat for UW chinook or spotted owl. The Services conclude that the short-term construction impacts of the Cougar Reservoir WTC project will not reduce appreciably the likelihood of both the survival and recovery of UW chinook, bull trout, or spotted owls in the wild by reducing the reproduction, numbers or distribution of these species. This conclusion is based on the following aspects of the Services' analysis of project impacts: (1) Disturbance and degradation of habitat quality for listed species will be short-term in duration; (2) flow and temperature conditions in the South Fork McKenzie River will resemble the natural regime during construction periods; and (3) formation of the ECTF will help guide the adaptive process, which is designed to respond to the most current information available on the ongoing impacts of the proposed project .

NMFS concludes that the proposed Cougar WTC project will not diminish appreciably the value of critical habitat for both the survival and recovery of UW chinook salmon. This conclusion is based on the small-scale and temporary impacts on essential features of UW chinook salmon critical habitat. USFWS concludes that construction of the Cougar WTC project is not likely to destroy or adversely modify spotted owl critical habitat because no spotted owl suitable or dispersal habitat will be affected.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Services offer four recommendations to the Corps for improving conditions for listed fishes in the South Fork McKenzie River:

1. Re-design the WTC tower based on overlapping/telescoping weir gates instead of ports, allowing flow to be taken from the surface at any pool elevation (this would provide more efficient temperature control and juvenile collection than the current multiple port design).

2. Closely coordinate the WTC project with the ongoing Cougar Fish Passage Evaluation Study to ensure maximum compatibility of the projects with one another, and maximum benefits to native fish species in terms of both restoring natural water temperatures and fish passage.

3. As soon as possible after completing the Cougar Fish Passage Evaluation Study, use this study as the basis to design and implement upstream and downstream long-term fish passage facilities at Cougar Dam.

4. Closely coordinate the WTC project with the ongoing consultation with the Services on the continued operation of the 13 Upper Willamette flood control projects to maximize restoration of the aquatic ecosystem within the Cougar WTC project action area.

In order for the Services to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Services request notification of the implementation of any conservation recommendations.

IX. REINITIATION OF CONSULTATION

This concludes formal consultation on the action outlined in the Corps' BA for the Cougar Reservoir Water Temperature Control Project. As provided in 50 CFR '402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner

or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take specified in the Incidental Take Statement is exceeded, any operations causing such take must cease pending reinitiation.

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XI. INCIDENTAL TAKE STATEMENT

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

An incidental take statement specifies the amount or extent of any authorized incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

The measures described below are non-discretionary, and must be undertaken by the Corps and made binding conditions of any contract issued in the course of construction of the Cougar WTC project for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions; or (2) fails to require its contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contracts, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Services as specified in the incidental take statement (50 CFR '402.14(i)(3)).

A. Amount or Extent of Incidental Take

1. UW Chinook Salmon and Bull Trout

For the purposes of this Opinion, incidental take is defined as take of UW chinook salmon and bull trout individuals (fertilized eggs, fry, juveniles, or adults) that results from the construction of the Cougar WTC project. The incidental take is expected to be in the form of harm, harassment, and mortality to UW chinook salmon and bull trout individuals from decreased water quality, loss of habitat area in Cougar Reservoir, reduced flows in the South Fork McKenzie River below the dam, entrainment into the unscreened diversion tunnel, migration delays for upstream migrating fish, and operation of interim fish passage facilities. Incidental take will also occur as a result of the capture and handling associated with

studies, monitoring and mitigation activities that are a part of the proposed project. The amount or extent of incidental take resulting from the proposed action is difficult to quantify due to the difficulty in finding individuals that have been killed or otherwise taken by the project. Furthermore, even if dead or injured individuals are found in the project area, determining the cause of mortality or injury may be difficult. Therefore, even though the Services expect some incidental take to occur due to the actions covered by this biological opinion, the best scientific and commercial data available are not sufficient to enable the Services to estimate a specific amount of incidental take to the species. In instances such as these, the Services designate the expected level of take as "unquantifiable." Based on the information in the BA, the Services anticipate that an unquantifiable amount of incidental take of UW chinook salmon and bull trout could occur as a result of the actions covered by this biological opinion. In the accompanying biological opinion, the Services determined that this level of anticipated take is not likely to result in jeopardy to the species.

2. Spotted Owl

The Service anticipates a small, but unquantifiable amount of incidental take of spotted owl pairs or resident singles due to disturbance associated with construction of the Cougar WTC project. This take is difficult to quantify because take due to harassment is difficult to detect. If spotted owls are nesting in suitable habitat within 0.25 mile of the proposed project (or within 1.0 mile of blasting), USFWS anticipates some of these individuals will be subject to harassment as a result of the noise associated with these activities. This take can be qualified in terms of the cumulative probability that: (1) suitable, unsurveyed habitat contains nesting spotted owls; (2) nesting birds will, in fact, be disturbed; and (3) if disturbed, reproductive output will be negatively affected. In the accompanying biological opinion, the USFWS determined that this level of anticipated take is not likely to result in jeopardy to the species.

