



STATE OF WASHINGTON

DEPARTMENT OF FISH AND WILDLIFE

1550 Alder St. N.W. □ Ephrata, Washington 98823 □ (509) 754-4624 FAX (509) 754-5257

February 26, 2010

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

**Subject: PRELIMINARY RECOMMENDATIONS FOR ENLOE DAM
HYDROELECTRIC PROJECT (FERC PROJECT #NUMBER 12569-001).**

Dear Ms. Bose:

I am writing to provide you with the Washington Department of Fish and Wildlife's (WDFW) preliminary recommendations for Okanogan County Public Utility District #1, Enloe Dam Hydroelectric Project (Project). The Project would be owned and operated by Public Utility District No. 1 of Okanogan County (applicant). The following comments address environmental impacts related to the issuance and exercise of the requested license, and provide recommendations for the conservation and development of fish and wildlife resources. In this letter, we identify and explain the basis for our recommendations. The WDFW does not object to the issuance of a new license for the Project provided our comments and recommendations are considered by the Federal Energy Regulatory Commission (FERC) and incorporated in the new license. Many of our recommendations for the Project are still being developed. Results from modeling and studies in the relicensing process are not yet complete. We expect that modeling and study results will provide new information that will have a

Kimberly D. Bose, Secretary
February 26, 2010
Page 2

bearing on our recommendations. Because the aforementioned and no Environmental Impact Statement (EIS) or Environmental Assessment (EA) has been issued by FERC, this response contains preliminary recommendations. We request the right to amend these comments and recommendations, if warranted, based on the results of information and conclusions developed during the FERC environmental analysis.

Summary of WDFW'S Jurisdictional Authority

WDFW has jurisdictional authority to review hydroelectric projects that could impact anadromous and resident fish resources. WDFW, under state law, has the responsibility for preserving, protecting, perpetuating, and managing the fish and wildlife resources of the state (Title 77, RCW). Consultation with WDFW is required for hydroelectric project development by the Fish and Wildlife Coordination Act, the Federal Power Act, and FERC rules 18 C.F.R. Part 4.

WDFW, pursuant to Sections 10(a) and 10(j) of the Federal Power Act (FPA), provides recommendations for fish and wildlife enhancement, protection and mitigation. Fish enhancement measures provide benefits of providing fish for harvest, and for wildlife that depend on fish as a food source. Fish enhancement measures may include providing additional habitat through providing access past barriers, providing additional spawning habitat, fish propagation, and studies to better understand impacts from hydroelectric projects.

Wildlife enhancement measures provide habitat for wildlife species that would

Kimberly D. Bose, Secretary
February 26, 2010
Page 3

otherwise be lost or unavailable. These species could include eagles, mule deer, bears, and many other species. There may also be benefits to fish through the preservation of riparian areas. Other wildlife enhancement measures could include creation of habitats, feeding, and studies to better understand the impacts from hydroelectric projects, wildlife habitat needs, effects of human activities, and food requirements. Our agency is mandated by state law to preserve, protect, perpetuate, and manage the fish and wildlife resources in Washington State.

Schedule

The Water Quality Certification application has not been submitted to the Washington Department of Ecology (Ecology) and is scheduled to be submitted to Ecology on or before February 26, 2010. From our experience, new information is likely to be developed during the certification process regarding water quantities and water quality associated with the project. Because the fish and wildlife resources for which WDFW has responsibility are greatly affected by water quantities and water quality, we will not be able to finalize our recommendations until we have had an opportunity to understand the information and conditions developed in the Water Quality Certification process. The water quality and quantity conditions of the certification will significantly affect recommendations by WDFW. For example, if flows in the certification in a particular month result in lower amounts of habitat and/or lower quality of habitat for a critical species than the values expected by WDFW, then WDFW would need to adjust other terms and conditions (e.g., large woody debris, riparian habitat protection) to address the higher than expected impacts of the project.

Kimberly D. Bose, Secretary
February 26, 2010
Page 4

Our Recommendations are presented below in two categories: Terrestrial and Aquatic.

I. TERRESTRIAL

For the protection and mitigation of impacts to wildlife resources, WDFW recommends the new license include the following as license articles: (A) a Wildlife Management Plan; and (B) a Vegetation Resources Management Plan.

A. Wildlife Management Plan: For the protection, mitigation of damages to, and enhancement of terrestrial wildlife resources, the licensee shall develop, within one year of license issuance, a Wildlife Management Plan (WMP). The WMP shall include wildlife measures identified in the applicant's FLA. The plan shall include, but is not limited to:

- a. Restore the existing unimproved shoreline road along Enloe Reservoir to a natural condition, eliminating the current interruption between the shoreline and upland habitat.
- b. Modify the Project's existing and proposed transmission lines and poles to prevent raptor electrocution and relocate the line within the current project boundary.
- c. Inclusion in the project construction schedule and transmission line construction a provision to avoid disturbances to foraging bald eagles between October 31 and March 31.

Kimberly D. Bose, Secretary
February 26, 2010
Page 5

- d. Installation of 10 artificial perch poles along the reservoir shoreline and in places where perch trees are sparse or lacking.
- e. Maintaining, repairing, or replacing perch poles or nest boxes as necessary.
- f. Planting of fast-growing native shade producing trees along the reservoir, such as native willows, alders and/or cottonwoods.
- g. Retention of dead trees along the reservoir until the planted trees are large enough for eagle use.
- h. Visual marking of the section of the Project transmission line crossing the Similkameen River.
- i. Installing nest boxes for small birds in areas that lack snags or natural tree cavities.
- j. Installing barriers on irrigation canal tunnels to prevent human entry while still allowing use by bats; and
- k. Exclude project activities within the winter hibernation period of bats.
- l. Provide a 200ft. wetland/riparian buffers.

The licensee shall prepare the plan after consultation with fish and wildlife management entities, specifically including WDFW. The WMP shall identify goals, objectives, and procedures for the management of bald eagle habitat (perching structures), riparian and wetland habitats, wildlife and habitat monitoring on project lands, and on lands that may be purchased to meet mitigation objectives. The WMP shall be tiered to any FERC-approved Vegetation Resources Management Plan so that goals and objectives of both plans are integrated and do not conflict. The WMP shall be updated every 5 years in

Kimberly D. Bose, Secretary
February 26, 2010
Page 6

consultation with fish and wildlife management entities. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies and tribes, and specific descriptions of how the agencies' and tribes' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies and tribes to comment and to make recommendations before filing with FERC. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based upon project-specific information.

Justification: In the final License Application (FLA), the licensee outlined various measures for the protection and mitigation of impacts to wildlife since the Project is expected to have long-term and short-term impacts on wildlife species (Okanogan PUD 2008). The primary impact will be associated with noise and human activity associated with Project construction and demolition of the original powerhouse. Construction noise is expected to result from the use of such equipment such as industrial trucks, pile drivers, earth moving equipment, and blasting to remove bedrock in or adjacent to the river. Long-term impacts are associated with future inundation of riparian habitat and perching habitat located along the Project's reservoir.