B. Reasonable and Prudent Measures

The Services believe that the following reasonable and prudent measures are necessary and appropriate to minimize take of bull trout, UW chinook salmon, and spotted owls:

1. Convene an Environmental Coordination Task Force (ECTF) to advise the Corps during and after the Cougar WTC construction period on actions to reduce impacts of the project to listed species based on data collected from the water quality and fish studies described below, and any other available and relevant information.

2. Monitor water quality before, during and after the construction period to provide data that will enable the ECTF to determine if further actions are necessary to reduce impacts of the Cougar WTC project on listed species.

3. Perform baseline studies of listed fish distribution and population parameters in the action area prior to construction of the WTC project. As with measure #2, this measure will provide data enabling the ECTF to determine if further actions are necessary to reduce impacts of the Cougar WTC project on listed

species.

4. Conduct studies to determine the response of listed fishes to altered conditions in Cougar Reservoir and the South Fork McKenzie River during reservoir drawdown for construction of the WTC project. As with measures #2 & #3, this measure will provide data enabling the ECTF to determine if further actions are necessary to reduce impacts of the Cougar WTC project to listed species.

5. Implement a temporary trap and haul program for listed fishes during project construction to reduce impacts to adult bull trout and UW chinook salmon by allowing them to move from the South Fork McKenzie River below the dam (strongly affected by Cougar WTC project) to the much higher quality habitat above the reservoir (not affected by the project).

6. Develop a plan and implement remedial actions as necessary to protect bull trout during construction.

7. Conduct post-construction monitoring to track recovery of listed fish populations.

8. Minimize disturbances to spotted owl pairs and their progeny during nesting season

9. Report on the progress in implementing the terms and conditions specified below.

C. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1.a. Establish an Environmental Coordination Task Force (ECTF) consisting of federal and state regulatory and resource agency representatives from NMFS, USFWS, Oregon Department of Fish and Wildlife, Willamette National Forest, the Corps, and possibly others, to assist the Corps in reviewing studies and monitoring results associated with the Cougar WTC project.

1.b. Provide data and coordinate meetings of the ECTF as needed to identify appropriate corrective action, formulate recommendations for facility design and corrective action, implement corrective actions, and provide information concerning the project to their constituencies and to the public.

1.c. Convene the ECTF at least quarterly, or more often if new information warrants, during the construction period for the Cougar WTC project, beginning in 2000 and continuing at least one year after project construction is completed.

2.a. Monitor the following water quality parameters in the project area before, during and after project construction (beginning in 2000 and continuing at least one year after project construction is completed):

(1) In the South Fork McKenzie River above Cougar Dam - flow, water temperature and turbidity of inflow;

(2) In the South Fork McKenzie River below the dam - flow, water temperature, turbidity, and dissolved oxygen (DO) of discharge, on an hourly basis at existing U.S. Geological Survey (USGS) gaging stations;

(3) In Cougar Reservoir - water temperature, DO, turbidity, and other parameters (percent oxygen saturation, pH, total dissolved solids, conductivity, and oxidation-reduction potential) in the reservoir/ residual pool above Cougar Dam on a weekly basis (or as agreed upon by the ECTF) at three or more sampling stations within the reservoir. Flow, water temperature and turbidity conditions at inflow to the residual pool should be compared to conditions in the residual pool and below the dam.

2.b. Maintain a daily log of stream and reservoir conditions, including any storm events, along with a database of the associated water quality parameters described above. Problem events should be reported by the Corps to Oregon Department of Environmental Quality (ODEQ), ODFW, NMFS, and USFWS, along with information about any corrective actions taken.

3.a. Collect information on the distribution, behavior and abundance of bull trout in the South Fork McKenzie River (upstream and downstream of Cougar Dam, and within the reservoir) during the two years (2000-2001) prior to drawdown. This study may be done in conjunction with ODFW, and should include gathering information on:

(1) Timing of migration out of the reservoir into the South Fork (above reservoir);

(2) Timing of migration from the South Fork downstream to the reservoir;

(3) Distribution, behavior, abundance and habitat use by bull trout within the reservoir, using appropriate radio telemetry techniques;

(4) Distribution, behavior and abundance of spawning bull trout in Roaring River and in the South Fork McKenzie River;

(5) The safest and most effective means of capturing and handling adult and sub-adult bull trout in the South Fork and in the reservoir;

(6) Effects to bull trout and UW chinook salmon passing downstream through Cougar Dam (via the regulating outlet and penstock, and through construction bypass tunnel).

4.a. Monitor distribution, abundance and behavior of bull trout within the residual pool (during drawdown) and reservoir (fall to spring months) during the construction period to determine response to

construction impacts.