The primary goal of the applicant's measures to mitigate impacts to wildlife resources (bald eagle) is to protect and enhance wildlife populations and habitat in the project area by mitigating any specific adverse impacts demonstrated to be caused by ongoing operation of the Project. Secondary goals are to restore or improve ecological quality and

Kimberly D. Bose, Secretary
February 26, 2010
Page 7

diversity, to restore or increase riparian habitat, and to provide for public use of wildlife resources. The WDFW concurs in principle with the goals of the licensee's wildlife mitigation measures. However, the applicant's proposed wildlife mitigation measures lack specific targets and outcomes to respond to current and future management needs in the project area. Therefore, it is WDFW's recommendation that the implementation of these wildlife mitigation measures be contained and fully planned for in a Wildlife Management Plan to be completed by the applicant. The development of the WMP and incorporating the additional measures recommended by the WDFW will minimize the effects of future project operations on wildlife resources and ensure the benefits of those measures are sustained through the duration of the new license term.

The applicant's proposed measures are designed to minimize impacts associated with Project construction, demolition and blasting which may disturb wildlife in the immediate vicinity of these activities. As a result, wildlife may be temporarily displaced from the immediate project area. Most wildlife species would be expected to return to the project area habitats once activities diminish and work is completed. Because unique or rare habitats occur infrequently in the project area, most wildlife may temporarily occupy less than ideal habitats. Most habitats in the project area are already affected by some level of disturbance, due to existing informal recreational access (Okanogan PUD 2008, Exhibit E.7). It is the intent of the applicant's proposed measures, specifically the planting riparian trees and shrubs, to increase the frequency and diversity of habitats in the project area to minimize these impacts.

Kimberly D. Bose, Secretary
February 26, 2010
Page 8

Once the Project is complete, minor noise will be associated with the operation and maintenance of the hydroelectric facility. Noise levels at the facility will be fairly constant at all times. Wildlife species may habituate to constant noise levels provided they are not harassed by personnel working at the facility. However, noise impacts will likely persist at varying levels throughout the term of the new license. Although not specifically proposed by the applicant, the recommended installation of perch poles will assist in offsetting this impact.

Impacts from the Project will also be associated with the installation of crest gates, connection to the applicant's nearby distribution line, and relocation of a portion of the unimproved access road along the reservoir. Crest gate operation will not raise the ordinary high water level behind the dam, but will inundate narrow strips of riparian habitat along the reservoir for longer periods than now occur (Okanogan PUD 2008, Figure E.3-7). Permanent alteration of approximately 5.1 acres of wetlands and riparian vegetation currently occupying seasonally exposed flats or benches along the reservoir will occur. WDFW's recommended riparian plantings and control of noxious weeds will assist in the creation and maintenance of habitats required for wildlife species in the project area. Relocating the access road bordering the reservoir will allow riparian habitat along low-lying section of the current road corridor to naturally reestablish itself, resulting in a net gain for wildlife.

Transmission lines pose a hazard to passerines, waterfowl, and raptors, including the bald eagle. WDFW's recommended protection measures are needed to prevent and/or

Kimberly D. Bose, Secretary
February 26, 2010
Page 9

minimize conflicts between the Project's power lines and avian species protected under the Migratory Bird Treaty Act. The specific sites identified above are described in the applicant's FLA (Okanogan PUD 2008, Exhibit E-3).

The applicant has proposed a strategy in its FLA for the protection of bald eagle habitat in the project area. This strategy includes the restoration of the existing unimproved shoreline road and modifying the transmission lines. WDFW concurs with the applicant's proposed bald eagle program because recreational activity along the Project's reservoir is increasing, causing a reduction in habitat quantity and quality. Based upon project-specific information, the degradation of shoreline vegetation including hindered recruitment of large cottonwood trees appears to be evident along the Project's reservoir shoreline. Snags of all sizes are important habitat for a number of wildlife species, but large snags are an important component of bald eagle habitat. Bald eagles use snags for roosting and as perch sites while foraging. Large snags are relatively rare within the Project area and existing snags are not likely to provide long-term perching habitat for bald eagles (Stalmaster *et al.* 1985, Rodrick and Milner 1991). This scarcity of suitable perch trees may deter eagles from foraging along the Project's reservoir. An increase in availability and distribution of perches would allow bald eagles to use more areas along the reservoirs, facilitate their foraging activities, and increase the likelihood of capturing prey.

WDFW's recommendation for perch poles addresses the impact that is likely to happen.

Kimberly D. Bose, Secretary
February 26, 2010
Page 10

The USFWS has designated the Townsend's big-eared bat as a Federal Species of Concern. This bat species is a candidate for the WDFW Threatened and Endangered Species List (<http://wdfw.wa.gov/wlm/diversty/soc/endanger.htm>), and the U.S. Forest Service has designated it as a sensitive species for Washington (USFS 2004).

Townsend's bats are considered rare throughout their North American range (Fellers and Pierson 2002). Population declines have been noted in Washington (Senger 1973), Oregon (Perkins and Levesque 1987), and California (Pierson and Fellers 1998).

The Bureau of Land Management (BLM) recently confirmed the existence of Townsend's bat night roosts in the irrigation tunnels located adjacent to the proposed access roads immediately adjacent to or within the Project boundary as documented in an October 28, 2008 correspondence letter from WDFW for this proceeding. At that time, evidence of all terrain vehicle use within the tunnels and other human evidence indicated disturbance of the bats and may have discouraged them from utilizing the tunnels since that occasion. The BLM also indicated that the Project's currently defunct powerhouse may have suitable habitat for Townsend's bats, but it is unclear if these bats utilize the powerhouse at this time. The Project's defunct penstocks may also provide suitable habitat for the bats. Secondary impacts related to the construction, maintenance, and increased recreational use associated with the Project may disturb Townsend's bats, which are highly sensitive to human disturbance. Although not proposed in the licensee's FLA, WDFW's recommendation to install barriers on the Project's defunct irrigation tunnels, while still allowing bat use, will minimize the impact of human disturbance on these animals and give them an alternate roost area when the penstock and powerhouse is

Kimberly D. Bose, Secretary
February 26, 2010
Page 11

replaced/demolished.

Buffers should be required around wetlands/riparian habitats to provide these benefits:

(1) protect and enhance waterfowl nesting and feeding sites; (2) provide nesting and roosting sites for songbirds, raptors, and other avifauna; (3) provide denning and feeding sites for riparian-associated mammals; and, (4) provide hiding cover for black bear, and mule deer.