4.b. Monitor distribution and behavior of bull trout in the South Fork below the dam during the construction period to determine response to construction impacts.

5.a. Develop and implement a temporary program to allow passage of migrating adult UW chinook salmon upstream of Cougar Dam during the project construction period.

5.b. Develop and implement a temporary program to allow passage past Cougar Dam of upstream migrating bull trout during the project construction period.

6.a. Prepare a "Bull Trout Rescue Plan" for implementation if conditions in the residual pool or South Fork warrant action. This may involve capturing bull trout in the South Fork to prevent them from entering the residual pool or capturing individuals trapped in the residual pool. Identify potential habitats within the McKenzie River watershed for temporary translocation of "rescued" bull trout.

6.b. Implement "Bull Trout Rescue Plan" if ECTF supports such action, with concurrence from USFWS.

7.a. Monitor fish response in the South Fork McKenzie River to determine trend of listed fish populations for at least one year following completion of construction of the Cougar WTC project. Gather information which will assist in selecting the appropriate location for construction of permanent trap and haul, or other fish passage facilities, above and below the dam.

8.a. Monitor noise levels at a recording station in the Rush Creek drainage, approximately 2,000 feet from the Rush Creek diversion tunnel intake and the Cougar Reservoir intake structure.

8.b. Construction noise at the monitoring station must not exceed 60 dBA. Noise during blasting must not exceed 90 dBC. If these thresholds are exceeded, the activity producing the noise must be halted.

8.c. Survey annually for owl presence and nesting within 1 mile of blasting. If nesting owls are present, monitor noise levels at the nest site and visually monitor the nest continuously during blasting operations to note behavioral responses of the owls and to determine reproductive success at the nests, according to established protocol. To obtain information regarding these nest sites, the Corps may wish to coordinate with Oregon Cooperative Fish & Wildlife Unit personnel who are conducting owl demographic studies in the area. The USFWS also requests that our office be informed if such opportunity arises.

9.a. Prepare quarterly monitoring, annual progress, and final project reports of progress on the implementation of each Term and Condition in this Biological Opinion. Annual reports shall be provided to NMFS and USFWS by January 31 of each year after the project construction begins, and continuing at least two years beyond project completion. A description of any progress on the implementation of the Conservation Recommendations should also be included in these reports. The annual reports should be

sent to NMFS and USFWS at the addresses below:

Oregon Branch Chief	State Supervisor
Habitat Conservation Division	Oregon State Office
National Marine Fisheries Service	U.S. Fish and Wildlife Service
525 NE Oregon Street, Suite 500	2600 SE 98th Avenue, Suite 100
Portland, Oregon 97232	Portland, Oregon 97266

In addition to NMFS and USFWS, copies of reports should also be provided to members of the ECTF.

Notice: While the incidental take statement provided in this consultation satisfies the requirements of the Endangered Species Act, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act.

To the extent that this statement concludes that take of any threatened or endangered species of migratory bird will result from the agency action for which consultation is being made, the USFWS will not refer the incidental take of any such migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Attachment 2

The Habitat Approach

Implementation of Section 7 of the Endangered Species Act for
Actions Affecting the Habitat of Pacific Anadromous Salmonids

Prepared by the National Marine Fisheries Service
Northwest Region
Habitat Conservation and Protected Resources Divisions
26 August 1999

I. Purpose

This document describes the analytic process and principles that the National Marine Fisheries Service (NMFS) Northwest Region (NWR) applies when conducting ESA § 7 consultations on actions affecting freshwater salmon[1] habitat.

II. Background

Section 7 of the Endangered Species Act[2] (ESA) requires Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitat.[3] Federal agencies must consult with National Marine Fisheries Service (NMFS) regarding the effects of their actions on certain listed species.[4] The NMFS evaluates the effects of proposed Federal actions on listed salmon by applying the standards of § 7(a)(2) of the ESA as interpreted through joint NMFS and U.S. Fish and Wildlife Service (FWS) regulations and policies.[5] When NMFS issues a biological opinion, it uses the best scientific and commercial data available to determine whether a proposed Federal action is likely to (1) jeopardize the continued existence of a listed species, or (2) destroy or adversely modify the designated critical habitat of a listed species.[6]

The Services' ESA implementing regulations define "jeopardize the continued existence of" to mean: "...to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."[7] Section 7(a)(2)'s requirement that Federal agencies avoid jeopardizing the continued existence of listed species is often referred to as the "jeopardy standard."[8] The ESA likewise requires that Federal agencies refrain from adversely modifying designated critical habitat.[9] The Services' ESA implementing regulations define the term "destruction or adverse modification" of critical habitat to mean:

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[1] For purposes of brevity and clarity, this document will use the word "salmon" to mean all those anadromous salmonid fishes occurring in, and native to, Pacific Ocean drainages of the United States – including anadromous forms of cutthroat and steelhead trouts, and not including salmonids occurring in Atlantic Ocean and Great Lakes drainages.