Wildlife may use vegetated buffers as travel corridors in an increasingly fragmented landscape. Buffers also provide important hiding cover and food sources to juvenile salmonids and other fishes where wetlands have connectivity to streams. Buffers of at least 50 ft. are required to provide minimal habitat protection for small-scale or tolerant species such as salamanders, rodents, and muskrat (Ziegler 1992). Larger buffers provide protection to more sensitive species such as cavity-nesting ducks, great blue heron, osprey, marten, and beaver (Ziegler 1992). Provision of wetland/riparian buffers at least 200 ft. in width provides benefits to wildlife.

Vegetated wetland/riparian buffers can also improve water quality by controlling the severity of soil erosion and removing a variety of pollutants from storm water runoff (Shisler et al. 1987). In addition, the root systems of the buffer vegetation aid in the maintenance of soil structure and soil stability (Broderson 1973). WDFW's recommendation for buffers provides appropriate mitigation for anticipated impacts.

Kimberly D. Bose, Secretary
February 26, 2010
Page 12

B. Vegetation Resources Management Plan: For the protection, mitigation of damages to, and enhancement of botanical resources, and at least one year before the start of any land-clearing or land-disturbing activities, the licensee shall file with FERC, for approval, a Vegetation Resources Management Plan (VRMP).

The VRMP shall provide for, but is not be limited to, the following measures:

- a. Plant native riparian trees, grasses, and shrubs, when they are called for;
- b. Abandon and restore the existing shoreline road;
- c. Plant riparian species along abandoned road corridor;
- d. Plant riparian species on the east and west banks downstream of Shanker's Bend;
- e. Install grazing control measures including fencing to protect sensitive riparian areas and restored sites;
- f. Monitor restored areas (uplands sites, riparian and wetland sites) every year for five years and continue monitoring every five years thereafter and replant sites if success criteria is not met. Appropriate success criteria are survival of eighty percent of plantings and diversity of species should survive five years after planting.
- g. Employ best management practices during construction and implementation to protect riparian and wetland vegetation;
- h. Provide a biological construction monitor to ensure minimal impact to aquatic and terrestrial resources during implementation of the project's new license;

Kimberly D. Bose, Secretary
February 26, 2010
Page 13

- i. Implement a noxious weed control program to increase wildlife forage. The program would include the development of survey protocols to be implemented over the life of the project and a timeline for surveying of noxious and invasive plants in the project area;
- j. Relocate the access road to the reservoir; and
- k. Survey for and document threatened and endangered plants every 5 years for the duration of the license term.

The VRMP shall include the following: (a) a schedule for completing the plan within one year of license issuance; (b) performance criteria; (c) monitoring provisions; (d) contingency and maintenance plans; and (e) provisions for the plan's periodic review and revision.

The licensee shall prepare the VRMP after consultation with fish and wildlife management entities, specifically including WDFW. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies and tribes, and specific descriptions of how the agencies' and tribes' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies and tribes to comment and to make recommendations before filing with FERC. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based upon project-specific information.

Kimberly D. Bose, Secretary
February 26, 2010
Page 14

Justification: In the FLA, the applicant proposed various measures to address impacts to botanical resources, including the development a Vegetation Resources Management Plan (Okanogan PUD 2008) to guide vegetation and weed management and monitoring near project facilities and roads, recreation sites, and transmission lines. In the absence of specific details concerning the implementation of this plan, WDFW is proposing that the licensee through the VRMP, at a minimum, limit the introduction and potential spread of noxious weeds and periodically survey for threatened and endangered plants in the existing and future habitats within the project area and any property that is purchased or managed for mitigation purposes.

Project-related impacts to botanical resources in the Project Area will occur from the reconstruction of specific road segments in the project area, powerhouse and related facilities, as well as on-going or emergency maintenance and vegetation management procedures. Inundation impacts will occur from the proposed crest gate operations. Potential impacts for each part of the project area are discussed in the following sections.

Most of the Project's new access road reconfiguration will follow an abandoned irrigation ditch and the old access road for this ditch through a disturbed area largely comprised of rocky habitat and debris. Adjacent vegetation is primarily shrub steppe. Near the dam, the road segment will follow the old irrigation ditch access road down to meet the existing dam access road north of the existing pump, near the proposed new parking area. Improving this segment of road is expected to result in negative impacts to the upland or riparian vegetation communities in this area.

Kimberly D. Bose, Secretary
February 26, 2010
Page 15

Upland vegetation in the vicinity of both proposed powerhouse locations and the proposed new access road is primarily shrub-steppe. This vegetation is subject to non-Project-related disturbance from natural rock falls, the county road upslope, and grazing. Potential Project-related construction impacts are due to vegetation removal and possible noxious weed encroachment in the vicinity of the proposed powerhouse and the access road. Like the new road areas, much of the area is rocky and unvegetated. Some upland meadow and developed areas at the east end of the dam would also be affected by access road construction. A small area of riparian vegetation at the dam would be removed during installation of the intake structure.

Potential Project-related operations impacts are likely to be to licensee vegetation management, maintenance activities, and other uses in the vicinity of the powerhouse and the access road. Vegetation management will include the application of one or more types of herbicides to vegetation in the immediate vicinity of the powerhouse.

Licensee operation of the proposed crest gates would result in the extended inundation of 12.2 acres along the shoreline of the reservoir that are only seasonally inundated under, current conditions. Of these new inundation acres, 1.1 acres supported upland vegetation in 2007 and 5.1 acres supported herbaceous wetland or riparian vegetation.

Some of the shallower inundated areas may continue to support or develop herbaceous wetland vegetation after the crest gates become operational. Increased area of inundation

Kimberly D. Bose, Secretary
February 26, 2010
Page 16

will remove riparian scrub. It will take ten to twenty years to replace the function of the lost riparian scrub habitat. The increase in the water elevation may enable herbaceous wetland vegetation to dominate on benches that currently support upland meadow; however, the measures proposed in the VRMP will ensure terrestrial impacts are minimized during the term of the new license. Management of other lands owned by the PUD (land purchased for the side channel refuge) will help to restore terrestrial impacts.

II. AQUATIC

For the protection and mitigation of impacts to aquatic resources, WDFW recommends the new license include the following in license articles: (a) a modified trashrack intake; (b) instream flows/discharges; (c) tailrace barrier nets; (d) a Fisheries Enhancement Plan; (e) ramping rates; (g) decommissioning; (h) inspections; and (i) adaptive management.

A. Modified Trashrack Intake: For the protection, and mitigation of damages to, fishery resources, and at least one year before the start of any land-disturbing or land-clearing activities, the licensee shall file, for FERC approval, detailed design drawings of an intake fish screen to reduce fish entrainment, together with a schedule to build the facility before commercial operation of the Project starts.

The design drawings shall include: (a) the screen and cover; (b) screen heating system; (c) automatic cleaning system; and (d) screen head differential monitoring instrumentation and headgate feedback control.