[2] 16 USC §§ 1531 *et seq.*

[3] 16 USC § 1536(a)(2) (1988).

[4] A 1974 Memorandum of Understanding between NMFS and FWS establishes that NMFS retains ESA jurisdiction over fish species that spend a majority of their lives in the marine environment, including salmon. *See* Memorandum of Understanding Between the U.S. Fish and Wildlife Service, United States Department of Interior, and the National Oceanic and Atmospheric Administration, United States Department of Commerce, Regarding Jurisdictional Responsibilities and Listing Procedures under the Endangered Species Act of 1973 (1974).

[5] *See* U.S. Fish and Wildlife Service and National Marine Fisheries Service., *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.* U.S. Government Printing Office, Washington, D.C. (1998).

[6] 16 USC § 1536(a)(2) (1988).

[7] 50 CFR § 402.02 (1999).

[8] *See* M.J. Bean and M.J. Rowland, *The Evolution of National Wildlife Law. Third Edition.* Praeger Publishers, Westport, Connecticut, pp. 240, 253 & 260 (1997).

[9] 16 USC § 15536(a)(2) (1988).

> . . . a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.[10]

A species is listed as endangered if it is in danger of extinction throughout all or a significant portion of its range.[11] A species is listed as threatened if it is likely to become endangered within the foreseeable future.[12] Listing a species under the ESA therefore reflects a concern for a species' continued existence—the concern is immediate for endangered species and less immediate, but still real, for threatened species. The purpose of the ESA is to provide a means whereby the ecosystems upon which listed species depend may be conserved, such that the species no longer require the protections of the ESA and can be delisted.[13] This constitutes "recovery" under the ESA.[14] Recovery, then, represents a state in which there are no serious concerns for the survival of the species.[15]

Impeding a species' progress toward recovery exposes it to additional risk, and so reduces its likelihood of survival. Therefore, in order for an action to not "appreciably reduce" the likelihood of survival, it must not prevent or appreciably delay recovery. Salmon survival in the wild depends upon the proper functioning of certain ecosystem processes, including habitat formation and maintenance. Restoring functional habitats depends largely on allowing natural processes to increase their ecological function, while at the same time removing adverse impacts of current practices.[16] Along these lines, the courts have recognized that no bright line exists in the ESA regarding the concepts of survival and recovery.[17] Likewise, available scientific information concerning habitat processes and salmon population viability indicates no practical differences exist between the degree of function essential for long-term survival and that necessary to achieve recovery.[18]

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[10] 50 CFR § 402.02 (1999).

[11] 16 USC § 1532(6) (1988).

[12] 16 USC § 1532(20) (1988).

[13] *See, e.g.*, 16 USC § 1532(3) (1988) (defining the term "conserve"); 16 USC § 1531 (b) (1988) (stating the purpose of the ESA).

[14] *See, e.g.*, 16 USC § 1533(f)(1) (1988) (describing the purpose of recovery plans).

[15] NMFS, *Memorandum from R.S. Waples, NMFS, to the Record* (1997).

[16] Stouder et al., *Pacific Salmon and Their Ecosystems: Status and Future Options*, Chapman and Hall, New York, New York (1997).

[17] *Idaho Department of Fish and Game v. NMFS,* 850 F.Supp. 886 (D. OR 1994) (discussing NMFS' biological opinion concerning the Federal Columbia River Hydropower System).

[18] *See* 51 Fed. Reg. 19,926 (1982). In the preamble to the § 7 consultation regulations, the Services recognized that in some cases, no distinction between survival and recovery my exist, stating "If survival is jeopardized, recovery is also jeopardized...it is difficult to draw clear-cut distinctions" [between survival and recovery].

III. Organization of Endangered Species Act § 7 Analyses

In conducting analyses of habitat-altering actions under § 7 of the ESA, NMFS uses the following steps: (1) Consider the status and biological requirements of the affected 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; (4) consider cumulative effects; (5) determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify its critical habitat. If jeopardy or adverse modification is found, NMFS must identify reasonable and prudent alternatives to the action if they exist.

The analytical framework described above is consistent with the Services' joint ESA § 7 Consultation Handbook[19] and builds upon the Handbook framework to better reflect the scientific and practical realities of salmon conservation and management on the West Coast. Below we describe this analytical framework in detail.

A. Describe the Affected Species' Status and Define its Biological Requirements.

1. Identify the Affected Species and Describe its Status

The first step in conducting this analysis is to identify listed species, and when known, populations of listed species, that may be affected by the proposed action. Under the ESA, a taxonomic species may be defined as a "distinct population segment."[20] The NMFS has established a policy that describes such "distinct population segments" as Evolutionarily Significant Units (ESUs).[21] An ESU is a population or group of populations that is substantially reproductively isolated from other conspecific populations and represents an important component in the evolutionary legacy of the species.[22] In implementing the ESA, NMFS has established ESUs as the listing unit for salmon under its jurisdiction. Therefore, for purposes of jeopardy determinations, NMFS considers whether a proposed action will jeopardize the continued existence of the affected ESU or adversely modify its critical habitat.[23]

When affected species and populations have been identified, NMFS considers the relative status of the listed species, as well as the status of populations in the action area. This may include parameters of abundance, distribution, and trends in both. Various sources of information exist to define species and population status. The final rule listing the species or designating its critical habitat is a good example of this type of information. Species' status reviews and factors

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[19] *See* FWS and NMFS, *supra* note 5.

[20] 16 USC § 1532(16) (1988).

[21] *See* 56 Fed. Reg. 58,618 (1991).

[22] R.S. Waples, *Definition of "Species" Under the Endangered Species Act: Application to Pacific Salmon*, National Marine Fisheries Service (1991).

[23] NMFS has recognized that in many cases ESUs contain a significant amount of genetic and life history diversity. Such diversity is represented by independent salmon populations that may inhabit river basins or major sub-basins within ESUs. In light of the importance of protecting the biological diversity represented by these populations, NMFS considers the effects of proposed actions on identifiable, independent salmon populations in judging whether a proposed action is likely to jeopardize the ESU as a whole.

for decline reports may also provide relevant information for this section. When completed, recovery plans and associated reports will provide a basis for determining species status in the action area.

2. Define the Affected Species' Biological Requirements

The listed species' biological requirements may be described in a number of different ways. For example, they can be expressed in terms of population viability using such variables as a ratio of recruits to spawners, a survival rate for a given life stage (or set of life stages), a positive population trend, or a threshold population size. Biological requirements may also be described as the habitat conditions necessary to ensure the species' continued existence (*i.e.*, functional habitats) and these can be expressed in terms of physical, chemical, and biological parameters. The manner in which these requirements are described varies according to the nature of the action under consultation and its likely effects on the species.

However species' biological requirements are expressed—whether in terms of population variables or habitat components—it is important to remember that there is a strong causal link between the two: actions that affect habitat have the potential to affect population abundance, productivity, and diversity; these effects are particularly noticeable when populations are at low levels—as they are now in every listed ESU. The importance of this relationship is highlighted by the fact that freshwater habitat degradation is identified as a factor of decline in every salmon listing on the West Coast.[24]

Habitat-altering actions continue to affect salmon population viability, frequently in a negative manner.[25] However, it is often difficult to quantify the effects of a given habitat action in terms of its impact on biological requirements for individual salmon (whether in the action area or outside of it). Thus it follows that while it is often possible to draw an accurate picture of a species' rangewide status—and in fact doing so is a critical consideration in any jeopardy analysis—it is difficult to determine how that status may be affected by a given habitat-altering action. Given the current state of the science, usually the best that can be done is to determine the effects an action has on a given habitat component and, since there is a direct relationship between habitat condition and population viability, extrapolate to the impacts on the species as a whole. Thus, by examining the effects a given action has on the habitat portion of a species' biological requirements, NMFS has a gauge of how that action will affect the population variables that constitute the rest of a species' biological requirements and, ultimately, how the action will affect the species' current and future health.

Ideally, reliable scientific information on a species' biological requirements would exist at both the population and the ESU levels, and effects on habitat should be readily quantifiable in terms of population impacts. In the absence of such information, NMFS' analyses must rely on generally applicable scientific research that one may reasonably extrapolate to the action area and to the population(s) in question. Therefore, for actions that affect freshwater habitat, NMFS usually defines the biological requirements in terms of a concept called properly functioning

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[24] *See, e.g.*, 57 Fed. Reg. 14,653 (April 22, 1992) (Snake River spring/summer and fall chinook); 62 Fed. Reg. 24,588 (May 6, 1997) (Southern Oregon/Northern California coho); 63 Fed. Reg. 13,347 (March 18, 1998) (Lower Columbia River and Central Valley steelhead).

[25] *See* NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996).

condition (PFC). Properly functioning condition is the sustained presence of natural[26] habitat-forming processes in a watershed (*e.g.*, riparian community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation. PFC, then, constitutes the habitat component of a species' biological requirements. The indicators of PFC vary between different landscapes based on unique physiographic and geologic features. For example, aquatic habitats on timberlands in glacial mountain valleys are controlled by natural processes operating at different scales and rates than are habitats on low-elevation coastal rivers.