Kimberly D. Bose, Secretary
February 26, 2010
Page 17

The filing shall include, but not limited to: (a) specifications for bar width and spacing; (b) approach velocity; (c) sweeping velocity; (d) a description of the methods and a schedule for installing the fish screen, (e) monitoring strategies to detect fish impingement at the intake fish screen and entrainment through the proposed powerhouse, and (f) corrective actions to minimize fish impingement and entrainment.

The licensee shall prepare the aforementioned drawings and schedule after consultation with fish management entities, specifically including WDFW. The licensee shall include with the drawings, documentation of consultation, copies of comments and recommendations on the drawings and schedule after they have been prepared and provided to the agencies and tribes, and specific descriptions of how the facilities and strategies accommodate the agencies' and tribes' comments. The licensee shall allow a minimum of 30 days for the agencies and tribes to comment and to make recommendations before filing the drawings and schedule with FERC. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

Justification: Entrainment into the Project's intake and passage through the turbines will result in injury or mortality to reservoir fish. Fish passing through the turbines would be lost to the upstream fishery regardless of the survival rate through the turbines. Attracted by the Project's turbine intake flows or swept up in turbine intake, this forced emigration removes these individuals from the gene pool. Smaller fish are expected to be more susceptible to entrainment as sampling in the reservoir substantiated the correlation

Kimberly D. Bose, Secretary
February 26, 2010
Page 18

between presences of shallow water and cover and use by smaller fish (ENTRIX, Inc. 2007).

The licensee proposes to install a modified intake trashrack as specified in its FLA (Okanogan PUD 2008, Exhibit A). However, the licensee's proposal does not include a monitoring component to track the presence or absence of fish impingement or entrainment at the intake or the proposed powerhouse. The intent of the licensee's proposal is to minimize the extent of larger-sized fish entrainment through the Project's proposed powerhouse. Specifically, the FLA reads, "Trashracks would be provided to protect turbine water passages from blockage by debris. The trashracks would be 22 feet high by 12.5 feet wide and would be constructed either from steel or high density polyethylene supported by a steel frame. A one-inch clear spacing is proposed between trashrack bars to prevent adult resident fish in the reservoir and small debris from entering the intake. A motorized trashrack mounted on a monorail would be provided to remove accumulated trash and debris." (Okanogan PUD 2008, appendix A-6). We concur with the licensee's supporting analysis related to the proposed intake's approach velocities, burst swimming speeds for fish species in close proximity to the intake, and turbine survival estimates. However, a monitoring component is also needed to track the presence or absence of fish impingement or entrainment at the facility since the new license is likely to be 30-50 years.

Estimated average monthly water velocities were calculated at three locations: the intake channel entrance, trashrack face, and intake structure face. The lowest average monthly

Kimberly D. Bose, Secretary
February 26, 2010
Page 19

velocities were found at the entrance to the intake channel and the highest were found at the face of the trashrack. The average monthly velocities at the face of the trashrack were less than 2 feet per second (fps) in the period from August through March and were between 2 and 3 fps in May, June, and July, the high flow months. Average monthly velocities at the face of the intake structure were less than 2 fps in all months.

The licensee compiled swimming speed data for a variety of species in the project reservoir. For some of these species, swimming speeds were estimated based on data available from fish in the same family. For some of the smaller fishes, no data were available, but these fish would likely pass through the trashracks and the penstock. Of the fishes evaluated, the average monthly velocities at the trashrack face exceeded the bursting speeds of large and smallmouth bass and northern pikeminnow during May, June, and July. The others have bursting speed higher than the average velocities at the trashrack face.

Based on the sampling in the reservoir, larger individuals of two native species (chiselmouth and northern pikeminnow) would likely have a greater potential of occupying the area near the intake. Native suckers, mountain whitefish and introduced species such as largemouth bass, carp and yellow perch may be present in the vicinity of the intake. Rainbow trout could potentially be present.

Larger fish would be excluded by the trashrack (Okanogan PUD 2008, Exhibit A). The Project intake will have close-spaced trashrack bars that will prevent larger fish from

Kimberly D. Bose, Secretary
February 26, 2010
Page 20

becoming entrained in the intake. These larger fish will have the swimming capability to move back upstream, away from the intake and avoid impingement on the trashrack. If smaller fish that might be incapable of swimming upstream against the intake flow do encounter the intake, it is assumed they can fit through the bars and move downstream through the turbines.

Survival of fish passing through the turbines was estimated using predictive models developed by the U.S. Department of Energy's Advanced Hydro Turbine System Program (Franke *et al.* 1997). The calculation methodology has been documented, and it is provided in the licensee's FLA (Okanogan PUD 2008, appendix E.3.2). Estimates of mortality were prepared for a variety of non-salmonid species encompassing the range of sizes found in the reservoir during the licensee's 2006 surveys. The survival estimates indicate relatively high survival, especially for juvenile fishes (approximately 2 inches) with about 5 percent mortality. Estimated survival rates decrease with increasing fish length; however larger fish (6 inches long or longer) would be discouraged, if not physically excluded, from passage through the close-spaced trashrack bars proposed for the intake.

WDFW's recommended modified trashrack intake, the monitoring requirement and an adaptive management program will address the expected impacts.

B. Flows/Discharges: The WDFW recommends establishment of instream flows as a condition for licensing and operation of the Project to protect fish inhabiting the bypass

Kimberly D. Bose, Secretary
February 26, 2010
Page 21

reach (the area that lies between the toe of Enloe Dam and the pool below Similkameen Falls where the powerhouse outflow rejoins the river). Specific instream flow recommendations will be developed based on studies to be conducted and analyzed during continued consultation with the applicant.

Justification: Instream flows are required by Washington law. A recent ruling by the Environmental Protection Agency against the North Carolina Department of Environment and Natural Resources in relation to instream flows and federal Clean Water Act instream flow requirements suggest that federal law also requires instream flows, <http://www.americanrivers.org/newsroom/press-releases/2010/the-epa-rules-against-north-1-10.html>.

The proposed project would bypass about 370 feet of the Similkameen River, including a plunge pool and a cascade. Absent instream/minimum flows coming through/over Enloe Dam, the plunge pool and Similkameen River downstream of the dam to the powerhouse will suffer loss of water and thus quantity and quality of aquatic habitat.

Although fish sampling in the plunge pool has been limited, the Similkameen River is inhabited by fish both upstream of the dam (including 7 or 8 species in limited sampling reported by Beecher and Fernau [1983]) and downstream (including observations by Entrix [2009]). Given fish presence both upstream and downstream, fish use of the plunge pool and remainder of the proposed bypass reach is a certainty. Annear et al. (2004) included the plunge pool method as an approach for determining appropriate

Kimberly D. Bose, Secretary
February 26, 2010
Page 22

instream flows, and this method was based on observations of common fish use of other plunge pools; the plunge pool method might be used for the Enloe project, but other approaches will also be considered.