In the PFC framework, baseline environmental conditions are described as "properly functioning," "at risk," or "not properly functioning." If a proposed action would be likely to impair[27] properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward PFC, it will usually be found likely to jeopardize the continued existence of the species or adversely modify its critical habitat or both, depending upon the specific considerations of the analysis. Such considerations may include for example, the species' status, the condition of the environmental baseline, the particular reasons for listing the species, any new threats that have arisen since listing, and the quality of the available information.

Since lotic[28] habitats are inherently dynamic, PFC is defined by the persistence of natural processes that maintain habitat productivity at a level sufficient to ensure long-term survival. Although the indicators used to assess functioning condition may entail instantaneous measurements, they are chosen, using the best available science, to detect the health of underlying processes, not static characteristics. "Best available science" advances through time; this advance allows PFC indicators to be refined, new threats to be assessed, and species status and trends to be better understood. The PFC concept includes a recognition that natural patterns of habitat disturbance will continue to occur. For example, floods, landslides, wind damage, and wildfires will result in spatial and temporal variability in habitat characteristics, as will anthropogenic perturbations.

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[26] The word "natural" in this definition is not intended to imply "pristine," nor does the best available science lead us to believe that only pristine wilderness will support salmon. The best available science does lead us to believe that the level of habitat function necessary for the long-term survival of salmon (PFC) is most reliably and efficiently recovered and maintained by simply eliminating anthropogenic impairments, and does not usually require artificial restoration. *See* Rhodes et. al., *A Course Screening Process for Potential Application in ESA Consultations.* Columbia River Inter-Tribal Fish Commission, Portland, Oregon, pp. 59-61, (1994); National Research Council, *Upstream, Salmon and Society in the Pacific Northwest. National Research Council*, National Academy Press, Washington, D.C., p. 201 (1996).

[27] In this document, to "impair" habitat means to reduce habitat condition to the extent that it does not fully support long-term salmon survival and therefore "impaired habitat" is that which does not perform that full support function. Note that "impair" and "impaired" are not intended to signify any and all reduction in habitat condition.

[28] Running water.

B. Evaluate the Relevance of the Environmental Baseline in the Action Area to the Species' Current Status.

The environmental baseline represents the current basal set of conditions to which the effects of the proposed or continuing action would be added. It "includes the past and present impacts of all Federal, State, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early § 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process."[29]

The environmental baseline does not include any future discretionary Federal activities (that have not yet undergone ESA consultation) in the action area. The species' current status is described in relation to the risks presented by the continuing effects of all previous actions and resource commitments that are not subject to further exercise of Federal discretion. For a new project, the environmental baseline consists of the conditions in the action area that exist before the proposed action begins. For an ongoing Federal action, those effects of the action resulting from past unalterable resource commitments are included in the baseline, and those effects that would be caused by the continuance of the proposed action are then analyzed for determination of effects.

The reason for determining the species' status under the environmental baseline (without the effects of the proposed or continuing action) is to better understand the relative significance of the effects of the action upon the species' likelihood of survival and chances for recovery. Thus if the species' status is poor and the baseline is degraded at the time of consultation, it is more likely that any additional adverse effects caused by the proposed or continuing action will be significant.

The implementing regulations specify that the environmental baseline of the area potentially affected by the proposed action should be used in making the jeopardy determination. Consequently, delineating the action area for the proposed or continuing action is one of the first steps in identifying the environmental baseline. For the lotic environs typical of salmon habitat-related consultations, a watershed or sub-basin geographic unit (and its downstream environs) is usually a logical action area designation. Most habitat effects are carried downstream readily, and many travel upstream as well (*e.g.*, channel downcutting). Moreover, watershed divides provide clear boundaries for analyzing the cumulative effects of multiple independent actions.[30]

C. Determine the Effects of the Action on the Species.

In this step of the analysis, NMFS examines the likely effects of the proposed action on the species and its habitat within the context of the its current status and existing environmental baseline. The analysis also includes an analysis of both direct and indirect effects of the action. "Indirect effects" are those that are caused by the action and are later in time but are still reasonably certain to occur. They include effects on species or critical habitat of future activities

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[29] *See* 50 CFR § 402.02 (1999) (definition of "effects of the action"). Action area is defined by the consultation regulations (50 CFR 402.02) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

[30] National Research Council, *Upstream, Salmon and Society in the Pacific Northwest. National Research Council*, National Academy Press, Washington, D.C., pp. 34, 213 & 359 (1996).

that are induced by the action subject to consultation and that occur after the action is completed. The analysis also takes into account direct and indirect effects of actions that are interrelated or interdependent with the proposed action. "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration.

NMFS may use either or both of two independent techniques in assessing the impact of a proposed action. First, NMFS may consider the impact in terms of how many listed salmon will be killed or injured during a particular life stage and gauge the effects of that take's effects on population size and viability. Alternatively, NMFS may consider the impact on the species' freshwater habitat requirements, such as water temperature, substrate composition, dissolved gas levels, structural elements, etc. This second technique is especially useful for habitat-related analyses because, while many cause and effect relationships between habitat quality and population viability are well known,[31] they do not lend themselves to meaningful quantification in terms of fish numbers. Consequently, while this second technique does not directly assess the effects of actions on population condition, it indirectly considers this issue by evaluating existing habitat conditions in light of habitat conditions known to be conducive to salmon conservation.