Given reports of WDFW biologists, the plunge pool, located immediately below Enloe Dam, provides holding and resting habitat for Chinook salmon as they wait to mature and move back to spawning areas downstream. Additional species that could use the plunge pool, either permanently or for periods ranging from brief to extended residence include mountain whitefish (Salmonidae: *Prosopium williamsoni*), rainbow trout and/or steelhead (Salmonidae: *Oncorhynchus mykiss*), Chinook salmon (Salmonidae: *Oncorhynchus tshawytscha*), carp (Cyprinidae: *Cyprinus carpio*), redbelt shiner (Cyprinidae: *Richardsonius balteatus*), leopard dace (Cyprinidae: *Rhinichthys falcatus*), northern pikeminnow (Cyprinidae: *Ptychocheilus oregonensis*), peamouth (Cyprinidae: *Mylocheilus caurinus*), largescale sucker (Catostomidae: *Catostomus macrocheilus*), brown bullhead (Ictaluridae: *Ameiurus punctatus*), largemouth bass (Centrarchidae: *Micropterus salmoides*), smallmouth bass (Centrarchidae: *Micropterus dolomieu*), Umatilla dace (Cyprinidae: *Rhinichthys umatilla*), mottled sculpin (Cottidae: *Cottus bairdi*) and torrent sculpin (Cottidae: *Cottus rhotheus*). These fishes have all been found in the Similkameen drainage in Washington close enough to the proposed project that they are likely to occur in the bypass at some time. All of these species are important natural resources and additionally provide some food and/or recreational value.

While the plunge pool is important as a resting location, the remainder of the potentially

Kimberly D. Bose, Secretary
February 26, 2010
Page 23

bypassed reach is also important aquatic habitat. Among the fish potentially inhabiting the Enloe bypass reach are rainbow trout (*Oncorhynchus mykiss*) that may be swept over the dam from upstream. These rainbow trout may contribute to maintaining the population of steelhead (anadromous *O. mykiss*, listed under the federal Endangered Species Act) in the Similkameen River downstream from Enloe Dam. Rainbow trout require well aerated water, which must be assured through continuous instream flow in the bypass.

Recent studies in the Columbia River watershed and elsewhere suggest that contribution of rainbow trout to steelhead is a very real possibility (Mullan, et al. 1992; Petterson, et al. 2001; Docker and Heath 2003; Narum, et al. 2004; Thrower, et al. 2004 a, b; Olsen, et al. 2006; Araki, et al. 2007; McPhee, et al. 2007; Pearsons, et al. 2007; Nichols, et al. 2008; Pearse, et al. 2009). Although there are different genetic selection pressures on anadromous and resident populations, resident and anadromous populations in a watershed are genetically more similar to each other than are steelhead in different watersheds or rainbow trout in different watersheds. Gene flow from resident rainbow to steelhead has been reported in basins where both forms spawn in the same reaches. The work by Thrower, et al. (2004 a,b) showed that even rainbow trout isolated above barrier falls could contribute to steelhead genes and the tendency to migrate (smolt) was retained in the population even with 70 years of isolation above a barrier falls. With the finding that Similkameen Falls is not a barrier to passage by anadromous salmonids, including steelhead, it is highly likely that steelhead penetrated farther upstream into the Similkameen River before construction of Enloe Dam. If so, upper Similkameen River

Kimberly D. Bose, Secretary
February 26, 2010
Page 24

rainbow trout would probably retain a genetic similarity to Similkameen steelhead. Araki et al. (2007) found that resident rainbow were important to maintaining the steelhead population in years of low steelhead numbers.

The Enloe Dam spillway at the upstream end of the plunge pool is impassable to upstream migrating salmon and steelhead or other fish, but it does not preclude fish from being swept over Enloe Dam from upstream. Most fish being swept over the dam into the plunge pool below would be expected to survive the fall if they land in water of sufficient depth to avoid injury. (Spill over dams yields high survival of downstream-migrating salmon and steelhead smolts at Columbia River dams. WDFW has dropped fish from airplanes into lakes as a means to stock lakes for recreational fishing.)

Similkameen Falls, the cascade downstream from the plunge pool, appears to be passable to some salmonids at some flows, with WDFW biological staff reports of salmon resting in the plunge pool.

Fish habitat in the plunge pool is well aerated as a result of water falling over Enloe Dam into the plunge pool. Dissolved oxygen concentrations are thus favorably high during the low flow season, particularly late summer, when air and water temperatures are high. Higher temperature reduces maximum oxygen concentrations in water, potentially stressing fish, but the presence of spill into the plunge pool preserves habitat value for fish even during late summer heat and low flow. Maintaining spill at all times into the plunge pool is thus important for maintaining habitat quality.

Kimberly D. Bose, Secretary
February 26, 2010
Page 25

Instream flows through the bypass would maintain connectivity (Annear et al. 2004), an important component of river habitat integrity. Connectivity includes transport of food from upstream into the plunge pool and bypass reach, as well as the transport downstream of production that occurs in the bypass reach. It also includes the degree of access from downstream, which probably varies with flow, season, species, and condition of fish; reports and professional opinions of WDFW biologists and biological staff indicate that the plunge pool is accessible to salmon and perhaps steelhead at times.

Long-term fish use of the bypass is most likely by whitefish, native minnows (Cyprinidae), suckers, and sculpin, and it may also be suitable for smallmouth bass. Although whitefish commonly inhabit waters with considerable velocity and depth, they can persist in calm, deep water for extended periods. Native minnows include leopard dace with moderate current preference and species such as peamouth that also inhabit lakes. Suckers are common associates of mountain whitefish. Sculpins inhabit a variety of habitats from slow to fast water.

Given the potential conservation value of resident trout that may be swept over Enloe Dam, it is prudent to ensure that conditions for their survival to spawning are adequate. Instream flows through the area known as the bypass, which includes the Enloe Dam plunge pool, located immediately at the base of the dam, are important for survival of fish in the bypass.

Kimberly D. Bose, Secretary
February 26, 2010
Page 26

Tailrace Net Barriers: For the protection and mitigation of impacts to aquatic resources downstream of the proposed powerhouse, and at least one year before the start of any land-disturbing or land-clearing activities, the licensee shall file with FERC, for approval, detailed design drawings of the conical net barriers to prevent fish from moving upstream and entering the proposed powerhouse's draft tubes. This filing shall include: (a) mesh size of the conical nets; (b) the dimensions of each conical net including a description of the escape exit to allow small debris and any resident fish that pass through the turbine to escape downstream; (c) expected approach velocities for the conical nets; (d) a description of how tailrace video monitoring shall be conducted to determine if adult salmonids are entering the nets at the downstream end of the barriers; (e) a contingency plan in the event the proposed tailrace net barriers do not perform according to criteria; and (f) a maintenance plan.