Though there is more than one valid analytical framework for determining effects, NMFS usually uses a matrix of pathways and indicators to determine whether proposed actions would further damage impaired habitat or retard the progress of impaired habitat toward properly functioning condition. For the purpose of guiding Federal action agencies in making effects determinations, NMFS has developed and distributed a document detailing this method.[32] This document is discussed in more detail below. The levels of effects, or effects determinations, are defined[33] as:

> **"No effect."** Literally no effect whatsoever. No probability of any effect. The action is determined to have "no effect" if there are no proposed or listed salmon and no proposed or designated critical habitat in the action area or downstream from it. This effects determination is the responsibility of the action agency to make and does not require NMFS review.
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> **"May affect, not likely to adversely affect."** Insignificant, discountable, or beneficial effects. The effect level is determined to be "may affect, not likely to adversely affect" if the proposed action does not have the potential to hinder attainment of relevant properly functioning indicators and has a negligible (extremely low) probability of taking proposed or listed salmon or resulting in the destruction or adverse modification of their habitat. An insignificant effect relates to the size of the impact and should never reach the scale where

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[31] *See* Spence et al., *An Ecosystem Approach to Salmonid Conservation*, ManTech Environmental Research Services Corporation, Corvallis, Oregon (1996).

[32] *See* NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996).

[33] These definitions are adapted from those found in NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996), and; U.S. Fish and Wildlife Service and National Marine Fisheries Service., *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.* U.S. Government Printing Office, Washington, D.C. (1998)

take occurs.[34] A "discountable effect" is defined as being so extremely unlikely to occur that a reasonable person cannot detect, measure, or evaluate it. This level of effect requires informal consultation, which consists of NMFS concurrence with the action agency's determination.

"May affect, likely to adversely affect." Some portion or aspect of the action has a greater than insignificant probability of having a detrimental effect upon individual organisms or habitat. Such detrimental effect may be direct or indirect, short- or long-term. The action is "likely to adversely affect" if it has the potential to hinder attainment of relevant properly functioning indicators, or if there is more than a negligible probability of taking proposed or listed salmon or resulting in the destruction or adverse modification of their habitat. This determination would apply when the overall effect of an action has short-term adverse effects even if the overall long-term effect is beneficial. In such instances, NMFS conducts a jeopardy analysis.

The above effects determinations are applicable to individual fish, including fry and embryos. The MPI should be applied at spatial scales appropriate to the proposed action so that its habitat effects on individuals are fully taken into account. For example, if any of the indicators in the MPI are thought to be degraded by the proposed action to the extent that take of an individual fish results, the action is determined to be "may affect, likely to adversely affect." For actions that are likely to adversely affect, NMFS must conduct a jeopardy analysis and render a biological opinion resulting in one of the conclusions below:

"Not likely to jeopardize" and/or "Not likely to result in the destruction or adverse modification of critical habitat." The action does not appreciably reduce the likelihood of species survival and recovery or result in the destruction or adverse modification of its critical habitat.

"Likely to jeopardize" and/or "Likely to result in the destruction or adverse modification of critical habitat." The action appreciably reduces the likelihood of species survival and recovery or results in the destruction or adverse modification of its critical habitat.

D. Consider Cumulative Effects in the Action Area.

The ESA implementing regulations define "cumulative effects" as those effects caused by future projects and activities unrelated to the action under consideration (not including discretionary Federal actions) that are reasonably certain to occur within the action area.[35] Since all future discretionary Federal actions will at some point be subject to § 7 consultation, their effects will be considered at that time and are not included in cumulative effects analysis.

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[34] "Take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct." 16 USC §1532(19) (1988).

[35] 50 CFR § 402.02 (1999).

E. Jeopardy Determinations.

In this step of the analysis, NMFS determines whether (a) the species can be expected to survive, with an adequate potential for recovery, under the effects of the proposed or continuing action, the environmental baseline and any cumulative effects; and (b) whether the action will appreciably diminish the value of critical habitat for both the survival and recovery of the species. 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 continued existence of the listed species or result in destruction or adverse modification of critical habitat.

For the jeopardy determination, NMFS uses the consultation regulations and the MPI analysis method to determine whether actions would further degrade the environmental baseline or hinder attainment of PFC at a spatial scale relevant to the listed ESU. That is, because salmon ESUs typically consist of groups of populations that inhabit geographic areas ranging in size from less than ten to several thousand square miles (depending on the species), the analysis must applied at a spatial resolution wherein the actual effects of the action upon the species can be determined.