The licensee shall prepare the tailrace net barrier filing after consultation with the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service, WDFW, and the Confederated Tribes of the Colville Reservation. The licensee shall include with the filing, documentation of consultation, copies of comments and recommendations on the drawings and schedule after they have been prepared and provided to the agencies and tribe, and specific descriptions of how the facilities accommodate the agencies' and tribes' comments. The licensee shall allow a minimum of 30 days for the agencies and tribe to comment and to make recommendations before filing this information with FERC. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

Kimberly D. Bose, Secretary
February 26, 2010
Page 27

Justification: The powerhouse tailrace will discharge into the pool below Similkameen Falls. Fish may swim upstream into the tailrace and could, theoretically, continue swimming upstream into the draft tube environment, if no barrier is in place. Chinook salmon, sockeye salmon, and steelhead have been observed as utilizing the pool below the falls as a holding area.

During full turbine flow operations, fish cannot travel sufficiently far upstream in the draft tube to be injured by the turbine. During periods of reduced turbine flows, when the larger anadromous salmonids could theoretically reach the turbine, a physical net barrier would be necessary at the outlet of each draft tube. The net barriers include a small opening at the downstream end of the net to allow any fish that had safely passed through the turbine to exit and move downstream. Given the conical shape of the net barrier, the relatively small opening, and net and streamer attachments to the draft tube outlet, it is unlikely that an adult salmonid would swim upstream through the barrier net and into the draft tube. However, if a fish were able to swim into the net, or is already present in the lower reaches of the draft tube, when the net barrier is installed, it would be able to escape through the net opening. The net barriers would also be installed prior to planned shut-down or start-up of the turbines. The barriers would not be deployed during high turbine flow conditions to prevent the high-velocity flows and debris loads from damaging the nets. During these conditions, velocities through the turbine are high enough to prevent fish from reaching the turbine, as described above. In the event of an

Kimberly D. Bose, Secretary
February 26, 2010
Page 28

unplanned shutdown, it may be necessary to deploy the barrier before restarting, depending on flow conditions and fish presence.

Fisheries Enhancement Plan: For the protection and mitigation of damages to fish resources, and at least one year before the start of any land-clearing or land-disturbing activities, the licensee shall file with FERC, for approval, a fisheries enhancement plan.

The plan shall provide for, but not be limited to, the following measures:

- a. Side channel/off-channel development/enhancement at locations in the lower Similkameen River or nearby Okanogan River (Okanogan PUD 2008, Appendix E.3.3).
- b. Gravel supplementation downstream of Enloe Dam (Okanogan PUD 2008, Exhibit E.3-51).
- c. Stocking of sterile triploid trout to support a recreational fishery above Enloe Dam.

The plan shall include the following: (a) a schedule for completing the plan within three years of the issuance of the FERC license ; (b) performance criteria; (c) monitoring provisions; (d) contingency plans; (e) provisions for the plan's periodic review and revision; (f) a maintenance plan to ensure proper function of the side channel/off channel development/enhancement projects; and (g) measures to implement and annually stock 10,000 pounds of catchable (1 lb/each, and greater than or equal to 12 inches length) sterile triploid trout in the Similkameen River above Enloe Dam.

Kimberly D. Bose, Secretary
February 26, 2010
Page 29

The licensee shall prepare the plan after consultation with the USFWS, National Marine Fisheries Service, WDFW, and the Confederated Tribes of the Colville Indian Reservation. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies and tribes, and specific descriptions of how the agencies' and tribes' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies and tribes to comment and to make recommendations before filing with FERC. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based upon project-specific information.

Justification: The implementation of the side channel/off-channel development/enhancement project in addition to the gravel supplementation downstream of Enloe Dam will benefit native fish species found in the Similkameen River. The focus of these measures will be on habitat needed for salmon and steelhead. The two measures together are intended to compensate for habitat loss resulting from the construction and operation of the Project. The specific actions would be designed to target federally-listed species, and species of special concern that inhabit the river downstream of the Project.

Specifically, even with the anticipated instream flow, the Project's bypass reach will experience reduced flow, and thus a reduction in quality or quantity of aquatic habitat. Recognizing these impacts, the applicant has proposed to implement these habitat

Kimberly D. Bose, Secretary
February 26, 2010
Page 30

measures as mitigation. This enhancement project will partially address impacts such as mortality associated with entrainment of fish in the powerhouse turbines and decreased production in the Similkameen River between the dam and the tailrace. The applicant's measures will also increase the abundance and condition of spawning, rearing, and summer thermal refugia habitat.

Stocking sterile triploid trout will address concerns that both the BLM and WDFW have in regards to the applicant's boulder cluster mitigation proposal and loss of recreational opportunity. Neither WDFW nor the BLM are in favor of boulder cluster placement as this is insufficient to mitigate for the resident fish impacts the applicant identifies in the FLA. The whitefish fishery above Enloe Dam is very limited and restricted to the winter months only. Boulder placement may provide some additional habitat for whitefish, but will do little in providing additional recreation benefits. However, trout stocking mitigates for entrainment mortality due to powerhouse turbines. In addition, a put-and-take trout fishery would provide a much greater recreational opportunity for a longer period of time and would better utilize the recreation site improvements that the PUD has proposed. Local economies would be boosted and site usage would increase in an area that normally is seldom used.

Ramping Rates: For the protection and mitigation of damages to aquatic resources, the licensee shall implement, during normal start-up and shutdown operations, the following interim ramping rates to protect aquatic resources downstream of the tailrace in the Similkameen River (FERC 1996 and Hunter 1992):

Kimberly D. Bose, Secretary
 February 26, 2010
 Page 31

SEASON	Daylight	Night
February 16 to June 15	No ramping	2 inches per hour.
June 16 to October 31	2 inches per hour	1 inch per hour.
November 1 to February 15	2 inches per hour	2 inches per hour.

Daylight is defined as the period from one hour before sunrise to one hour after sunset; night is defined as the period from one hour after sunset to one hour before sunrise.

The location at which to measure ramping rate compliance shall be mutually determined by the licensee, the USFWS, National Marine Fisheries Service, WDFW, and the Confederated Tribes of the Colville Reservation, before project operation begins.

The interim ramping rates may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods for project maintenance purposes, upon mutual agreement between the licensee, the USFWS, National Marine Fisheries Service, WDFW, and the Confederated Tribes of the Colville Reservation. If the interim ramping rates are so modified, the licensee shall notify the agencies, tribes and FERC as soon as possible, but no later than 10 days after each such incident.