The analysis takes into account the species' status because determining the impact upon a species' status is the essence of the jeopardy determination. Depending upon the specific considerations of the analysis, actions that are found likely to impair currently properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat towards PFC at the population or ESU scale will generally be determined likely to jeopardize the continued existence of listed salmon, adversely modify their critical habitat, or both. Specific considerations include whether habitat condition was an important factor for decline in the listing decision, changes in population or habitat conditions since listing, and any new information that has become available.

If NMFS anticipates take of listed salmon incidental to the proposed action, the biological opinion is accompanied by an incidental take statement with reasonable and prudent measures to minimize the impact of such take, and non-discretionary terms and conditions for implementing those measures. Discretionary conservation recommendations may also accompany the biological opinion to assist action agencies further the purposes of habitat and species conservation specified in §§ 7(a)(1) and 7(a)(2).

F. Identify reasonable and prudent alternatives to a proposed or continuing action that is likely to jeopardize the continued existence of the listed species.

If the proposed or continuing action is likely to jeopardize the listed species or destroy or adversely modify critical habitat, NMFS must identify reasonable and prudent alternatives that comply with the requires of § 7(a)(2) and with the applicable regulations. The reasonable and prudent alternative must be consistent with the intended purpose of the action, consistent with the action agency's legal authority and jurisdiction, and technologically and economically feasible. At this stage of the consultation, NMFS will also indicate if it is unable to develop a reasonable and prudent alternative.

IV. Application Tools Useful in Conducting § 7 Analyses - The Matrix

As previously mentioned, NMFS has developed an analytic methodology to help determine the environmental effects a given action will have by describing an action's effects on PFC.[36] This document includes a *Matrix of Pathways and Indicators* (MPI; often called "The Matrix,") and a dichotomous key for making effects determinations based on the condition of the environmental baseline and the likely effects of a given project. The MPI helps the action agency and NMFS describe current freshwater habitat conditions, determine the factors limiting salmon production, and identify sensitive areas and any risks to PFC. This document only *helps* make effects determination, it does not describe jeopardy criteria per se.

The pathways for determining the effects of an action are represented as six conceptual groupings (*e.g.*, water quality, channel condition, and dynamics) of 18 habitat condition indicators (*e.g.*, temperature, width/depth ratio). Default indicator criteria[37] (mostly numeric, though some are narrative) are laid out for three levels of environmental baseline condition: properly functioning, at risk, and not properly functioning. The effects of the action upon each indicator is classified by whether it will restore, maintain, or degrade the indicator.

The MPI provides a consistent, but geographically adaptable, framework for effects determinations. The pathways and indicators, as well as the ranges of their associated criteria, are amenable to alteration through the process of watershed analysis. The MPI, and variations on it, are widely used in § 7 consultations. The MPI is also used in other venues to determine baseline conditions, identify properly functioning condition, and estimate the effects of individual management prescriptions. This assessment tool was developed for forestry activities. NMFS is working to adapt it for other types of land management, and for larger spatial and temporal scales.

For practical purposes, the MPI analysis must sometimes be applied to geographic areas smaller than a watershed or basin due to a proposed action's scope or geographic distribution. These circumstances necessarily reduce analytic accuracy because the processes essential to aquatic habitats extend continuously upslope and downslope, and may operate quite independently between drainages.[38] Such loss of analytic accuracy should typically be offset by more conservative management practices in order to achieve parity of risk with the watershed approach. Conversely, a watershed approach to habitat conservation provides greater analytic certainty, and hence more flexibility in management practices.

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[36] NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996).

[37] The unmodified "matrix" uses ranges of values for indicators that are generally applicable between species and across the geographic distribution of salmon. The indicators can be, and have been, modified for more specific geographic and species applications.

[38] L. B. Leopold, *A View of the River*, Harvard University Press, Cambridge, Massachusetts, chapter 1 (1994).

V. Conclusion

The NMFS has followed regulations under §§ 7 and 10 of the ESA to develop an analytical procedure used to consistently assess whether any proposed action would jeopardize or conserve federally protected species. There is a legacy of a more than a century of profound human alterations to the Pacific coast drainages inhabited by salmon.[39] The analytical tool described as the MPI enables proposed actions to be assessed in light of the species current status, the current conditions, and expected effects of the action. Proposed actions that fail to conserve fish and their habitats as initially proposed can be redesigned to avoid jeopardy and begin to restore watershed processes. Conservation of listed salmon will depend largely on the recovery of watershed processes that furnish their aquatic habitat.

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[39] *See* Cone and Ridlington, *The Northwest Salmon Crisis, a Documentary History.* Oregon State University Press, Corvallis, Oregon, pp. 12-21 & 154-160 (1996); W. Nehlsen *et al.*, *Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington*, Fisheries, Vol.16(2), pp. 4-21 (1991).