Justification: The above table describes the ramping rate decreases and increases recommended by WDFW given that no ramping rates were proposed by the applicant in its FLA. The applicant does propose to synchronize the use of its proposed crest gates with the operation of the project's future powerhouse to avoid flow fluctuations below the project in the Similkameen River. In addition, the applicant acknowledges the

Kimberly D. Bose, Secretary
February 26, 2010
Page 32

importance of ramping rates in its Initial Consultation Document (Okanogan PUD 2005). However, the specific details and criteria to minimize flow fluctuations below the Project are not fully outlined or contemplated in the FLA. Down-ramping regulation and minimization of flow fluctuation amplitude avoids and minimizes direct mortality to juvenile fish and the loss of eggs. These restrictions include the lag time it takes for fluctuations to pass through all affected fish habitat downstream to the confluence of the Similkameen and Okanogan rivers.

The applicant proposes to operate the Project in the run-of-river mode using a water level sensor in Enloe Reservoir that will regulate the flow through the powerhouse to balance reservoir inflow and outflow, keeping the reservoir near full. It is the WDFW belief that actual powerhouse operation will depend on loading of turbines within certain efficiency ranges and power demand. Because the applicant is not proposing spill as a way to balance inflows and outflows, it is not likely that inflows will always equal outflows because operation of the powerhouse will drive downstream flow levels. This will be most evident when the project load-follows demand.

Rapid reductions in streamflow downstream of regulating structures, such as hydropower dams, have a well-documented history of causing direct mortality to juvenile salmon and steelhead (Anglin *et al.* 2006 and Hunter 1992). Hydropower maintenance and shut-down operations can also result in detrimental flow fluctuations that can cause repeated stranding and large-scale mortality to salmon fry and juveniles. In turn, exposed eggs and juvenile fish are subject to rapid predation by birds. Stream morphology, bar slope,

Kimberly D. Bose, Secretary
February 26, 2010
Page 33

side channels, time of day, and size and species of fish are all factors that influence this stranding. In addition to direct impacts to fish, significant disruptions to the aquatic invertebrate community occurs which indirectly impacts fish production.

For these reasons, the ramping rates recommended by WDFW provide the appropriate balance between protection of aquatic resources and power operations.

Decommissioning: Within six months of license issuance, the licensee will provide evidence of financial security to ensure that at the end of the license term the licensee will be financially responsible and capable of decommissioning and removing all necessary parts of the project. The licensee shall also ensure funding for a long-term mitigation plan for environmental impacts of project decommissioning. Undeveloped project lands shall be perpetually reserved for fish, wildlife, and recreational use. Lands managed as wildlife habitat under the Wildlife Management Plan shall continue to be so managed for perpetuity. If the licensee relinquished ownership of project lands, this ownership shall be relinquished to State, Federal, or non-profit organizations that will ensure the perpetuity of these uses.

Justification: The environmental impacts of project retirement can be substantial. Failing dams and other structures can cause severe damage to downstream ecosystems and dwellings. Toxic compounds, such as PCBs and asbestos, are entombed within generating facilities and may be released if projects are improperly abandoned. High volumes of fine sediments are stored behind dams and will be released, with predictably

Kimberly D. Bose, Secretary
February 26, 2010
Page 34

severe environmental consequences, when reservoir pool levels are substantially lowered. It is imperative, therefore, that the new license applicant show sufficient financial ability to cover the costs of facility removal and environmental restoration.

The disposition of project lands is also a matter of great significance to fish and wildlife. Washington State is experiencing population growth and project lands are highly vulnerable to conversion to homes and urban development. This conversion would result in the loss of acres of functional fish and wildlife habitat. But if, according to WDFW recommendation, project lands are held in public ownership, then fish, wildlife, and cultural values will largely be retained. Because project-related impacts to fish and wildlife will continue to occur during and after decommissioning, the requirement to mitigate for these impacts will persist well into the future. Hence, it is our recommendation to retain project lands in a usage compatible with continuing mitigation and preservation of fish and wildlife resources.

Inspections: The licensee shall allow representatives of WDFW, other interested resource agencies and tribes to inspect the project site at any reasonable time before and during construction and operation to inspect fish and wildlife protection components, including erosion control measures. The licensee shall maintain and make available a record of project operations, including the daily amount of diversion, the daily amount of spillage over the crest gates, and the rate of change of both diverted flows and bypassed flows.

An annual inspection shall be scheduled to ensure fish protection components (including

Kimberly D. Bose, Secretary
February 26, 2010
Page 35

erosion control measures) are functioning to the satisfaction of resource agencies and tribes. Any problems identified as a result of this review will be addressed and remedied by the licensee in consultation with resource agencies and tribes.

Justification: Without the ability to identify construction and operational impacts to fish and wildlife it will be impossible for WDFW and the other resource agencies to determine whether protection, mitigation, and enhancement measures are being carried out in the intended manner.

Adaptive Management: For the protection and mitigation of impacts to fish and wildlife resources, within one year of the issuance of the license, the licensee shall develop an adaptive management plan in consultation with WDFW. The plan shall include: a) a statement of goals, b) monitoring protocols, c) decision criteria, and d) actions to be completed in response to monitoring results.

Justification: Because the current knowledge regarding the fish and wildlife resources impacted by the Project is incomplete, adaptive management should be incorporated to address information uncertainty and new information as it is developed. The adaptive management must be established in a manner that provides for monitoring of actions, an analysis of results, and modification of the actions (if so indicated). Adaptive management must not be used in a manner that creates delays in implementation of protection, mitigation, and enhancement measures.

Kimberly D. Bose, Secretary
February 26, 2010
Page 36

Thank you for your consideration of our requests. Enclosed is a list of references. If you need clarification about our requests or you have comments on WDFW's preliminary recommendations, terms and conditions regarding the license for Enloe Hydroelectric Project, please contact me by phone at (509) 754-4624, extension 213, or via email at: Patrick.Verhey@dfw.wa.gov, or at the letterhead address.

Sincerely,

A handwritten signature in cursive script that reads "Patrick Verhey".

Patrick Verhey
Hydroelectric Mitigation Biologist
Washington State Department of Fish and Wildlife

References

WDFW Recommendations for Terms and Conditions for Enloe Dam, FERC #12569
February 25, 2010

Anglin, D.R., S.L. Haeseker, J.J. Skalicky, H. Schaller, K.F. Tiffan, J.R. Hatten, P. Hoffarth, J. Nugent, D. Benner, and M. Yoshinaka. 2006. Effects of hydropower operations on spawning habitat, rearing habitat and stranding/entrapment mortality of fall Chinook salmon in the Hanford Reach of the Columbia River. Final draft report. USFWS. Columbia River Fisheries Program Office. Vancouver, Washington.

Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth, and C. Stalnaker. 2004. Instream Flows for Riverine Resource Stewardship - Revised Edition. Instream Flow Council, Cheyenne, WY.

Araki, H., R.S. Waples, W.R. Ardren, B. Cooper, and M.S. Blouin. 2007. Effective population size of steelhead trout: influence of variance in reproductive success, hatchery programs, and genetic compensation between life-history forms. *Molecular Ecology* (2007) 16: 953–966 doi: 10.1111/j.1365-294X.2006.03206.x

Beecher, H.A., and R.F. Fernau. 1983. Fishes of oxbow lakes of Washington. *Northwest Science* 57 (2): 125-131.

Broderson, J.M. 1973. Sizing Buffer Strips to Maintain Water Quality. M.S. Thesis. Univ. Wash., Seattle, WA.

Docker, M. F., and D. D. Heath, 2003 Genetic comparison between sympatric anadromous steelhead and freshwater resident rainbow trout in British Columbia, Canada. *Conserv. Genet.* 4: 227–231.

ENTRIX, Inc. 2007. Fish Distribution and Habitat Use of the Similkameen River in Relation to the Enloe Dam, Draft Report. Enloe Dam Hydroelectric Project, FERC No. 12569, ENTRIX, Inc., Olympia, Washington.

Entrix. 2009. Technical memorandum: Fish survey in Similkameen Falls pool. Final, November 10, 2009. Entrix, Seattle. 10 pp.

Fellers, G.M. and E.D. Pierson. 2002. Habitat use and foraging behavior of Townsend's big-eared bat (*Corynorhinus townsendii*) in Coastal California. *Journal of Mammalogy.* 83:167-177.

FERC (Federal Energy Regulatory Commission). 1996. Order Issuing License. Enloe Dam Hydroelectric Project. September 13, 1996.

Franke, G. F., D. R. Webb, R. K. Fisher, Jr., D. Mathur, P. N. Hopping, P. A. March, M. R. Headrick, I. T. Laczó, Y. Ventikos, and F. Sotiropoulos. 1997. Development of Environmentally Advanced Hydropower Turbine System Design Concepts. Idaho National Engineering and Environmental Laboratory. August 1997.

Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: A review of the biological effects, mechanical causes and options for mitigation. Technical Report No. 119. WDFW. Olympia, WA.

McPhee, M. V., F. Utter, J. A. Stanford, K. V. Kuzishchin, K. A. Savvaitova et al., 2007 Population structure and partial anadromy in *Oncorhynchus mykiss* from Kamchatka: relevance for conservation strategies around the Pacific Rim. *Ecol. Freshw. Fish* 16: 539–547.

Mullan, J.W., K.R. Williams, G. Rhodus, T.W. Hillman, and J.D. McIntyre. 1992. Production and habitat of salmonids in mid-Columbia River tributary streams. U.S. Fish and Wildlife Service Monograph 1.

Narum, S. R., C. Contor, A. Talbot and M. S. Powell, 2004 Genetic divergence of sympatric resident and anadromous forms of *Oncorhynchus mykiss* in the Walla Walla River, U.S.A. *J. Fish Biol.* 65: 471–488.

Nichols, K.M., A.F. Edo, P.A. Wheeler, and G.H. Thorgaard. 2008. The genetic basis of smoltification-related traits in *Oncorhynchus mykiss*. *Genetics* 179: 1559–1575.

Okanogan PUD (Public Utility District No.1 of Okanogan County). 2005. Initial Consultation Document. Enloe Dam Hydroelectric Project (FERC No. 12569). July 20, 2005.

Okanogan PUD (Public Utility District No.1 of Okanogan County) 2008. Final License Application. Public Utility District No. 1 of Okanogan County. August 22, 2008.

Pearse, D.E., S. A. Hayes, M. H. Bond, Chad V. Hanson, E.C. Anderson, R.B. Macfarlane, and J. C. Garza. 2009. Over the falls? Rapid evolution of ecotypic differentiation in steelhead/rainbow trout (*Oncorhynchus mykiss*). *Journal of Heredity* doi:10.1093/jhered/esp040

Pearsons, T.N., S.R. Phelps, S.W. Martin, E.L. Bartrand, and G. A. McMichael. 2007. Gene Flow between Resident and Anadromous Rainbow Trout in the Yakima Basin: Ecological and Genetic Evidence. *Redband Trout: Resilience and Challenge in a Changing Landscape*. Oregon Chapter, American Fisheries Society. pp. 56-64

Perkins, J.M. and C. Levesque. 1987. Distribution, status, and habitat affinities of Townsend's big eared bat (*Plecotus townsendii*) in Oregon. Unpublished report 86-5-01. Oregon Department of Fish and Wildlife, Portland, Oregon, USA.

Pettersson J.C.E., M.M. Hansen, and T. Bohlin. 2001. Does dispersal from landlocked trout explain the coexistence of resident and migratory trout females in a small stream? *J Fish Biol.* 58:487-495.

Pierson, E.D. and G.M. Fellers. 1998. Distribution and ecology of the big-eared bat, *Corynorhinus townsendii*, U.S. Geological Survey, Species at Risk Report.

Rodrick, E. and R. Milner, Editors. 1991. Management recommendations for Washington's priority habitats and species. Washington Department of Wildlife, Wildlife Management, Fish Management, and Habitat Management Divisions, Olympia, WA.

Senger, C.M. 1973. Survival and movement of big-eared bats (*Plecotus townsendii*) in lava tubes in southwestern Washington. *Bulletin of the National Speleological Society.* 35:33.

Shisler, J.K., R.A. Jordan, and R.N. Wargo. 1987. Coastal Wetland Buffer Delineation. New Jersey Dept. Envir. Prot., Div. Coastal Resources, Trenton, NJ. 102 pp.

Stalmaster, M.V., R.L. Knight, B.L. Holder, and R.J. Anderson. 1985. Bald eagles. Pages 269-290. *in*: E.R. Brown (editor): Management of wildlife and fish habitats in forests of Western Oregon and Washington, Part 1. USDA Forest Service, Pacific Northwest Region. Publication R6-FNWL-192-1985.

Thrower F., C. Guthrie, J. Nielsen, J.E. Joyce. 2004a. A comparison of genetic variation between an anadromous steelhead, *Oncorhynchus mykiss*, population and seven derived populations sequestered in freshwater for 70 years. *Environmental Biology of Fishes* 69:111-125.

Thrower, F. P., J. J. Hard and J. E. Joyce. 2004b. Genetic architecture of growth and early life-history transitions in anadromous and derived freshwater populations of steelhead. *Journal of Fish Biology* (2004) 65 (Supplement A): 286-307

USFS (United States Forest Service). 2004. Update of the Regional Forester's Sensitive Species list. Memo to Forest Supervisors. U.S. Forest Service, Portland, Oregon, USA.

Ziegler, R. 1992. Buffer Needs of Wetland Wildlife. Wash. Dept. Wildl. Olympia, WA. 31 pp.

Document Content(s)

WDFW Enloe Dam Prelim Rec T and C FERC 12569.PDF.....1-38